Maharaja Ranjit Singh Punjab Technical University
DABWALI ROAD, BATHINDA-151001
[Established by Govt. of Punjab vide Act No. 5 of 2015, UGC Act 2(f)]
DEAN ACADEMIC AFFAIRS

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Ref. No.: DAA/MRSPTU/2017/847 **Date: 20-04-2017**

SUBJECT: 1st MEETING OF FACULTY OF ENGINEERING & TECHNOLOGY ON 25.04.2017.

To

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Sir/Madam,

It is to inform you that **1st Meeting of MRSPTU Faculty of Engineering & Technology** has been scheduled on 25/04/2017 at 11.00 AM in Committee Room of Giani Zail Singh Campus College of Engg., & Tech., Bathinda. You are requested to make it convenient to attend this meeting. You are further requested to confirm your availability to attend this meeting and travel plan by email. TA/Honorarium will be paid as per MRSPTU, BTI norms.

DEAN ACADEMIC AFFAIRS,
MRSPTU, BATHINDA

Copy to:

1) PA to Hon’ble Vice Chancellor MRSPTU, Bathinda for Information Please
2) Registrar, MRSPTU, Bathinda
3) Assistant Registrar Accounts, MRSPTU, Bathinda.

ITEM NO. 01.01 INFORMATION REGARDING 1ST MEETING OF STANDING COMMITTEE OF MRSPTU ACADEMIC COUNCIL HELD ON 20.12.2016

It is for information of the members that 1st Meeting of Standing Committee of MRSPTU Academic Council was held on 20.12.2016 and 1st year Syllabi of various Programmes for 2016 Batch were approved. Minutes of this Meeting are enclosed in **ANNEXURE-I**. 1st year Syllabi of these Programmes for 2016 Batch are also included in the agenda for today's Meeting.

The Members of Faculty please note it.

ITEM NO. 01.02 APPROVAL OF SYLLABI OF UNDER GRADUATE PROGRAMMES

Syllabi of Under Graduate Programmes have been prepared for 2016 Batch onwards **(Annexure-III)**.

The matter is placed before the Faculty for deliberation and approval.

ITEM NO. 01.03 APPROVAL OF SYLLABI OF POST GRADUATE PROGRAMMES

Syllabi of Post Programmes have been prepared for 2016 Batch onwards **(Annexure-IV)**.

The matter is placed before the Faculty for deliberation and approval.

NOTE: ***Any other Agenda item can be discussed with the permission of the Chair.***

MINUTES OF 1ST MEETING OF MRSPTU STANDING COMMITTEE OF ACADEMIC COUNCIL HELD ON 20.12.2016.

1st Meeting of Maharaja Ranjit Singh Punjab Technical University Bathinda Standing Committee of Academic Council was held on 20.12.2016 at 11:30 am in the committee room of MRSPU Campus under the chairmanship of Vice Chancellor. The following members were present

1.	**Dr. (Prof.) Mohan Paul Singh Ishar** Vice-Chancellor, MRSPTU, Bathinda	**Chairman**
2.	**Dr. (Prof.) Ashish Baldi** Dean Faculty (Pharmacy), Professor, HOD, Deptt. of Pharmacy, Main Campus, MRSPTU, Bathinda	**Member**
3.	**Campus Director** Giani Zail Singh Campus College of Engineering & Technology, Bathinda (Constituent College).	**Member**
4.	**Director** Punjab Institute of Technology, Nandgarh, District Bathinda (Constituent College).	**Member**
5.	**Director** Punjab Institute of Technology, GTB Garh, District Moga (Constituent College)	**Member**
6.	**Dean Academic Affairs** MRSPTU, Bathinda	**Member**
7.	**Dean College Development Council** MRSPTU, Bathinda	**Member**
8.	**Dean R&D** MRSPTU, Bathinda	**Member**
9.	**Dean Students Welfare** MRSPTU, Bathinda	**Member**
10.	**Dean Planning &Development** MRSPTU, Bathinda	**Member**
11.	**Controller of Examinations** MRSPTU, Bathinda	**Member**
12.	**Registrar** MRSPTU, Bathinda	**Member**

The following decisions were taken in the meeting:

ITEM NO. 01.01 **APPROVAL OF SYLLABI OF UNDER GRADUATE PROGRAMMES**

DECISION: Syllabi of 1st and 2nd semesters approved.

ITEM NO. 01.02 **APPROVAL OF SYLLABI OF POST GRADUATE PROGRAMMES.**

DECISION: Syllabi of 1st and 2nd semesters approved.

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Dean Academic Affairs,
MRSSTU, Bathinda

MINUTES OF 1ST MEETING OF MRSPTU STANDING COMMITTEE OF ACADEMIC COUNCIL HELD ON 20.12.2016.

ITEM NO. 01.03 **APPROVAL OF SYLLABI OF ONE-YEAR SKILL CERTIFICATE PROGRAMMES.**

DECISION: The University has proposed to start following Skill Certification Programmes:

1. MRSPTU Curriculum for One-Year Certificate Programme in Computer Maintenance Programming Assistant for 2016-17 batch onwards.
2. MRSPTU Curriculum for One-Year Certificate Programme in Electrician 2016-17 batch onwards.
3. MRSPTU Curriculum for One-Year Certificate Programme in Farm Equipment Technician 2016-17 batch onwards.
4. MRSPTU Curriculum for One-Year Certificate Programme in Food Processing 2016-17 batch onwards.
5. MRSPTU Curriculum for One-Year Certificate Programme in Servicing and Maintenance of Electronic Instruments 2016-17 batch onwards.
6. MRSPTU Curriculum for One-Year Certificate Programme in Tool and Die Maker 2016-17 batch onwards.
7. MRSPTU Curriculum for One-Year Certificate Programme in Plumbing 2016-17 batch onwards.
8. MRSPTU Curriculum for One-Year Certificate Programme in Refrigeration and Air Conditioning Mechanic (RAC Mechanic) for 2016-17 batch onwards.
9. MRSPTU Curriculum for One-Year Certificate Programme in Welding for 2016-17 batch onwards.

It was decided that:

(i) In case of these Programmes, suggestions received through email from the members of concerned BOS will be sent to the Chairpersons of the respective BOS for deliberations with the other members of the BOS.

(ii) All of the suggestions received for these Programmes will be further discussed with experts from the concerned field and NITTTR.

(iii) Vice Chancellor is authorized to approve the revised curriculum of above programmes.

ITEM NO. 01.04 **APPROVAL OF CHOICE BASED CREDIT SYSTEM EFFECTIVE FROM 2016 BATCH ONWARDS**

DECISION: After deliberations on the Choice Based Credit System, the following decisions have been made (Choice Based Credit System is appended in the **Annexure-I** after including the following modified rules).

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Dean Academic Affairs,
MRSSTU, Bathinda

MINUTES OF 1ST MEETING OF MRSPTU STANDING COMMITTEE OF ACADEMIC COUNCIL HELD ON 20.12.2016.

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1. Point 11(a) of previous CBCS

Existing Rule: A student is required to maintain at least 4.0 CGPA at the end of each academic year, failing which he/she will be declared failed in that academic year. He/she will have to seek readmission to the odd semester of that academic year.

Modified Rule: A student is required to earn at least 25% of the credits registered by him/her in an academic year, failing which he/she will be declared failed in that academic year. He/she will have to seek readmission to the odd semester of the academic year.

2. Point 11(d) of previous CBCS

Existing Rule: In a Programme of more than 2 years, a student can register for Courses of 5th semester only after clearing his/her all Courses of 1st semester, even if he/she maintains at least CGPA of 4.0 at end of 2nd academic year. A student can register for Courses of 6th semester only after clearing his/her all Courses of 2nd semester.

Modified Rule: In a Programme of more than 2 years, a student can register for Courses of 5th semester only after clearing his/her all Courses of 1st semester. A student can register for Courses of 6th semester only after clearing his/her all Courses of 2nd semester.

3. Point 15 (End Semester University Examination) of previous CBCS

Existing Rule: Written Quiz of 10 questions set by MRSPTU for 20 marks.

Modified Rule: Viva/Questionnaire by the External Examiner for 20 marks.

Existing Rule: Practical performed by the student and recorded on the answer sheet.

Modified Rule: Evaluation of Answer sheet of the Practical Examination by the External Examiner for 20 marks.

4. It was also decided that a tutorial is to be designed to disseminate the details of Relative Grading System.
5. Point 9(A) &9(B) of existing CBCS have been deleted.

ITEM NO. 01.05 **APPROVAL OF THE COURSE WORK RECOMMENDED BY DDRC FOR Ph.D. ADMISSION IN THE DEPARTMENT OF ELECTRICAL ENGINEERING, GZSCCET, BATHINDA**

DECISION: Approved.

ITEM NO. 01.06 **APPROVAL OF THE REVISED Ph.D. REGULATIONS AS NOTIFIED BY UGC (MIN. STANDARDS AND PROCEDURE FOR AWARD OF M.PHIL./Ph.D. DEGREES) REGULATIONS-2016**

DECISION: Approved.

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Dean Academic Affairs,
MRSSTU, Bathinda

ITEM NO. 01.07	**APPROVAL OF THE SCORE CARD VALIDITY RELAXATION TO GPAT AND GATE QUALIFIED CANDIDATES FOR Ph.D. ENTRANCE TEST EXEMPTION**
DECISION:	It was decided that the Entrance Test for admission to Ph.D. Programme will be exempted for GATE & GPAT qualified candidates irrespective of their validity period. In case GATE/GPAT qualified candidates are more than the number of seats available they shall have to appear and qualify Ph.D. Entrance Test (PET) of MRSPTU, Bathinda.
ITEM NO. 01.08	**APPROVAL OF PRE-Ph.D. COURSE WORK FOR FACULTY SERVING MRSPTU, BATHINDA MAIN CAMPUS GZSCCET, BATHINDA**
DECISION:	It was decided that a candidate as a part time teacher (Lecture basis) is allowed to register for Pre-Ph.D Courses.
ITEM NO. 01.09	**RATIFICATION/APPROVAL OF EQUIVALENCE OF SYLLABI ALREADY GRANTED.**
DECISION:	Ratified.
ITEM NO. 01.10	**RATIFICATION/APPROVAL OF MIGRATION ORDERS.**
DECISION:	Ratified.
ITEM NO. 01.11	**APPROVAL OF ACADEMIC CALENDER 2017 & THE LIST OF HOLIDAYS FOR THE CALENDAR YEAR 2017.**
DECISION:	Approved & appended in **Annexure-II.** III IV
ITEM NO. 01.12	**APPROVAL OF MoU WITH DIFFERENT BODIES/ ORGANISATIONS.**
DECISION:	Approved.
ITEM NO. 01.13	**APPROVAL OF INCLUSION OF NEW MEMBERS IN DIFFERENT BoS.**
DECISION:	Approved and it was further decided that if required, more members can be involved as special invitees.
ITEM NO. 01.14	**INTIMATION OF APPROVAL OF MRSPTU, BATHINDA BY AIU.**
DECISION:	Noted by the members.

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Dean Academic Affairs,
MRSSTU, Bathinda

MINUTES OF 1ST MEETING OF MRSPTU STANDING COMMITTEE OF ACADEMIC COUNCIL HELD ON 20.12.2016.

ITEM NO. 01.15 **CHANGE IN CRITERIA TO RE-ESTABLISH EXAMINATION CENTRES.**

DECISION: Approved, if any examination centre is cancelled due to any reason, it may be considered for re-establishment after 1 year instead of 2 years.

General Decisions:

1. It was further decided that before putting the syllabus to Academic Council for approval, the syllabus is to be got approved in the meeting of concerned Faculty.
2. All regular faculty members possessing Ph.D. qualification are permitted to guide Ph.D. students. However, other conditions for approval of registered supervisors, as notified in Ph.D Regulations apply.
3. UGC nomenclature should be checked and implemented accordingly.
4. Uniformity in Internal and External marks distribution must be ensured.

The Meeting concluded with a vote of thanks to the Chair.

Susharan 30/1/2017
DEAN
ACADEMIC AFFAIRS,
MRSPTU, BTI
Dean Academic Affairs,
MRSSTU, Bathinda

The minutes are placed for approval please.

Approved, [illegible]

VICE CHANCELLOR
MRSPTU, BATHINDA

Annexure – I
CBCS

MRSPTU CHOICE BASED CREDIT SYSTEM-2016

1. PREAMBLE:

Maharaja Ranjit Singh Punjab Technical University, Bathinda (MRSPTU) has been established as an affiliating University vide Punjab Act No. 5 of 2015 notified through Punjab Government Gazette-Extraordinary (Regd. No. CHD/0092/2015-2017) notification No. 5-Leg./2015 dated 12th February, 2015.

Current evaluation system based on percentage of marks secured in the examinations in MRSPTU, Bathinda will be replaced with grading system called **'CHOICE BASED CREDIT SYSTEM' (CBCS)** w.e.f. academic session 2016-17. This credit system of continuous evaluation is as per guidelines of UGC and pertains to relative evaluation of the student's performance instead of absolute evaluation. The student will have the flexibility to pick up open elective Courses out of a pool of Courses available across different departments, suitable to his/her taste, requirement and capability. He/she will have the option to drop a Course after registering for it at a later stage, if permitted under the rules. The performance of a student in a Course is measured in terms of Credit Points earned by him/her in that course. It is proposed to implement this CBCS for various Programmes – B.Tech., B.Arch., M.Tech., M.Sc., MBA, etc., being offered by MRSPTU in its Constituent/Affiliated Colleges. This Credit System, after necessary amendments, if any, and there after the approval of the competent authority, will be known as **MRSPTU CHOICE BASED CREDIT SYSTEM-2016.** The CBCS facilitates transfer of credits earned by a student across different Departments/Centres of other recognized/accredited universities or institutions of higher education in India and abroad.

In Relative Grading System, the following two acute circumstances normally bothering the students are nullified.

a) When majority of students score very high marks because, either the question paper is easy or the evaluator is very lenient.

b) When majority of students score very low marks because, either the question paper is tough or the evaluator is very strict.

This Credit System will be implemented for students of 2016 batch and onwards. If the total number of students are equal to or less than 30 in a Course in MRSPTU, then Absolute Grading System will be followed. On the other hand, if total number of students are more than 30 in a Course in MRSPTU, then Relative Grading System will be followed. In Relative Grading System, grades will be awarded according to performance of students relative to their top peers in the same Course.

2. DEFINITIONS OF KEY TERMS:

a) **MRSPTU:** Maharaja Ranjit Singh Punjab Technical University, Bathinda-151001.

b) **VICE CHANCELLOR:** Vice Chancellor of MRSPTU.

c) **DEAN ACADEMIC AFFAIRS:** Dean Academic Affairs of MRSPTU.

d) **PROGRAMME:** Two/Three/Four/Five Year UG/PG Degree as applicable. It also includes Ph.D. Degree.

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e) **BRANCH OF A PROGRAMME:** For example: Mechanical Engineering, Civil Engineering are the branches of B. Tech. Programme.

f) **PROGRAMME CURRICULUM:** Each Programme Curriculum contains, prescribed Course Structure known as Study Scheme. The Study Scheme consists of Courses grouped into various types, viz. Foundation Courses, Core Courses, Departmental Electives, Open Electives and Professional Skills.

g) **COURSE:** Any subject (Theory/Practical) or a Project/Training/Field Work/Thesis/Seminars of the Curriculum of a Programme. Different Courses may have different credits allotted to them.

h) **COURSE SYLLABUS:** A Course Syllabus contains,

- Contents of study
- Course Code
- Course Nomenclature
- L-T-P-C (Number of Hours/Week for: Lectures, Tutorials, Practicals, Credits)
- Course Prerequisites (if any)
- Course Objectives
- Expected Outcomes
- Four Units in a Theory Course and the number of Lectures allotted to each unit
- Suggested Text and Reference Books
- Date of approval of Study Scheme by the Academic Council.

i) **BOARD OF STUDIES (BOS) OF A PROGRAMME:** The BOS shall prepare and recommend the Curriculum of the Programme and submit it to Academic Council for approval. The term of BOS shall be for 2 years.

j) **PROGRAMME COORDINATOR:** Chairperson BOS will be Programme Coordinator. He/she is deemed to own the Curriculum of the Programme Branch.

i) **COURSE COORDINATOR:** The Dean Academic Affairs, MRSPTU shall nominate a faculty member as Course Coordinator for each Course of the Programmes being taught in the University/affiliated/constituent colleges. Course Coordinator should be teaching/have taught that Course. Course Coordinator will be heading a team of five faculty members across all Affiliated/Constituent colleges. The Committee is deemed to own that Course of the Programme. Its Chairperson will be Course Coordinator.

This team will decide, the contents of syllabus for 1st and 2nd midterm semester tests. It will ensure that the same quantum of Course Content is covered in each College before each midterm test. He/she will also prepare Assignment/Tutorial Sheets and provide a copy of it to every faculty member teaching that Course. This Committee will have its term for 2 years.

j) **END SEMESTER UNIVERSITY EXAMINATIONS:** External examinations conducted by MRSPTU at the end of a semester.

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k) **COURSE PLAN:** Each faculty member will prepare a plan sheet in which he/she will record the topics to be covered/experiments to be performed in each lecture /tutorial/ lab, mode of delivery of lectures/tutorials and reference material to be used.

l) **LETTER GRADES:** Performance of a student in a Course is measured in terms of Letter Grades. Every Letter Grade has been given a numerical weight called Grade Point on a scale of 10 points.

m) **COURSE CREDITS:** A class room Lecture/Tutorial of 60-minute duration per week is equivalent to one credit. A laboratory session/Practical or Field work/ Project or a combination of these of two hours per week is equivalent to one credit. Number of credits allotted to a Training/Project/Field Work/Thesis/Seminar Course will be decided by the concerned BOS.

n) **CREDIT POINTS:** Performance of a student in a Course is measured in terms of Credit Points earned by the student in that Course.

Credit Point earned in a Course = Grade Point earned in that Course x Credits allotted to that Course.

o) **SEMESTER GRADE POINT AVERAGE (SGPA):** Performance of a student in a Semester is measured in terms of Semester Grade Point Average (SGPA), rounded up to two decimal places.

$$\text{SGPA} = \frac{\text{Total Credit Points earned by a student in a Semester}}{\text{Total Credits for the Courses registered by the student in that Semester}}$$

p) **CUMULATIVE GRADE POINT AVERAGE (CGPA):** Overall cumulative performance of a student over all Semesters is measured in terms of 'Cumulative Grade Point Average' (CGPA), rounded up to two decimal places.

$$\text{CGPA} = \frac{\text{Total Credit Points earned by a student in all Semesters in a Programme}}{\text{Total Credits for the Courses registered by the student in that Programme}}$$

q) **GRADE CARD:** After the end of every Semester, a student is issued a Grade Card depicting details of the Courses registered by him/her, which includes Course Titles, Course Codes, number of Credits allotted to that Course, Grades, SGPA and CGPA earned by the student up to end of that Semester.

r) **INTERNAL ASSESSMENT:** It is continuous evaluation of the performance a student in a Course during a Semester in 2 midterm sessional tests, quizzes, assignments, projects, attendance, seminars and discussions, etc.

s) **L-T-P-C OF A COURSE**: 2-1-2-4 means that Course consists of two Lecture Hours, one Tutorial Hour, two Laboratory Hours per week and the Course has been allotted 4 Credits. Number of Laboratory Hours per week to be allotted to any Laboratory Course will be decided by the concerned BOS.

t) **COURSE FLOWCHART:** Pictorial representation to show how various Courses (Fundamental, Core, Departmental Elective, Open Elective) are connected through pre-requisites.

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u) **INTERPRETATION COMMITTEE:** If any doubt/conflict arises in the interpretation of any of the Academic Regulations, the matter will be referred by the Vice Chancellor to the Interpretation Committee for its interpretation. Final decision lies with the Vice Chancellor.

v) **AWARD OF DEGREE:** A student will be awarded Degree after the end of the Programme when he/she fulfils the requirements to earn that Degree.

3. DURATION OF A PROGRAMME:

A Programme of N academic year duration is divided into 2N semesters. Each semester consists of 15-18 weeks of academic work equivalent to 90 actual teaching days. Odd semester is scheduled from July to December and Even semester from January to June. Maximum duration allowed for a student to complete his/her Degree is N+2 academic years, where N stands for the minimum academic years required to earn the Degree.

4. END SEMESTER UNIVERSITY EXAMINATIONS:

a) GENERAL:

(i) End Semester University examinations shall be held by MRSPTU as per Date Sheet announced on its website and the Study Scheme of the Programme.

(ii) The College/Institute office shall display on its Notice Board, the schedule of examination/date sheet etc. as soon as it is received from the University. The University will notify the date sheet of the End Semester examinations, preferably fifteen days before the start of the examinations.

(iii) The medium of instruction and examination shall be English.

b) ELIGIBILITY CRITERIA TO APPEAR IN END SEMESTER UNIVERSITY EXAMINATION OF A COURSE: The student must have registered for that Course and has attended at least 75% of contact hours in that Course for becoming eligible to appear in the End Semester University Examination. He/she should not have any dues pending towards him/her.

5. EVALUATION SYSTEM - CHOICE BASED CREDIT SYSTEM:

a) **UG DEGREE PROGRAMME STRUCTURE:** Each UG Degree Programme consists of Fundamental (F), Core (C), Departmental Electives (E), Open Elective (O), Professional Skills (S) and Training/Project Work Courses.

b) **PG DEGREE PROGRAMME STRUCTURE:** Each PG Degree Programme consists of Core (C), Departmental Electives (E), Open Elective (O), Project Work/Thesis and Professional Skills (S) Courses.

c) **CORE COURSES (C):** Core Courses comprise of Theory/Practical subjects, projects/thesis, seminars, visits, discussions, studio and Field work, etc. These Courses include Courses of basic sciences and humanities. Around 65% Credits of the Programme are assigned to Department Specific Courses and about 15% Credits of the Programme are allotted to Courses from the arena of basic sciences and humanities, wherever applicable. These are compulsory Courses.

d) **DEPARTMENTAL ELECTIVES (E):** These Courses are offered to a student by his/her own department. He/she has to choose any of these Courses out of the basket

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of Courses offered by his/her department. Around 20% of the total Credits of the Programme are earmarked for these Courses.

e) **OPEN ELECTIVES (O):** These Courses are offered by a department to students of other departments. This provides resilience to the technical education system and generates interest for learning among the students. He/she has to choose any of these Courses out of the pool of Courses offered by the other departments. Around 8% of the total Credits of the Programme are earmarked for these Courses.

f) **PROFESSIONAL SKILLS COURSES (S):**

One Credit Course of Professional Skills at UG level may be offered in various semesters to build up the aptitude of the students progressively, which includes,

(i) Human Values,
(ii) Written and Oral Communication Skills,
(iii) Personality Development.

Contents for the above will be different for different semesters.

One Credit Course for technical writing, presentation and personality development in various semesters and evaluation based on midterm papers and presentation of 10 minutes may be added at PG level.

g) Each Semester consists of Theory Courses and Lab/Seminar/Project/Training/Thesis Courses as given in illustration in Table-I.

h) 1st academic year of Four Year Degree Programme will have 50 Credits.

i) Total Credits in a Programme will be N x 45, where N stands for the minimum of academic years required to earn the Degree.

j) F, C, E Courses are of 3L+1T type and are of 4 Credits each. O Courses are of 3L type and are of 3 Credits each. S Courses are of 1P type and are of 1 Credit each.

k) Credits for Lab/Seminar/Project/Training/Thesis Courses etc. are to be decided by concerned BOS. BOS may deviate from the distribution shown in Table-I for fine tuning/special reasons.

l) A Lab/Workshop/Drawing/Studio Course may be of more than two hrs. duration.

m) In PG Degree Programmes where thesis work is not feasible, BOS of that Programme may add more Core Courses in the Curriculum.

6. **GENERAL GUIDELINES FOR CURRICULUM OF A FOUR YEAR BACHELOR DEGREE PROGRAMME:** An illustration is given below in Table-I for distribution of various Courses of a Four Year Bachelor Degree Programme. BOS may redistribute these subjects.

a) Training-I: In house 4-week training during summer vacation after 2nd sem.
b) Training-II: In house/Ind. 6-week training during summer vacation after 4th sem.
c) Training-III: In house/Ind. 8-week training during summer vacation after 6th sem.

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TABLE-I

Sem.	Fundamental (F)		Core (C)		Deptt. Elective (E)	Open Elective (O)	Profess. Skills (S)	Training/ Project/ Thesis	Total Contact Hrs.	Total Credits
	Th.	Lab.	Th.	Lab.						
I	5 (20)	4 (5)	---	---	---	---	---	---	30	25
II	5 (20)	3 (5)	---	---	---	---	---	---	30	25
III	---	---	4 (16)	2 (2)	1 (2)	---	1 (1)	Training-I (2)	25	23
IV	---	---	4 (16)	2 (2)	1 (3)	---	1 (1)	---	24	22
V	---	---	3 (12)	2 (2)	1 (2)	1 (3)	1 (1)	Training-II (3)	25	23
VI	---	---	2 (8)	2 (2)	2 (8)	1 (3)	1 (1)	---	24	22
VII	---	---	2 (8)	2 (2)	1 (4)	1 (3)	---	Training-III (4) + Project-I (4)	19	25
VIII	---	---	1 (4)	1 (1)	1 (4)	---	---	Project-II (6)	10	15
Total Credits										180

7. **GENERAL GUIDELINES FOR CURRICULUM OF A THREE/FIVE YEAR BACHELOR DEGREE PROGRAMME:** For Three Year Bachelor Degree Programmes: BBA, B.Com., BCA, etc. and for Five Year Bachelor Degree Programme: B.Arch., the concerned BOS may decide Courses of its own by following the concept of Fundamental (F), Core (C), Departmental Electives (E), Open Elective (O), Professional skills (S) and Training/Project Work/Seminar Courses, as illustrated in the Table-I.
8. **GENERAL GUIDELINES FOR CURRICULUM OF M.TECH. & OTHER TWO YEAR PG DEGREE PROGRAMMES WITH THESIS:** An illustration is given below in Table-II for distribution of various Courses of M.Tech. & other Two Year Degree Programmes with Thesis. BOS may redistribute these subjects.

TABLE-II

Sem.	Fundamental (F)		Core (C)		Deptt. Elective (E)	Open Elective (O)	Professional Skills (S)	Training/ Project/ Thesis	Total Contact Hrs.	Total Credits
	Th.	Lab.	Th.	Lab.						
I	---	---	3 (12)	1 (2)	2 (8)	---	---	---	26	22
II	---	---	2 (8)	1 (2)	2 (8)	1 (4)	---	---	26	22
III	---	---	---	---	1 (4)	1 (4)	1 (4)	Project + seminar (10+4)	12	26
IV	---	---	---	----	---	---	---	Thesis (20)	---	20
Total Credits										90

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TABLE-III

Sem.	Fundamental (F)		Core (C)		Deptt. Elective (E)	Open Elective (O)	Soft Skills (S)	Training/ Project/ Thesis	Total Contact Hrs.	Total Credits
	Th.	Lab.	Th.	Lab.						
I	---	---	3 (12)	2 (4)	1 (4)	1 (3)	---	---	27	23
II	---	---	3 (12)	1 (2)	2 (8)	---	1 (1)	---	25	23
III	---	---	3 (12)	2 (4)	1 (4)	1 (3)	1 (1)	---	28	24
IV	---	---	2 (8)	1 (2)	---	---	---	Project + Seminar (10)	22	20
Total Credits										90

9. REGISTRATION FOR COURSES:

a) Before the start of registration for Courses by students for a semester, every department of each college will announce its Departmental and Open Electives being offered, on its website.

b) Registration dates will be announced by University on its website.

c) Before a student can register for a particular Course, he/she should have fulfilled conditions of pre-requisite (if applicable) attached to that Course.

d) If more than 80 students register for a Course, then class will be split into two sections.

e) Online registration procedure will be adopted.

f) Departmental/Open Elective Course will be run in a college, only if minimum 15 students have registered for this Course.

g) Every student has to register for minimum 15 Credits and maximum 35 Credits in a semester, in a UG Programme. However, maximum limit of 35 Credits is allowed only in any two semesters. Condition of minimum credits is not applicable in final semester.

h) Every student has to register for minimum 12 Credits and maximum 35 Credits in a semester, in a PG Programme. However, maximum limit of 35 Credits is allowed only in any two semesters. Condition of minimum credits is not applicable in final semester.

i) If a student wants to drop any Course registered by him/her for a semester, he/she may do so before the start of first sessional test in that semester provided he/she fulfills the condition specified in subsection 9 (c).

j) Lab Courses, seminars, projects etc. may be added in a semester by BOS as per need of the Courses being taught in that semester.

k) Each midterm internal assessment test will be of 1.5 hrs duration.

l) Each End Term University Examination will be of three hrs or as specified.

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- **m)** A student is eligible to register for reappear examination of a Course only in that semester in which that Course is being offered.
- **n)** The student should obtain at least 25% marks in external University examination in a course to qualify it.
- **o)** The average internal assessment marks submitted by a teacher of his/her class in a particular Course (subject) must not be greater than 75%. If The average internal assessment marks submitted by a teacher of his/her class in a particular Course (subject) is greater than 75%, then the teacher will have to submit the complete academic record (attendance register, MST answer sheets and assignments etc.) of that class to the University.

10. ELIGIBILITY CRITERIA FOR PROMOTION TO NEXT ACADEMIC YEAR AND EARN THE DEGREE:

- **a)** A student is required to earn at least 25% of the credits registered by him/her in an academic year, failing which he/she will be declared failed in that academic year. He/she will have to seek readmission to the odd semester of the academic year.
- **b)** A student has to earn ≥ 30% marks in a Course to qualify it, failing which he/she will be declared failed in that Course. A failed student has to repeat the Course by appearing in continuous evaluation tests, quizzes etc. during the semester and End Semester University Examination.
- **c)** If a student fails in Departmental Elective/Open Elective Course, he/she has the option to repeat the same Course by appearing in continuous evaluation tests, quizzes etc. during the semester and End Semester University Examination or choose another Departmental Elective/Open Elective Course.
- **d)** In a Programme of more than 2 years, a student can register for Courses of 5th semester only after clearing his/her all Courses of 1st semester. A student can register for Courses of 6th semester only after clearing his/her all Courses of 2nd semester.
- **e)** Total Credits mentioned for Study Scheme of any Programme are the minimum Credits to be earned to qualify the Programme. However, one can register for maximum 200 Credits in a UG Programme and maximum 100 Credits in a PG Programme.
- **f)** In the beginning of syllabus of each Open Elective Course, it should be clearly mentioned, whether there is any Pre-requisite or not for this Course.
- **g)** Minimum 5.0 CGPA will be required to qualify the Programme.

11. RELATIVE GRADING SYSTEM:

At the end of the semester, for every Course registered by a student, he/she is assigned a Letter Grade (Table-IV) based on his/her overall performance based on his/her continuous evaluation during the semester and End Semester University Examinations. over the semester in all the assessments carried out in that Course.

- **a)** Relative grading system for a Course will be followed, when the total number of students in all colleges registering for a that Course are more than 30. Otherwise, Absolute Grading System shall be followed.
- **b)** In relative grading system CGPA x 10.0 = % age marks.

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c) For every Course, a student is required to have at least 75% attendance to appear in the End Semester University Examination.

d) If the value of $\overline{X}-1.5SD$ comes out to be less than 30, then the student will have to secure minimum 30 marks to qualify the course (pass grade E).

e) If the value of $\overline{X}-1.5SD$ comes out to be more than 40, then the student will have to secure minimum 40 marks to qualify the course (pass grade E).

f) If the value of $\overline{X}-1.5SD$ comes out to be greater than 30 but less than 40, then the student will have to secure minimum $\overline{X}-1.5SD$ marks (MIN) to qualify the course (pass grade E).

g) Any student who has obtained F grade in any of the Courses, he/she will have to repeat that Course by appearing in both internal and external examinations during the maximum tenure of the Programme (N+2 years, where N is the no. of years of Programme. For example, N = 4 for 4-year B. Tech. Programme). His/her grade in that Course shall be calculated based on the performance of the regular students along which he/she is appearing for improvement. However, he/she will not have to attend classes again. The new grade of the student shall be calculated on the basis of the group of students appearing that particular Course, in that particular Semester in that academic session.

h) Average $\overline{X}$ will be calculated up to second decimal.

i) A student who wants to reappear in a particular Course, will be given the grade by considering him/her in the group of students who are appearing in that examination at that time. Such a student wanting to reappear will have to appear both in internal tests, submit assignments etc. for continuous evaluation and in end semester examination.

TABLE-IV

Letter Grade/ Performance Grade given in a Course	**Grade Point earned**	**Academic Performance in a Course**	**Relative Grading Formula** **X_i =Marks obtained by a candidate in a Course in the University,** **$\overline{X}$ =Average marks in a Course in the University** **N=Total students in a Course in the University,** **MIN=$\overline{X}-1.5SD$ =Minimum marks required to pass a Course**	**Added Constraint for award of the Grade**
A^+	10	Outstanding	$X_i > \overline{X}+1.5SD$	Marks X_i>85%
A	9	Excellent	$\overline{X}+1.5SD \ge X_i > \overline{X}+1.0SD$	In order to obtain grade E or higher grade in a Course, the student must obtain at least 25% marks in End Semester external
B^+	8	Very Good	$\overline{X}+1.0SD \ge X_i > \overline{X}+0.5SD$	
B	7	Good	$\overline{X}+0.5SD \ge X_i > \overline{X}$	

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C	6	Average	$\overline{X} \geq X_i > \overline{X}$ -0.5SD	University examination in it, otherwise he/she would get grade F.
D	5	Below Average	$\overline{X}$ -0.5SD $\geq X_i > \overline{X}$ -1.0S D	
E	4	Pass	$\overline{X}$ -1.0SD $\geq X_i >$ MIN	
F	0	Fail	MIN> X_i, (If MIN≥40 then MIN=40, If MIN<30 then MIN=30)	11 (d), (e), (f), (g).
R	0	Detained on attendance basis	---	Detained on attendance basis & is required to repeat Course by attending classes when the Course is offered.

j) After completing the requisite number of credits to obtain a Degree/Diploma, if a student wishes to improve his/her CGPA, he/she will be allowed to do so in maximum five theory subjects already studied by him earlier. This permission to improve is subject to the condition that he/she has cleared all his/her subjects and during the maximum tenure of the Programme (N+2 years, where N is the no. of years of Programme. For example, N = 4 for 4-year B. Tech. Programme). His/her grade in that Course shall be calculated based on the performance of the regular students along which he/she is appearing for improvement.

$$\text{Standard Deviation SD} = \sqrt{\frac{\sum_{i=1}^{i=N}(X_i - \overline{X})^2}{N}}$$

12. MARKS DISTRIBUTION FOR THEORY COURSE:

a) Internal Assessment: Maximum Marks: 40

Distribution of Internal Assessment will be as follow:

Mid Term Sessional Tests	60%
Assignments & Tutorial Sheets (Minimum 5)	25%
Written Quizzes	15%

b) End Semester External University Examination: Maximum Marks: 60

MARKS DISTRIBUTION FOR LAB COURSE:

Internal Assessment:	Maximum Marks: 60
End Semester Lab. Course External Examination:	Maximum Marks: 40

13. All study schemes should allot 100 marks for each Course.

14. **EVALUATION FOR LAB COURSES:** Evaluation of performance of a student in a semester is as given below in Table-V,

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TABLE-V			
Internal Assessment (internal)		**End Semester Univ. Examination**	
Component	**Marks**	**Component**	**Marks**
Record Marks based on continuous assessment of Lab/practical work, considering regularity and timely submission of lab record (i.e. practical note book)	30	Viva/Questionnaire of 20 marks by the External Examiner	20
Viva Voce/Quiz/Assignments/Mini Project	30	Evaluation of Answer sheet of 20 marks of the Practical Examination by the External Examiner.	20

15. ABSOLUTE GRADING SYSTEM:

In absolute grading system CGPA x 10.0 = % Marks

TABLE-VI				
Letter Grade/ Performance Grade given in a Course	**Grade Point earned**	**Academic Performance in a Course**	**M = %Marks obtained**	**Added constraint for award of the Grade**
A^+	10	Outstanding	$X_i > 90$	In order to obtain grade E or higher grade in a Course, the student must obtain at least 25% marks in End semester external examination, otherwise he/she would get grade F
A	9	Excellent	$80 < X_i \leq 90$	
B^+	8	Very Good	$70 < X_i \leq 80$	
B	7	Good	$60 < X_i \leq 70$	
C	6	Average	$50 < X_i \leq 60$	
D	5	Below Average	$45 < X_i \leq 50$	
E	4	Pass	$40 \leq X_i \leq 45$	
F	0	Fail	$40 > X_i$	Student will get F in a Course when he/she earns <40 Marks
R	0	Detained on attendance basis	---	Detained on attendance basis & is required to repeat Course by attending classes when the Course is offered

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Annexure – II
Academic Calendar
2017

Maharaja Ranjit Singh Punjab Technical University
DABWALI ROAD, BATHINDA-151001
[Established by Govt. of Punjab vide Act No. 5 of 2015, UGC Act 2(f)]

Ref. No. DAA/MRSPTU/702 Date: 24/01/2017

Academic Calendar 2017

S. No.	Event	Date
Even Semester		
1.	Start of Semester	3rd Jan-2017
2.	1st Mid Semester Test	21st -25th Feb-2017
3.	2nd Mid Semester Test	18th -22nd April-2017
4.	Classes up to	6th May-2017
5.	End Semester Examinations	9th May-2017 onwards
6.	Practical Examinations	Immediately after the regular Examinations of classes
7.	Summer Vacation	12th June - 11th July-2017
Odd Semester		
1.	Start of Semester	17th July-2017
2.	1st Mid Semester Test	18th -22nd Sept.-2017
3.	2nd Mid Semester Test	13th -17th Nov-2017
4.	Classes up to	30th Nov-2017
5.	End Semester Examinations	5th Dec-2017
6.	Practical Examinations	Immediate after the regular Examinations of classes
7.	Winter Vacation	22nd Dec-2017 - 2nd Jan-2018

Note: All the Institutes must ensure 90 teaching days. To ensure 90 teaching days, classes should be held on Saturdays also, if needed.

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Annexure – III

Maharaja Ranjit Singh Punjab Technical University
Bathinda -151001
(Established by Govt. of Punjab vide Punjab Act No. 5 of 2015)

Ref. No. Reg./Notification/Admin./ 061/413 Dated: 20-01-2017

NOTIFICATION

It is hereby notified that the holidays as listed below shall be observed as Public Holidays by **Administrative (Non-vacational) Staff** of the University and its Constituent Colleges/PIT(s)/Affiliated Colleges during the Calendar **Year 2017.**

S. No.	Name of the Holiday(s)	Date on which they fall	Day of the week
1	All Saturdays		
2	All Sundays		

Public/Gazetted Holidays

S. No.	Name of the Holiday(s)	Date on which they fall	Day of the week
1	Parkash Gurpurab Sri Guru Gobind Singh Ji	5th January	Thursday
2	Republic Day	26th January	Thursday
3	Basant Panchmi / Birthday of Satguru Ram Singh Ji	1st February	Wednesday
4	Birthday of Sri Guru Ravidas Ji	10th February	Friday
5	Maha Shivaratri	24th February	Friday
6	Holi	13th March	Monday
7	Shahidi Divas S. Bhagat Singh Ji	23rd March	Thursday
8	Ram Navami	4th April	Tuesday
9	Mahavir Jayanti	9th April	Sunday
10	Vaisakhi	13th April	Thursday
11	Good Friday	14th April	Friday
12	Birthday of Dr. B.R. Ambedkar	14th April	Friday
13	Lord Parshuram Jayanti	29th April	Saturday
14	May Day	1st May	Monday
15	Martyrdom Day of Sri Guru Arjan Dev Ji	29th May	Monday
16	Kabir Jayanti	9th June	Friday
17	Idu'l Fitr	26th June	Monday
18	Martyrdom Day of Shahid Udham Singh	31st July	Monday
19	Independence Day	15th August	Tuesday
20	Janmashtami	15th August	Tuesday

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S. No.	Name of the Holiday(s)	Date on which they fall	Day of the week
21	Parkash Utsav Sri Guru Granth Sahib Ji	22nd August	Tuesday
22	Birthday of Baba Sri Chand Ji	30th August	Wednesday
23	Id-ul-Zuha (Bakrid)	2nd September	Saturday
24	Maharaj Agarsain Jayanti	21th September	Thursday
25	Birthday of S. Bhagat Singh Ji	28th September	Thursday
26	Dussehra	30th September	Saturday
27	Birthday of Mahatma Gandhi Ji	2nd October	Monday
28	Birthday of Maharishi Valmiki Ji	5th October	Thursday
29	Parkash Gurpurab of Sri Guru Ram Dass Ji	7th October	Saturday
30	Diwali	19th October	Thursday
31	Vishwakarma Day	20th October	Friday
32	Parkash Gurpurab of Sri Guru Nanak Dev Ji	4th November	Saturday
33	Shahidi Divas S. Kartar Singh Srabha Ji	16th November	Thursday
34	Martyrdom Day of Sri Guru Teg Bahadur Ji	23rd November	Thursday
35	Christmas day	25th December	Monday

1. The University/Colleges shall open at 11:00 am on account of **Raksha Bandhan** and **Bhai Dooj** as and when these occasions fall.

Restricted Holidays

Besides above holidays, each employee will also be permitted to avail himself/herself any two (2) holidays to be chosen by him/her out of the Restricted Holidays below during the Calendar Year 2017.

S. No.	Name of the Holiday(s)	Date on which they fall	Day of the week
1	New Year Day	1st January	Sunday
2	Lohri	13th January	Friday
3	Nirwan Diwas of Bhagwan Adinath ji	26th January	Thursday
4	International Women Day	8th March	Wednesday
5	Holla Mohalla	13th March	Monday
6	Buddh Purnima	10th May	Wednesday
7	Nirjala Ekadashi	5th June	Monday
8	Death Anniversary of Maharaja Ranjit Singh	29th June	Thursday

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S. No.	Name of the Holiday(s)	Date on which they fall	Day of the week
9	Birthday of BabaJiwan Singh Ji	5th September	Tuesday
10	Anant Chaturdashi	5th September	Tuesday
11	Muharram	1st October	Sunday
12	Karva Chauth	8th October	Sunday
13	Birthday of Baba Banda Singh Ji Bahadur	16th October	Monday
14	GoverdhanPooja	20th October	Friday
15	Birthday of Sant Nam Dev Ji	31st October	Tuesday
16	New Punjab Day	1st November	Wednesday
17	Birthday of Prophet Mohammad Sahib (Milad-un-Nabi or Id-e-Milad)	2nd December	Saturday
18	Jor Mela Sri Fatehgarh Sahib	25th, 26th & 27th December	Monday, Tuesday & Wednesday

Registrar

Copy to:

1. PA to Vice Chancellor, Maharaj Ranjit Singh Punjab Technical University, Bathinda.
2. Campus Director, GZSCCET, Bathinda.
3. Dean: Academic Affairs, R & D, Student Welfare and Planning & Development.
4. Directors: College Development Council, IQAC, Training & Placement, Sports & Youth Welfare, PIT (Nandgarh), PIT (GTB Garh) Moga, PIT (Rajpura), PIT (Mansa).
5. Controller of Examinations and Public Relations Officer.
6. HODs: Electrical Engg., Electronics & Communication Engg., Pharmacy, Mechanical Engg., Computer Sc. & Engg., Civil Engg., Text. Engg., Architecture, Applied Mathematics, Applied Chemistry, Applied Physics and Computer Applications.
7. Director, Centre for IT Enables Services to upload on University Website.
8. Chief Warden.
9. Dy. Registrar (Admin.), (Store & Purchase) & (A/cs) and Asstt. Registrar (A/cs.).
10. Incharge: Humanities & Management, Estate, Horticulture, Security, Library, Dispensary, Workshop, Transport & Guest House.

Registrar

Dean Academic Affairs
MRSSTU, Bathinda

20/23

Annexure – IV

Maharaja Ranjit Singh Punjab Technical University
Bathinda -151001
(Established by Govt. of Punjab vide Punjab Act No. 5 of 2015)

Ref. No. Reg./Notification/ Teaching/ 60/412

Dated: 20-01-2017

NOTIFICATION

It is hereby notified that the holidays as listed below shall be observed as **Public Holidays** by **Vacational** and **Non-vacational Staff** working in the teaching departments of the University and its Constituent Colleges/PIT(s)/Affiliated Colleges during the Calendar **Year 2017**.

S. No.	Name of the Holiday(s)	Date on which they fall	Day of the week
1	All Saturdays		
2	All Sundays		

Public/Gazetted Holidays

S. No.	Name of the Holiday(s)	Date on which they fall	Day of the week
1.	Parkash Gurpurab Sri Guru Gobind Singh Ji	5th January	Thursday
2.	Republic Day	26th January	Thursday
3.	Birthday of Sri Guru Ravidas Ji	10th February	Friday
4.	Maha Shivaratri	24th February	Friday
5.	Holi	13th March	Monday
6.	Shahidi Divas S. Bhagat Singh Ji	23rd March	Thursday
7.	Mahavir Jayanti	9th April	Sunday
8.	Vaisakhi	13th April	Thursday
9.	Good Friday/Birthday of Dr. B.R. Ambedkar	14th April	Friday
10.	Martyrdom Day of Sri Guru Arjan Dev Ji	29th May	Monday
11.	Idu'l Fitr	26th June	Monday
12.	Independence Day and Janmashtami	15th August	Tuesday
13.	Id-ul-Zuha (Bakrid)	2nd September	Saturday
14.	Dussehra	30th September	Saturday
15.	Birthday of Mahatma Gandhi Ji	2nd October	Monday
16.	Birthday of Maharishi Valmiki Ji	5th October	Thursday
17.	Diwali	19th October	Thursday
18.	Vishwakarma Day	20th October	Friday
19.	Parkash Gurpurab of Sri Guru Nanak Dev Ji	4th November	Saturday
20.	Christmas day	25th December	Monday

Dean Academic Affairs,
MRSSTU, Bathinda

1. The University/Colleges shall open at 11:00 am on account of **Raksha Bandhan** and **Bhai Dooj** as and when these occasions fall.
2. In order to compensate for lesser number of Gazetted Holidays, Non-vacational staff working in the teaching departments shall be entitled for eleven (11) Compensatory Leaves to be availed during vacations, not less than three (3) at a time.

Restricted Holidays

Besides above holidays, each employee will also be permitted to avail himself/herself any three (3) holidays to be chosen by him/her out of the Restricted Holidays below during the Calendar Year 2017.

S. No.	Name of the Holiday(s)	Date on which they fall	Day of the week
1.	New Year Day	1st January	Sunday
2.	Lohri	13th January	Friday
3.	Nirwan Diwas of Bhagwan Adinath ji	26th January	Thursday
4.	Basant Panchmi / Birthday of Satguru Ram Singh Ji	1st February	Wednesday
5.	International Women Day	8th March	Wednesday
6.	Holla Mohalla	13th March	Monday
7.	Ram Navami	4th April	Tuesday
8.	Lord Parshuram Jayanti	28th April	Friday
9.	May Day	1st May	Monday
10.	Buddh Purnima	10th May	Wednesday
11.	Nirjala Ekadashi	5th June	Monday
12.	Kabir Jayanti	9th June	Friday
13.	Death Anniversary of Maharaja Ranjit Singh Ji	29th June	Thursday
14.	Martyrdom Day of Shahid Udham Singh	31st July	Monday
15.	Parkash Utsav Sri Guru Granth Sahib Ji	22nd August	Tuesday
16.	Birthday of Baba Sri Chand Ji	30th August	Wednesday
17.	Birthday of BabaJiwan Singh Ji Anant Chaturdashi	5th September	Tuesday
18.	Maharaj Agarsain Jayanti	21th September	Thursday
19.	Birthday of S. Bhagat Singh Ji	28th September	Thursday
20.	Muharram	1st October	Sunday
21.	Parkash Gurpurab of Sri Guru Ram Dass Ji	7th October	Saturday

Gursharan

Dean Academic Affairs
MRSSTU, Bathinda

22/23

S. No.	Name of the Holiday(s)	Date on which they fall	Day of the week
22.	Karva Chauth	8th October	Sunday
23.	Birthday of Baba Banda Singh Ji Bahadur	16th October	Monday
24.	GoverdhanPooja	20th October	Friday
25.	Birthday of Sant Nam Dev Ji	31st October	Tuesday
26.	New Punjab Day	1st November	Wednesday
27.	Shahidi Divas S. Kartar Singh Srabha Ji	16th November	Thursday
28.	Martyrdom Day of Sri Guru Teg Bahadur Ji	23rd November	Thursday
29.	Birthday of Prophet Mohammad Sahib (Milad-un-Nabi or Id-e-Milad)	2nd December	Saturday
30.	Jor Mela Sri Fatehgarh Sahib	25th, 26th & 27th December	Monday, Tuesday & Wednesday

Registrar

Copy to:

1. PA to Vice Chancellor, Maharaj Ranjit Singh Punjab Technical University, Bathinda.
2. Campus Director, GZSCCET, Bathinda.
3. Dean: Academic Affairs, R & D , Student Welfare and Planning & Development.
4. Directors: College Development Council, IQAC, Training & Placement, Sports & Youth Welfare, PIT (Nandgarh), PIT (GTB Garh) Moga, PIT (Rajpura), PIT (Mansa).
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Registrar

Dean Academic Affairs,
MRSSTU, Bathinda

23/23

AGENDA FOR 1ST MEETING OF MRSPTU FACULTY OF ENGINEERING & TECHNOLOGY ON 25.4.2017

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GROUP-A

B.TECH. 1ST SEMESTER   TOTAL CONTACT HRS. = 31   TOTAL CREDITS = 25

Course		Contact Hrs.			Marks			Credits
Code	Name	L	T	P	Internal	External	Total	
BPHY0-101	Applied Physics	3	1	0	40	60	100	4
BMAT0-101	Applied Mathematics-I	4	1	0	40	60	100	5
BHUM0-101	Communicative English	2	1	0	40	60	100	3
BELE0-101	Basics of Electrical Engineering	2	0	0	40	60	100	2
BHUM0-103	Human Values & Professional Ethics	2	0	0	40	60	100	2
BESE0-101	Environmental Science	2	0	0	40	60	100	2
BPHY0-102	Applied Physics Lab.	0	0	2	60	40	100	1
BHUM0-102	Communicative English Lab.	0	0	2	60	40	100	1
BELE0-102	Basics of Electrical Engineering Lab.	0	0	2	60	40	100	1
BMFP0-101	Manufacturing Practice	1	0	6	60	40	100	4
Total 6 Theory & 4 Lab. Courses		16	3	12	480	520	1000	25

B.TECH. 2ND SEMESTER TOTAL CONTACT HRS. = 31   TOTAL CREDITS = 25

Course		Contact Hrs.			Marks			Credits
Code	Name	L	T	P	Internal	External	Total	
BCHM0-101	Applied Chemistry	3	1	0	40	60	100	4
BMAT0-201	Applied Mathematics-II	4	1	0	40	60	100	5
BMEE0-101	Elements of Mechanical Engineering	3	1	0	40	60	100	4
BECE0-101	Basics of Electronics Engineering	2	0	0	40	60	100	2
BCSE0-101	Basics of Computer Programming	3	0	0	40	60	100	3
BMEE0-102	Engineering Drawing	1	0	4	40	60	100	3
BCHM0-102	Applied Chemistry Lab.	0	0	2	60	40	100	1
BECE0-102	Basics of Electronics Engineering Lab.	0	0	2	60	40	100	1
BCSE0-102	Basics of Computer Programming Lab.	0	0	4	60	40	100	2
Total 6 Theory & 3 Lab. Courses		16	3	12	420	480	900	25

MRSPTU

Note: Marks of 4 Week Training during Summer Vacation will be included in 3rd Semester

Total Marks in Group-A B.Tech. First Year = 1st Semester 1000 + 2nd Semester 900 = 1900

Total Credits in Group-A B.Tech. First Year = 1st Semester 25 + 2nd Semester 25 = 50

GROUP-B

B.TECH. 1ST SEMESTER TOTAL CONTACT HRS. = 31 TOTAL CREDITS = 25

Course		Contact Hrs.			Marks			Credits
Code	**Name**	**L**	**T**	**P**	**Internal**	**External**	**Total**	
BCHM0-101	Applied Chemistry	3	1	0	40	60	100	4
BMAT0-101	Applied Mathematics-I	4	1	0	40	60	100	5
BMEE0-101	Elements of Mechanical Engineering	3	1	0	40	60	100	4
BECE0-101	Basics of Electronics Engineering	2	0	0	40	60	100	2
BCSE0-101	Computer Programming	3	0	0	40	60	100	3
BMEE0-102	Engineering Drawing	1	0	4	40	60	100	3
BCHM0-102	Applied Chemistry Lab.	0	0	2	60	40	100	1
BECE0-102	Basics of Electronics Engineering Lab.	0	0	2	60	40	100	1
BCSE0-102	Basics of Computer Programming Lab.	0	0	4	60	40	100	2
Total 6 Theory & 3 Lab. Courses		16	3	12	420	480	900	25

B.TECH. 2nd SEMESTER TOTAL CONTACT HRS. = 31 TOTAL CREDITS = 25

Course		Contact Hrs.			Marks			Credits
Code	**Name**	**L**	**T**	**P**	**Internal**	**External**	**Total**	
BPHY0-101	Applied Physics	3	1	0	40	60	100	4
BMAT0-201	Applied Mathematics-II	4	1	0	40	60	100	5
BHUM0-101	Communicative English	2	1	0	40	60	100	3
BELE0-101	Basics of Electrical Engineering	2	0	0	40	60	100	2
BHUM0-103	Human Values & Professional Ethics	2	0	0	40	60	100	2
BESE0-101	Environmental Science	2	0	0	40	60	100	2
BPHY0-102	Applied Physics Lab.	0	0	2	60	40	100	1
BHUM0-102	Communicative English Lab.	0	0	2	60	40	100	1
BELE0-102	Basics of Electrical Engineering Lab.	0	0	2	60	40	100	1
BMFP0-101	Manufacturing Practice	1	0	6	60	40	100	4
Total 6 Theory & 4 Lab. Courses		16	3	12	480	520	1000	25

MRSPTU

Note: Marks of 4 Week Training during Summer Vacation will be included in 3rd Semester

Total Marks in Group-B B.Tech. First Year = 1st Semester 900 + 2nd Semester 1000 = 1900

Total Credits in Group-B B.Tech. First Year = 1st Semester 25 + 2nd Semester 25 = 50

APPLIED PHYSICS

Subject Code: BPHY0-101 **L T P C** **Duration: 48 Hrs.**

3 1 0 4

UNIT-I

1. EM waves & Dielectrics (6 Hrs.)

Introduction and physical significance of Gradient, Divergence & Curl, Dielectric polarization (qualitative only), Types of polarization, Displacement Current Maxwell's Equations, Equation of EM waves in free space, velocity of EM waves, Poynting Theorem, Electromagnetic Spectrum (Basic ideas of different region).

2. Quantum Theory (6 Hrs.)

Need and origin of Quantum Concept, Wave-particle duality, Matter waves, Group & Phase velocities, Concept of Uncertainty Principle, wave function & its Significance, normalization of wave function, Schrodinger wave equation: time independent and dependent, Eigen functions & Eigen values, particle in a box in 1-D.

UNIT-II

3. Elements of crystallography (6 Hrs.)

Unit cell, Basis, Space lattice, Crystal Systems, Miller Indices of Planes & Directions in cubic system, Continuous & Characteristic X-Rays, X-Ray Diffraction & Bragg's law in Crystals, Bragg's spectrometer, X-ray radiography.

4. Magnetic Materials & Superconductivity (7 Hrs.)

Basic ideas of Dia, Para, Ferro & Ferri, Ferrites, Magnetic Anisotropy, Magnetostriction its applications in production of Ultrasonic waves, Superconductivity, Superconductors as ideal diamagnetic materials, Signatures of Superconducting state, Meissner Effect, Type I & Type II superconductors, Introduction to BCS theory, Application of superconductivity.

MRSPTU

UNIT-III

5. Lasers (6 Hrs.)

Spontaneous & Stimulated emissions, Population Inversion, Pumping Mechanisms, Einstein's Coefficients, Components of a laser System, Three and four level laser systems; Ruby, He-Ne, CO_2 and semiconductor Lasers, Introduction to Holography.

6. **Fibre Optics (6 Hrs.)**

Introduction, Acceptance Angle, Numerical Aperture, Normalized frequency, Modes of propagation, material dispersion & pulse broadening in optical fibres, fibre connectors, splices and couplers, applications of optical fibres.

UNIT-IV

7. Special Theory of Relativity (5 Hrs.)

Concept of Ether, Michelson Morley Experiment, Einstein's postulates, Lorentz transformation equations; length, time and simultaneity in relativity, addition of velocity, variation of mass with velocity (concept only), Mass-Energy and Energy-momentum relations.

8. Nanophysics (6 Hrs.)

Nanoscale, surface to volume ratio, electron confinement, nanoparticles (1D, 2D, 3D), Nanomaterials, Unusual properties of nanomaterials, synthesis of nanomaterials- ball milling and sol-gel techniques, Carbon nanotubes (synthesis and properties), applications of nanomaterials.

Recommended Books

1. Serway and Jewett, 'Physics of Scientists and Engineers', (Vol.1 & Vol. 2), 6th Edn, Cengage Learning.
2. A. K. Malik, H.K. Singh, 'Engineering Physics', Tata McGraw Hill, **2010.**
3. V. Raghvan, 'Material Sciences and Engg.', 5th Edn., Prentice Hall of India, **2004.**
4. A. Beiser, S. Mahajan, S. R. Choudhary, 'Concepts of Modern Physics', 6th Edn., Tata McGraw Hill, **2003.**
5. D.J. Griffiths, 'Introduction to Electrodynamics', 4th Edn., Prentice Hall, **2013.**
6. C.K. Kao, 'Optical Fibre System, Technology, Design & Applications', McGraw Hill, **1982.**
7. K. Thygrajan; A.K. Ghatak, 'Laser Theory & Applications', Mc Millan India Ltd., **2007.**

APPLIED MATHEMATICS-I

Subject Code: BMAT0-101 **L T P C** **Duration: 48 Hrs.**

4 1 0 5

Learning objectives

To introduce the concepts and to develop working knowledge on matrix theory, Complex numbers, Convergence of infinite series and concepts of differential equations.

UNIT-I

1. Linear Algebra (10 Hrs.)

Elementary transformations, Rank of a matrix, Row reduced echelon form, Reduction to normal form, Linear independence and dependence of vectors, Gauss- Jordan method to find inverse of a matrix, Solution of simultaneously linear algebraic equations, Linear transformations, Orthogonal transformations, Eigen values and eigen vectors, Cayley-Hamilton theorem, Reduction to diagonal form, Orthogonal, Unitary, Hermitian matrices.

UNIT-II

2. Complex Numbers and Elementary Functions of Complex Variable (11 Hrs.)

De-Moivre's theorem and its applications, Real and imaginary parts of exponential, Logarithmic, circular, Inverse circular, Hyperbolic, Inverse hyperbolic functions of complex variables. Summation of trigonometric series (C+iS method).

UNIT-III

3. Sequence and Series (11 Hrs.)

Introduction to sequence and series, Convergence and divergence of series, Tests of convergence (without proofs), Comparison test, Integral test, Ratio test, Raabe's test, Logarithmic test, Cauchy's root test and Gauss test. Alternating series- Absolute and conditional convergence, Leibnitz test. Power series-Weirstrass M-test.

MRSPTU

UNIT-IV

4. Differential Equations and its Applications (3 Hrs.)

Leibnitz's linear and Bernoulli's equation, Exact differential equations, Equations reducible to exact form by integrating factors, Equations of the first order and higher degree, Clairaut's equation.

Solution of linear ordinary differential equations of second and higher order; Methods of finding complementary functions and particular integral, Special methods for finding particular integrals- Method of variation of parameters. Cauchy's homogeneous and Legendre's linear equation. Simultaneous linear equations with constant coefficients.

Applications to electric R-L-C circuits, Deflection of beams, Simple harmonic motion, Simple pendulum.

Recommended Books

1. E. Kreyszig, 'Advanced Engineering Mathematics', 9th Edn., John Wiley, **2006.**
2. Michael D. Greenberg, 'Advanced Engineering Mathematics', 2nd Edn., Pearson Education, **1998**.
3. Peter V.O. Nil, 'Advanced Engineering Mathematics', 7th Edn., Wordsworth Publishing Company, **2012.**
4. R.K. Jain and S.R.K. Iyengar, 'Advanced Engineering Mathematics', 4th Edn., Narosa, **2014**.
5. B.S. Grewal, 'Higher Engineering Mathematics', 40th Edn., Khanna Publishers, New Delhi, **2007**.
6. pipes, L.A. and Harvill, L.R., Applied Mathematics for Engineers and physicists, 3rd Edn., Mc Graw Hill, **1970**.
7. H.C. Taneja, 'Engineering Mathematics, Volume-I & Volume-II', 2nd Edn., I.K. Publishers, **2010.**
8. Babu Ram, 'Advanced Engineering Mathematics', Pearson Education, **2009**.
9. J.S. Bindra, 'Applied Mathematics', Volume II, 9th Edn., Kataria Publications, **2012**.

COMMUNICATIVE ENGLISH

Subject Code: BHUM0-101	L	T	P	C	Duration: 45 Hours
	2	1	0	3	

Course Objectives

i) To expose the students to effective communication strategies and different modes of communication.

ii) To enable the students to analyze his/her communication behaviour and that of others.

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iii) To enable a student to apply effective communication skills professionally and socially.

UNIT-I (12 Hrs)

Communication: Meaning, its types, Significance, Process, Channels, Barriers to Communication, Making Communication Effective, Role in Society.

Business Correspondence: Elements of Business Writing, Business Letters: Components and Kinds, Memorandum, Purchase Order, Quotation and Tenders, Job Application Letters, Resume Writing etc.

UNIT-II (10 Hrs)

Discussion Meeting and Telephonic Skills: Group Discussion, Conducting a Meeting, Telephone Etiquettes, Oral Presentation: Role of Body Language and Audio Visual Aids.

Grammar: Transformation of Sentences, Words used as Different Parts of Speech One Word Substitution, Abbreviations, Technical Terms etc.

UNIT-III (11 Hrs)

Reading Skills: Process of reading, Reading Purposes, Models, Strategies, Methodologies, Reading Activities.

Writing Skills: Elements of Effective Writing, Writing Style, Technical Writing: Report Writing.

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UNIT-IV (12 Hrs)

Listening Skills: The process of Listening, Barriers to Listening, Effective Listening Skills and Feedback Skills.

Speaking Skills: Speech Mechanism, Organs of Speech, Production and Classification of Speech Sound, Phonetic Transcription, Skills of Effective Speaking, Components of Effective Talk.

Course Outcomes

The students after undertaking this course will be able to:

i) Understand and appreciate the need of communication training.
ii) Use different strategies of effective communication and select the most appropriate mode of communication for a given situation.
iii) Speak effectively and assertively
iv) Correspond effectively through different modes of written communication.
v) Present himself/herself professionally through effective resumes and interviews.

Recommended Books

1. M. V, Rodriques, 'Effective Business Communication', Concept Publishing Company New Delhi, **1992, reprint 2000.**
2. Adhikari Sethi, 'Business Communication', McGraw Hill.

3. Indrajit Bhattacharya, ‘An Approach to Communication Skills’, Dhanpat Rai Co., (Pvt.) Ltd. New Delhi.
4. Chrissie Wright, ‘Handbook of Practical Communication Skills’, Jaico Publishing House, Mumbai.
5. L. Gartside, ‘Modern Business Correspondence’, Pitman Publishing London.
6. Rizvi M Ashraf, ‘Effective Technical Communication’, McGraw Hill.

BASICS OF ELECTRICAL ENGINEERING

Subject Code: BELE0-101 **L T P C** **Duration: 22 Hrs.**

2 0 0 2

UNIT-1

1. Review of Direct Current (DC) Circuits (4 Hrs.)

Review of circuit elements and connected terminology, Kirchoff‟s Laws- Statement and Illustrations, Star-Delta Conversion, Ohm’s Law- Statement, Illustration and Limitation, Effect of Temperature on Resistance.

UNIT-II

2. Alternating Current (AC) Fundamentals (5 Hrs.)

Generation of alternating electro-motive force (EMF), Peak, Root Mean Square and average value of alternating current, Phasor representation of alternating quantities, Alternating Quantities in Rectangular and polar forms. Introduction of Resistive, Inductive & Capacitive circuits and their series and parallel combinations, Concept of resonance in series and parallel circuits.

3. Three Phase Balanced Systems (4 Hrs.)

Concept of 3-phase EMF Generation, Numbering of phases, phase sequence, Types of connections: star and delta connections, relationship between line voltages/currents and phase voltages/currents, Phasor diagrams.

UNIT-III

4. Magnetic Circuits and Transformer (5 Hrs.)

Comparison between magnetic and electric circuits, Electromagnetic Induction and its law, Self-Inductance, Mutual Inductance, Coupling Coefficient between two magnetically coupled circuits. Single Phase Transformer: Construction, Working principle, Losses & Efficiency.

UNIT-IV

5. Rotating Electrical Machines (4 Hrs.)

Construction and working principle of D.C. machines (series and shunt), three phase Induction motor (squirrel cage and slip ring) and their applications.

Recommended Books

1. Vincent Deltoro, ‘Electrical Engineering fundamentals’, 2nd Edition, Prentice Hall, New Delhi, **2007.**
2. Mittle and Mittle, ‘Basic Electrical Engineering’, 3rd Edn., Tata McGraw Hill, New Delhi, **2006.**
3. H. Cotton, ‘Advanced Electrical Technology’, Reem Publications Ltd., **1983.**
4. I.J. Nagrath and D.P. Kothari, ‘Electrical Machines’, Tata McGraw, Delhi, **2006**.
5. Ashfaq Husain, ‘Fundamentals of Electrical Engineering’ Danpat Rai Publications, **2002.**

MRSPTU

HUMAN VALUES & PROFESSIONAL ETHICS

Subject Code: BHUM0-103	L T P C 2 0 0 2	Duration: 24 Hrs

Course Objectives and Expected Outcomes

To help the students discriminate between what is valuable and what is superficial in the life. To help the students develop the critical ability to distinguish between essence and form in life - this ability is to be developed not for a narrow area or field of study, but for everyday situations in life, covering the widest possible canvas. To help the students develop sensitivity and awareness; leading to commitment and courage to act on their own belief. It is not sufficient to develop the discrimination ability; it is important to act on such discrimination in a given situation. Knowingly or unknowingly, our education system has focused on the skill aspects (learning and doing) - it concentrates on providing to its students the skills to do things. In other words, it concentrates on providing "How to do" things. The aspects of understanding "What to do" or "Why something should be done" is assumed. No significant cogent material on understanding is included as a part of the curriculum. A result of this is the production of graduates who tend to join into a blind race for wealth, position and jobs. Often it leads to misuse of the skills; and confusion and wealth that breeds chaos in family, problems in society, and imbalance in nature. This course is an effort to fulfill our responsibility to provide our students this significant input about understanding. This course encourages students to discover what they consider valuable. Accordingly, they should be able to discriminate between valuable and the superficial in real situations in their life. It has been experimented at IIITH, IITK and UPTU on a large scale with significant results.

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UNIT-I (6 Hrs)

Course Introduction - Need, Basic Guidelines, Content and Process for Value Education
Understanding the need, basic guidelines, content and process for Value Education. Self-Exploration-what is it? - its content and process; "Natural Acceptance" and Experiential Validation- as the mechanism for self-exploration, Continuous Happiness and Prosperity- A look at basic Human Aspirations Right understanding, Relationship and Physical Facilities- the basic requirements for fulfillment of aspirations of every human being with their correct priority, Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario Method to fulfill the above human aspirations: understanding and living in harmony at various levels

UNIT-II (8 Hrs)

Understanding Harmony in the Human Being - Harmony in Myself!
Understanding human being as a co-existence of the sentient "I" and the material "Body"
Understanding the needs of Self ("I") and "Body" - *Sukh* and *Suvidha*
Understanding the Body as an instrument of "I" (I being the doer, seer and enjoyer)
Understanding the characteristics and activities of "I" and harmony in "I"
Understanding the harmony of I with the Body: *Sanyam* and *Swasthya*; correct appraisal of Physical needs, meaning of Prosperity in detail, Programs to ensure *Sanyam* and *Swasthya*

Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship

Understanding harmony in the Family- the basic unit of human interaction; Understanding values in human-human relationship; meaning of *Nyaya* and program for its fulfillment to ensure *Ubhay-tripti*; Trust (*Vishwas)* and Respect (*Samman)* as the foundational values of relationship; Understanding the meaning of *Vishwas*; Difference between intention and competence Understanding the meaning of *Samman*, Difference between respect and differentiation; the other salient values in relationship

UNIT-III (6 Hrs)

Understanding the Harmony in the Society (Society Being an Extension of Family)

Samadhan, Samridhi, Abhay, Sah-astitva as comprehensive Human Goals Visualizing a universal harmonious order in society- Undivided Society (*Akhand Samaj),* Universal Order (*Sarvabhaum Vyawastha)*- from family to world family!

Understanding Harmony in the Nature and Existence - Whole existence as Co-existence

Understanding the harmony in the Nature; Interconnectedness and mutual fulfillment among the four orders of nature- recyclability and self-regulation in nature; Understanding Existence as Co-existence (*Sah-astitva*) of mutually interacting units in all-pervasive space; Holistic perception of harmony at all levels of existence

UNIT-IV (4 Hrs)

Implications of the above Holistic Understanding of Harmony on Professional Ethics

Natural acceptance of human values Definitiveness of Ethical Human Conduct; Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order; Competence in professional ethics:

- Ability to utilize the professional competence for augmenting universal human order,
- Ability to identify the scope and characteristics of people-friendly and eco-friendly production systems,
- Ability to identify and develop appropriate technologies and management patterns for above
- production systems;
- Case studies of typical holistic technologies, management models and production systems; Strategy for transition from the present state to Universal Human Order:
- At the level of individual: as socially and ecologically responsible engineers, technologists and managers
- At the level of society: as mutually enriching institutions and organizations

Recommended Books

1. R. R. Gaur, R. Sangal, G. P. Bagaria, ‘A Foundation Course in Value Education’, **2009.**

Suggested Readings/Books

1. Ivan Illich, ‘Energy & Equity’, The Trinity Press, Worcester, and Harper Collins, USA, **1974.**
2. E.F. Schumacher, ‘Small is Beautiful: A Study of Economics as if People mattered’, Blond & Briggs, Britain, **1973.**
3. A. Nagraj, ‘Jeevan Vidya ek Parichay’, Divya Path Sansthan, Amarkantak, **1998.**
4. Sussan George, ‘How the Other Half Die’s, Penguin Press. Reprinted **1986, 1991.**
5. P.L. Dhar, R.R. Gaur, ‘Science and Humanism’, Commonwealth Publishers, **1990**.
6. A.N. Tripathy, ‘Human Values’, New Age International Publishers, **2003.**
7. Subhas Palekar, ‘How to practice Natural Farming’, Pracheen (Vaidik) Krishi Tantra Shodh, Amravati, **2000.**
8. Donella H. Meadows, Dennis L. Meadows, Jorgen Randers, William W. Behrens III, ‘Limits to Growth - Club of Rome’s report’, Universe Books, **1972.**
9. E. G. Seebauer & Robert L. Berry, ‘Fundamentals of Ethics for Scientists & Engineers’, Oxford University Press, **2000.**
10. M. Govindrajran, S. Natrajan & V.S. Senthil Kumar, ‘Engineering Ethics (including Human Values)’, Eastern Economy Edition, Prentice Hall of India Ltd.
11. B P Banerjee, ‘Foundations of Ethics and Management’, Excel Books, **2005.**
12. B. L. Bajpai, **2004,** ‘Indian Ethos and Modern Management’, New Royal Book Co., Lucknow, Reprinted **2008.**

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ENVIRONMENTAL SCIENCE

Subject Code: BESE0-101 **L T P C** **Duration: 48 Hrs.**
2 0 0 2

Course Objectives:

1. To identify global environmental problems arising due to various engineering/industrial/ and technological activities and the science behind these problems
2. To realize the importance of ecosystem and biodiversity for maintaining ecological balance.
3. To identify the major pollutants and abatement devices for environmental management and sustainable development.
4. To estimate the current world population scenario and thus calculating the economic growth, energy requirement and demand.
5. To understand the conceptual process related with the various climatologically associated problems and their plausible solutions.

UNIT-1

1. The Multidisciplinary Nature of Environmental Studies (2 Hrs.)

Definition, scope and importance. Need for public awareness.

2. Natural Resources (Hrs.)

Renewable and Non-renewable Resources:

Natural resources and associated problems.

(a) Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people.

(b) Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.
(c) Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies.
(d) Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.
(e) Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources, case studies.
(f) Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification.
(g) Role of an individual in conservation of natural resources.
(h) Equitable use of resources for sustainable lifestyles.

UNIT-1I

3. Ecosystems (8 Hrs.)

(a) Concept of an ecosystem.
(b) Structure and function of an ecosystem.
(c) Producers, consumers and decomposers.
(d) Energy flow in the ecosystem.
(e) Ecological succession.
(f) Food chains, food webs and ecological pyramids.
(g) Introduction, types, characteristic features, structure and function of the following ecosystem:
  i) Forest ecosystem.
  ii) Grassland ecosystem.
  iii) Desert ecosystem.
  iv) Aquatic ecosystems (ponds, streams, lakes, rivers, ocean estuaries).

4. Biodiversity and its Conservation (6 Hrs.)

(a) Introduction – Definition: genetic, species and ecosystem diversity.
(b) Biogeographical classification of India.
(c) Value of biodiversity: consumptive use, productive use, social, ethical aesthetic and
(d) option values.
(e) Biodiversity at global, national and local levels.
(f) India as a mega-diversity nation.
(g) Hot-spots of biodiversity.
(h) Threats to biodiversity: habitat loss, poaching of wildlife, man wildlife conflicts.
(i) Endangered and endemic species of India.
(j) Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

UNIT-1II

5. Environmental Pollution (8Hrs.)

Definition

(a) Causes, effects and control measures of:
  i) Air pollution

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- ii) Water pollution
- iii) Soil pollution
- iv) Marine pollution
- v) Noise pollution
- vi) Thermal pollution
- vii) Nuclear pollution

(b) Solid Waste Management: Causes, effects and control measures of urban and industrial wastes.
(c) Role of an individual in prevention of pollution.
(d) Pollution Case Studies.
(e) Disaster management: floods, earthquake, cyclone and landslides

6. Social Issues and the Environment (8 Hrs.)

(a) From unsustainable to sustainable development
(b) Urban problems and related to energy
(c) Water conservation, rain water harvesting, Watershed Management
(d) Resettlement and rehabilitation of people; its problems and concerns. Case studies.
(e) Environmental ethics: Issues and possible solutions
(f) Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case studies.
(g) Wasteland reclamation
(h) Consumerism and waste products
(i) Environmental Protection Act
(j) Air (Prevention and Control of Pollution) Act
(k) Water (Prevention and control of Pollution) Act
(l) Wildlife Protection Act
(m) Forest Conservation Act
(n) Issues involved in enforcement of environmental legislation
(o) Public awareness

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UNIT-1V

7. Human Population and the Environment (7 Hrs.)

(a) Population growth, variation among nations
(b) Population explosion – Family Welfare Programmes
(c) Environment and human health
(d) Human Rights
(e) Value Education
(f) HIV/AIDS
(g) Women and Child Welfare
(h) Role of Information Technology in Environment and Human Health
(i) Case Studies

8. Field Work (6 Hrs.)

(a) Visit to a local area to document environmental assets river/
(b) forest/grassland/hill/mountain
(c) Visit to a local polluted site – Urban / Rural / Industrial / Agricultural

(d) Study of common plants, insects, birds
(e) Study of simple ecosystems-pond, river, hill slopes, etc (Field work equal to 5 lecture hours)

Recommended Books

1. J.G. Henry and G.W. Heinke, 'Environmental Sc. & Engineering', Pearson Education, **2004.**
2. G.B. Masters, 'Introduction to Environmental Engg. & Science', Pearson Education, **2004.**
3. Erach Bharucha, 'Textbook for Environmental Studies', UGC, New Delhi.

APPLIED PHYSICS LAB.

Subject Code: BPHY0-102 **L T P C**
0 0 2 1

At least 10 experiments should be performed in one semester

LIST OF PRACTICALS

1. To study the magnetic field of a circular coil carrying current.
2. To find out polarizability of a dielectric substance.
3. To study the laser beam characteristics like; wave length using diffraction grating element.
4. Study of diffraction using Laser beam and thus to determine the grating element.
5. To study the angular divergence of laser beam.
6. To study laser interference using double slit or Michelson's Interferometer.
7. To determine numerical aperture of an optical fibres
8. To determine attenuation and propagation losses in optical fibres.
9. To find out the frequency of AC mains using electric-vibrator.
10. To find the refractive index of a material (solid or liquid) using spectrometer.
11. To study the B-H curve using CRO.
12. To determine the grain size of a material using optical microscope.
13. To find the velocity of ultrasound in liquid.

Recommended Books

1. C.L. Arora, 'Practical Physics', S. Chand & Co., **1997.**
2. R.S. Sirohi, 'Practical Physics', Wiley Eastern.

COMMUNICATIVE ENGLISH LAB

Subject Code: BHUM0-102 **L T P C**

0 0 2 1

The Communicative English Language Lab focuses on the production and practice of sounds of language and familiarizes the students with the use of English in everyday situations and contexts.

Course Objectives

1. To expose the students to a variety of self-instructional, learner-friendly modes of language learning.

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2. To help the students cultivate the habit of reading passages from the computer monitor, thus providing them with the required facility to face computer-based competitive exams.
3. To enable them to learn pronunciation through stress on word accent, intonation, and rhythm.
4. To train them to use communication skills effectively for interviews, group discussions, public speaking etc.

Syllabus

The following course content is prescribed for the Communicative English Laboratory sessions:

1. Introduction to the Sounds of English- Vowels, Diphthongs & Consonants.
2. Introduction to Stress and Intonation.
3. Situational Dialogues / Role Play.
4. Oral Presentations- Prepared and Extempore.
5. ‘Just A Minute’ Sessions (JAM).
6. Describing Objects / Situations / People.
7. Information Transfer
8. G.D. and Debate

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The teacher may use following different classroom techniques to give practice and monitor the progress of the students:

- Role Play
- Question-Answer
- Discussion
- Presentation of Papers
- Seminars etc.

Minimum Requirement

The Communicative English Language Lab shall have two parts:

i) The Computer aided Language Lab for 30 students with 30 systems, one master console, LAN facility and English language software for self- study by learners.

ii) The Communication Skills Lab with movable chairs and audio-visual aids with a P.A System & a LCD projector/ T. V.

System Requirement (Hardware Component)

Computer network with *LAN* with minimum 30 multimedia systems

Suggested Software

1. Cambridge Advanced Learners’ English Dictionary with CD.
2. The Rosetta stone English Library

3. Clarity Pronunciation Power – Part I
4. Mastering English in Vocabulary, Grammar, Spellings, Composition
5. Dorling Kindersley series of Grammar, Punctuation, Composition etc.
6. Language in Use, Foundation Books Pvt. Ltd with CD.
7. Oxford Advanced Learner's Compass, 7th Edition
8. Learning to Speak English - 4 CDs
9. Microsoft Encarta with CD
10. Murphy's English Grammar, Cambridge with CD.
11. English in Mind, Herbert Puchta and Jeff Stranks with Meredith Levy, Cambridge

Reference Books

Books Suggested for English Language Lab Library (to be located within the lab in addition to the CDs of the text book which are loaded on the systems):

1. Spoken English (CIEFL) in 3 volumes with 6 cassettes, OUP.
2. English Pronouncing Dictionary, Daniel Jones Current Edition with CD.
3. R. K. Bansal and J. B. Harrison, 'Spoken English', Orient Longman, **2006**.
4. Dr. A. Ramakrishna Rao, Dr. G. Natanam & Prof. S.A. Sankaranarayanan, 'English Language Communication: A Reader cum Lab Manual'. Anuradha Publications, Chennai.
5. Krishna Mohan & N.P. Singh, 'Speaking English Effectively', Macmillan.
6. J. Sethi, Kamlesh Sadanand & D.V. Jindal, 'A Practical Course in English Pronunciation, (with two Audio cassettes)', Prentice-Hall of India Pvt. Ltd., New Delhi.
7. T. Balasubramanian, 'A Text Book of English Phonetics for Indian Students', Macmillan.
8. 'English Skills for Technical Students**,** WBSCTE' with British Council, OL

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Course Outcomes

The students after undertaking this course will be able to:

i) Understand and appreciate the need of communication skills in personal and professional life.
ii) Use different medias/channels of communication and select the most appropriate for a given situation.
iii) Speak and present himself/herself professionally and socially effectively through effective talks, resumes, interviews etc.

BASICS OF ELECTRICAL ENGINEERING LAB.

Subject Code: BELE0-102 **L T P C**
0 0 2 1

List of Experiments

NOTE: Students are required to perform eight experiments, they must perform at least one experiment each from Group I to III and all experiments from Group-IV.

Group-I

1. To verify Ohm's law and its limitations.
2. To verify Kirchoff's Laws (KVL and KCL)

3. To measure the resistance and inductance of a coil by ammeter-voltmeter method.
4. To find voltage-current relationship in a R-L series circuit and to determine the power factor of the circuit.

Group-II

5. To verify the voltage and current relations in star and delta connected systems.
6. To measure power and power factor in a single- phase AC circuit.
7. To Study the various types of switches like Relays, SPST, DPST, MCB and Stair case switch.

Group-III

8. To study the principle of fluorescent lamp.
9. To verify the rating of compact fluorescent lamp (CFL).
10. To Study the home power supply system.

Group-IV

11. To perform open- and short circuit tests on a single phase transformer and calculate its efficiency
12. To start and reverse the direction of rotation of a
    i) DC motor
    ii) Induction motor

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Recommended Books

1. S.K. Bhattacharya, 'Experiments in Basic Electrical Engineering', New Age International, New Delhi, **2007.**

MANUFACTURING PRACTICES

Subject Code: BMFP0-101 **L T P C**

1 0 6 4

Introduction of various manufacturing practices, tools and equipment used, Hand on experience by making different jobs in respective shops like:

1. Machine Shop
2. Sheet Metal Shop
3. Fitting Shop
4. Welding Shop
5. Carpentry and Pattern Making Shop
6. Forging Shop
7. Foundry Shop
8. Electrical and Electronics Shop

Safety Awareness in workshop: it is very important to know & understand to keep the safety in workshop during working. The concerned shop in-charge must ensure the safe practice sessions. The student must be aware of and follow safety norms and rules during practice in Workshop.

APPLIED CHEMISTRY

Subject Code: BCHM0-101 **L T P C** **Duration: 48 Hrs.**
3 1 0 4

UNIT - I

1. Molecular Spectroscopy (8 Hrs.)

UV/Visible Spectroscopy: Selection rule, Principle and instrumentation, Electronic Transitions, Chromophores & Auxochromes, Factors affecting λ_{max} intensity of spectral lines, Types of absorption bands, Frank Condon Principle, Applications.

IR Spectroscopy: Principle and instrumentation; Force Constant, Anharmonic Oscillator Model, Finger Print region, Fundamental modes of vibrations, Factors affecting vibrational frequency, Applications.

2. NMR Spectroscopy (8 Hrs.)

Principle & instrumentation; Chemical shift; Factors affecting Chemical Shift; Spin-Spin Splitting;Coupling Constant, High resolution NMR spectrum, NMR spectrum of EtOH, Relaxation process, Applications.

UNIT - II

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3. Polymers (5 Hrs.)

Introduction; Functionality; Classifications of Polymers, Types of polymerization; Specific features of polymers; Structures - regularity and irregularity; Tacticity of polymers; Average molecular weights and size; Effect of molecular weight on the properties of polymers; Glass Transition Temperature, Crystallinity of polymers, Introduction to polymer reinforced composite.

4. Petrochemicals (5 Hrs.)

Introduction; First, second & third generation petrochemicals; Primary Raw Materials for Petrochemicals. Natural gas and its treatment processes; Properties of natural gas; Crude oil: Composition of and classification of crude oil; Physical separation processes; Conversion processes.

UNIT - III

5. Water and its Treatment (5 Hrs.)

Specifications of water, Hardness of water, Treatment and problems of Boiler feed water, Different methods of the water softening, Domestic water treatment of water, Desalination of water.

6. Coordination and Organometallic Chemistry (6 Hrs.)

Coordination number and structures of coordination complexes, Nomenclature of Coordination Compounds, Theory of bonding- crystal field and molecule orbital theory for Tetrahedral and octahedral complexes, JT distortion.

UNIT - IV

7. Green Chemistry and its Applications (5 Hrs)

Introductory overview - Definition and concepts of Green chemistry; Twelve Principles of Green chemistry, Use of alternative feedstock (bio-fuels); Use of innocuous reagents in natural processes; Alternative solvents; Design of the safer chemicals; Designing alternative reaction methodology. Microwave and ultrasonic radiation in Green synthesis - Minimizing energy consumption.

8. Corrosion and its Prevention (6 Hrs.)

Introduction; Wet and Dry corrosion; Different types of surface films; Mechanisms of wet corrosion; Galvanic corrosion; Galvanic Series; Concentration cell corrosion and differential aeration corrosion; Soil and microbial corrosion; Factors affecting corrosion; Various methods of corrosion control.

Recommended Books

1. William Kemp, 'Organic Spectroscopy', Palgrave Foundations, **1991.**

2. D. A. Skoog, F. J. Holler and A. N. Timothy, 'Principle of Instrumental Analysis', 5th Edn., Saunders College Publishing, Philadelphia, **1998.**

3. G. W. Castellan, 'Physical Chemistry', 3rd Edn, 1995, Narosa, reprint **2004**.

4. C. P. Poole, Jr., F. J. Owens, 'Introduction to Nanotechnology', Wiley Interscience, **2003**.

5. L.E. Foster, 'Nanotechnology', Science Innovation & Opportunity, Pearson Education, **2007**.

6. M. Lancaster, 'Green Chemistry- An Introductory Text', 1st Edn,, Royal Society of Chemistry, Cambridge, UK, **2010**.

7. Sami Matar, Lewis F. Hatch, 'Chemistry of Petrochemical Processes', 2nd Edn, Gulf Publishing Company, Houston, Texas, **2000.**

8. Jones, Denny, 'Principles and Prevention of Corrosion', 2nd Edn, Upper Saddle River, New Jersey: Prentice Hall, **1996**.

9. Nicholas J. Turro, 'Modern Molecular Photochemistry', University Science Books, Sausalito, California, **2010**.

10. Mohamed Belgacem, Alessandro Gandini, 'Monomers, Polymers and Composites from Renewable Resources', ELSEVIER, **2008**.

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APPLIED MATHEMATICS-II

Subject Code: BMAT0-201 **L T P C**

4 1 0 5

Learning Objectives

To introduce the concepts and to develop working knowledge on curve tracing, Partial differentiation and its applications, Multiple integration and vector calculus.

UNIT-I

Differential & Integral Calculus and its Applications (11 Hrs.)

Curve tracing- Tracing of standard cartesian, Parametric and polar curves, Curvature of cartesian, Parametric and polar curves. Rectification of standard curves, Areas bounded by standard curves, Volumes and surfaces of revolution of curves, Applications of integral calculus to find center of gravity and moment of inertia.

UNIT-II

Partial Differentiation and its Applications (13 Hrs.)

Functions of several variables, Limit and continuity, Change of variable, Chain rule, Partial differentiation, Homogeneous functions and Euler's theorem, Composite functions, Total derivative, Derivative of an implicit function; Change of variable, Jacobians. Tangent and normal to surface, Taylor's and Maclaurin's series for functions of two variables, Errors and approximations, Maxima and minima of function of several variables, Lagrange's method of undetermined multipliers.

UNIT-III

Multiple Integrals and its Applications (10 Hrs.)

Double and triple integrals and their evaluation, Change of order of integration, Change of variables, Applications of double and triple integral to find area and volumes.

UNIT-IV

Vector Calculus and its Applications (11 Hrs.)

Scalar and vector fields, Differentiation of vectors, Velocity and acceleration, Vector differential operators: Del, Gradient, Divergence and curl and their physical interpretations, Formulae involving del applied to point function and their products, Line, surface and volume integrals, Solenoidal and irrotational vectors, Gauss divergence theorem, Green's theorem in plane, Stoke's theorem (without proofs) and their applications.

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Recommended Books

1. G. B. Thomes, R.L. Finney, ‘Calculus and Analytic Geometry’, 9th Edn., Pearsons Education, **1995.**

2. E. Kreyszig, ‘Advanced Engineering Mathematics’, 9th Edn., John Wiley, **2006.**

3. Peter V.O. Nil, ‘Advanced Engineering Mathematics’, Wordsworth Publishing Company.

4.Jain, R.K. and S.R.K. Iyengar, ‘Advanced Engineering Mathematics’, 4th Edn., Narosa.

5. B.S. Grewal, ‘Higher Engineering Mathematics’, 40th Edn., Khanna Publishers, New Delhi, **2007**.

6. H.C. Taneja, ‘Engineering Mathematics’, Volume-I & Volume-II, 2nd Edn., I.K. Publisher, **2010**.

7. Babu Ram, ‘Advanced Engineering Mathematics’, Peaeson Education, **2009**.

8. J.S. Bindra, ‘Applied Mathematics’, Volume-I, 9th Edn., Kataria Publications, **2009**.

BASICS OF ELECTRONICS ENGINEERING

Subject Code: BECE0-101 **L T P C** **Duration: 25 Hrs.**

2 0 0 2

UNIT-I

1. **Diodes (3 Hrs.)**
   PN Junction diode, LED, Photodiode, Zener diode, Avalanche & Zener phenomenon.
2. **Diode Applications (4 Hrs.)**
   Rectification: Half Wave & Full Wave, Bridge vs Centre Tapped Rectifiers; Switching: ideal vs Practical; Regulation, Power supply design

UNIT-II

3. **Transistors (4 Hrs.)**
   Bipolar Junction Transistors: NPN, PNP types; Terminology: Biasing, Q-Point; JFET
4. **Transistor Applications (4 Hrs.)**
   Common Emitter, Common Base, Common Collector configurations; Transistor as Amplifier and Switch.

UNIT-III

5. **Digital Electronics Fundamentals (5 Hrs.)**
   Analog vs Digital Signals, Digital Signal Representations with Binary and Timing diagrams, Multi-input Basic and Composite Gates working with symbolic representation, Universal Gates, ICs, Performance Characteristics terminology, Boolean Expression simplification with K-maps upto 4-variables

UNIT-IV

6. **Transducers (5 Hrs.)**
   Measurements, Measurement system with blocks, Transducers & their nomenclature; Static Performance Characteristics- Qualitative & Quantitative description; Representation of Working Principal on fully labelled graphs and Applications of LVDT, RTD, Thermistors, Strain Gauges.

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Recommended Books

1. Robert Boylestad and Louis Nashelsky, 'Electronic Devices and Circuits', Prentice Hall of India 10th Edn,, **2009.**

2. R.P. Jain, 'Modern Digital Electronics', Tata McGraw Hill, **2003.**

3. Bhargava, Kulshreshtha, Gupta, 'Basic Electronics and Linear Circuits' TTTI Chandigarh, TMH, **1984.**

4. M.S. Sukhija and T.K. Nagsarkar, 'Basic of Electrical and Electronics Engineering' Oxford University Press, **2012**,

BASICS OF ELECTRONICS ENGINEERING LAB.

Subject Code: BECE0-102 **L T P C**
0 0 2 1

List of Experiments

NOTE: Students shall perform at least 10 experiments out of the following to qualify and need to submit written record of each experiment in a Practical File with sketch and specifications of all components/Devices used in that Experiment

1. To measure amplitude and frequency of various signals (Sine, Triangular & Square) with CRO
2. To plot and analyze fully labeled V-I characteristics of P-N junction diode and compare results with the data sheets
3. To obtain and plot input-output waveforms of half wave Rectifier
4. To obtain and plot input-output waveforms of Full Wave Rectifier (Centre-tap and Bridge)
5. To obtain and plot input-output characteristics of Zener diode and compare results with the data sheets
6. To plot V-I characteristics of BJT in CB configuration and calculate static transistor parameters and compare results with the data sheets
7. To plot V-I characteristics of BJT in CE configuration and calculate static transistor parameters and compare results with the data sheets
8. To plot and evaluate V-I characteristic of FET and evaluate static parameters and compare results with the data sheets
9. To verify truth tables of various logic gates and realize various gates using universal gates
10. To obtain and analyze I/O graphical plot for LVDT and compare results with the data sheets
11. To obtain and analyze I/O graphical plot for RTD or Thermistor and compare results with the data sheets
12. Collect and comprehend the technical specifications of any two commercial electronic systems (LED TV, LCD TV, Microwave oven, Washing machine etc.).

Recommended Books

1. Paul B. Zbar, Albert Paul Malvino, Michael A. Miller, ‘Basic Electronics’, 7th Edn., Glenco, **1994.**
2. R.P. Jain, ‘Modern Digital Electronics’, Tata Mc Graw Hill**.**
3. L.K. Maheshwari, M.M.S. Anand, ‘Laboratory Manual for Introductory Electronics Experiments’, New Age International, **1997.**

ELEMENTS OF MECHANICAL ENGINEERING

Subject Code: BMEE0-101 **L T P C** **Duration: 43 Hrs.**
3 1 0 4

Objectives and Expected Course Outcome

1. In the vast spectrum of Mechanical Engineering, this subject gives a very primitive information in vide application of day to day life with emphasis on the principles and fundamentals involved in the inter-conversion of thermal energy into mechanical energy.

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2. The subject also offers a bird’s eye-view to all students about the basics of Mechanical Engineering.

UNIT-I

1. Basic Concepts of Thermodynamics and various laws (12 Hrs.)

Thermodynamic System, Boundary and Surroundings, Thermodynamic System types, basic definitions, reversible and irreversible process, Temperature, pressure, heat, work, internal energy, enthalpy and specific heat, Zeroth law of Thermodynamics, first law of Thermodynamics, its corollaries and applications on various cyclic processes (constant volume, constant pressure, constant temperature, adiabatic and polytropic, Free Expansion Process), Steady State energy flow process and its engineering applications

Second Law of Thermodynamics, its corollaries and applications. Heat Engine, Heat Pump and Refrigerator, Claussius Inequality, concept and philosophy of entropy, entropy changes during various Processes, third law of thermodynamics

2. Basics of Automobiles (6 Hrs.)

IC engines and its classification, petrol and diesel engines, two and four stroke engines, basic components of IC engines, BHP, IHP, FHP, Mechanical efficiency, gears and its types, power transmission in automobiles, basic function of clutch, brake, differential, axle, tyres.

UNIT-II

3. Fluids and Fluid Mechanics (5 Hrs.)

Fluids, types of fluids, properties of Fluids, Pascal law, Archimedes law, buoyancy and buoyant force, Continuity equation and Bernoulies equation

UNIT-III

4. Laws of forces (6 Hrs.)

Two dimensional force system, basic concepts, rigid body, free body diagram, resolution of forces into components, triangle law of forces, parallelogram law of forces, polygon law of forces, Lami’s equation. Varigon’s theorem, Application,

5. Friction: Introduction (4 Hrs.)

Laws of Coulomb’s friction, equilibrium of bodies involving dry friction, Applications.

UNIT-IV

6. Centroid, Centre of Gravity and Moment of Inertia (10 Hrs.)

Difference between centre of gravity and centroid. determination of position of centroid of plane geometric figures of I, T, Circular and Triangular Sections. Determination of position of Centre of Gravity (CG) of simple solid figures. Parallel axis theorem, Perpendicular axes Theorem, Radius of gyration, determination of area Moment of Inertia of I, T, Circular and Triangular Sections.

Recommended Books

1. A. Yunus Cengel and Mishal A. Boles, ‘Thermodynamics & Engineering Approach’, 4th Edn., Tata Mc Graw Hill, **2011.**
2. G.S. Sawhney, ‘Fundamentals of Mechanical Engg.: Thermodynamics, Mechanics, Theory of Machines, Strength of Materials and Fluid Dynamics’ 3rd Edn., PHI, **2013.**
3. P.N. Chandramouli, ‘Engineering Mechanics’, PHI, **2013.**
4. K.U. Siddiqui, ‘A Text Book of Automobile Engineering’, 1st Edn., New Age, **2011.**
5. K.L. Kumar, ‘Engineering Fluid Mechanics’, S. Chand, **2015.**

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6. R.K. Rajput, 'A text Book of Fluid Mechanics', S. Chand, **2013.**

BASICS OF COMPUTER PROGRAMMING

Subject Code: BCSE0-101	**L T P C** **3 0 0 3**	**Duration: 45 Hrs.**

COURSE OBJECTIVES

This course is designed to explore computing and to show students the art of computer programming. Students will learn some of the design principles for writing good programs.

COURSE OUTCOMES

CO1: Understand, analyze and implement software development tools like algorithm, pseudo codes and programming structure

CO2: Study, analyze and understand logical structure of a computer program, and different construct to develop a program in 'C' language

CO3: Write small programs related to simple/ moderate mathematical, and logical problems in 'C'.

CO4Study, analyze and understand simple data structures, use of pointers, memory allocation and data handling through files in 'C'.

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UNIT-I

1. Introduction to Problem Solving and Programming Languages (10 Hrs.)

Problem Solving Aspects, Program Development Steps, Introduction to Programming Languages, Types and Categories of Programming Languages, Program Development Environments

2. Logic development and Algorithms

Types of Problem: Data Centric and Process Centric, Problem Solving Strategies, Problem Analysis, formal definition of problem, Top- Down design and Bottom –Up design, Algorithms, Flow charts, Flow chart symbols, Pseudo codes, illustrative examples

UNIT-II

3. Introduction to C Programming Language (12 Hrs.)

Introduction to C Language, Evolution and Characteristics of C Language, Compilation Model, Character Set, Keywords, Identifiers, Data Types, Variables, Constants, Operators, Expressions, Type conversion and Type Casting, Overview of Pre-processors, Structure of a C Program, Input and Output Statements

4. Control Statements

Basic Programming Constructs, Sequence, Selection Statements 'if' Statement, Conditional / Ternary /?: Operator, Switch Statement, Iteration Statements, 'for' statement, 'while' statement, 'do - while' statement, break, continue Statement

UNIT-III

5. Arrays and Strings (11 Hrs.)

Need for an Array, Memory Organization of an Array, Declaration and Initialization, Basic Operation on Arrays, Multi-dimensional Array, Strings

6. Pointers

Introduction, Declaration and Initialization, Pointer Arithmetic, Pointers and Arrays, Dynamic Memory Allocation

UNIT-IV

7. Functions and Storage Classes (12 Hrs.)

Need for Functions, Function Prototype, Function Definition, Function Call Passing Arguments, Functions and Arrays, Functions and Pointers, Command Line Arguments, Recursive Functions, String Functions, Automatic Storage Class, Register Storage Class, Static Storage Class, External Storage Class

8. Structures

Declaration and Initialization, Structures and Arrays, Structures and Pointers, Structures and Functions, Introduction to Unions, Enumeration, Typedef Statement

9. Files

Introduction, File Operations, Character I/O, String I/O, Numeric I/O, Formatted I/O, Block I/O

Recommended Books

Text Books

1. Yashwant P. Kanetkar, 'Let us C', BPB Publications.
2. Yashwant P. Kanetkar, 'Pointers in C', BPB Publications.
3. Jitender Chhabra, 'Programming with C', Schaum's Series.
4. Reema Thareja, 'Computer Fundamentals & Programming in C', Oxford.
5. Peter Nortan, 'Computing Fundamentals', Tata McRaw Hill.

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Reference Books

1. Cognizant, 'Problem Solving and C Programming',
2. R.S. Salaria, 'Problem Solving and Programming in C'.
3. Allen B. Tucker, 'Computer Science Handbook', CRC Press B.E. Computer Science and Engineering 2014-2015.

ENGINEERING DRAWING

Subject Code: BMEE0-102 **L T P C** **Duration: 45 Hrs.**

1 0 4 3

Objectives and Expected Outcomes

1. Main objective of the Engineering Drawing is to introduce the students to visual science in the form of technical graphics. General instructions related to Theory of Orthographic Projection of points, lines, planes and solids as per the BIS codes prevalent to drawing practice will be introduced initially.
2. Section of solids and development of surfaces, isometric projection and orthographic projection of simple solids/blocks will upgrade the basic understanding and visualization of geometrical objects and to certain extent the machine parts.

UNIT-I

1. Introduction (4 Hrs.)

Introduction to drawing equipment and use of instruments. Symbols and conventions in drawing Practice. Types of lines and their use, BIS codes for lines, Technical lettering as per BIS codes, Introduction to Dimensioning, Concepts of scale in drawing, Types of scales.

2. Projection of Points and Lines (9 Hrs.)

Projection of points in quadrants, projection of lines parallel to both H P and V P, Parallel to one and inclined to other, inclined to both. True length and angle orientation of straight line: rotation method and trapezoidal method and trace of line.

UNIT-II

3. Projection of Planes (6 Hrs.)

Difference between plane and lamina. Projection of lamina Parallel to one and perpendicular to other, Perpendicular to one and inclined to other, Inclined to both reference planes and trace of planes.

4. Projection of Solids (6 Hrs.)

Definition of solids, types of solids. Projection of solids in first or third quadrant, with axis parallel to one and perpendicular to other, axis parallel to one inclined to other, axis inclined to both the principle plane, Visible and invisible details in the projection.

UNIT-III

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5. Section of Solids (6 Hrs.)

Definition of Sectioning and its purpose. Procedure of Sectioning, Types of sectional planes. Illustration through examples.

6. Development of Surface (6 Hrs.)

Purpose of development, Parallel line, radial line and triangulation method. Development of prism, cylinder, cone and pyramid surface for both right angled.

UNIT-IV

7. Isometric Projection (4 Hrs.)

Basic Principle of Isometric projection, Difference between isometric projection and isometric drawing. Isometric projection of solids such as cube, prism, pyramid and cylinder

8. Orthographic Projection (8 Hrs.)

Review of principle of Orthographic Projection, Sketch/drawing of blocks, and of simple machine parts.

Recommended Books

1. P.S. Gill, 'Engineering Drawing', 4th Edn., S.K. Kataria.
2. N.S. Parthasarthy Vela Murli, 'Engineering Drawing', 3rd Edn., Oxford University Press.
3. Basant Aggarwal and C.M. Aggarwal, 'Engineering Drawing', 3rd Edn., Mc Graw Hill Education (India) Pvt., Ltd.

APPLIED CHEMISTRY LAB.

Subject Code: BCHM0-102 **L T P C**

0 0 2 1

1. Analysis of Effluents

- Determination of Residual Chlorine.

- Determination of water by EDTA method.
- Determination of COD in a given water sample.
- Determination of H_2O by dissolved oxygen analyser.
- Determination of turbidity by Nephelometer

2. Analysis of Fuels and Lubricants

- Determination of Iodine value of oil.
- Determination of Flash & Fire point by Abele's Apparatus
- Determination of the viscosity of oil.
- Determination of Acid Value of and Aniline point of oil
- Determination of refractive index for oils.

3. Synthesis & analysis of metal complexes

- Preparation of Ni-DMG complex.
- Preparation of Tetramminecopper(II)sulphatemonohydrate [$Cu(NH_3)_4]SO_4.H_2O$]
- Determination of copper & nickel in the given solution by iodometric method.
- Determination of amount of Cu in the copper ore.
- Estimation of ferrous & ferric ions in the given solution

3. Instrumental Analysis

- Determination of the surface tension by stalagmometer
- Determination λ-max by spectrophotometer and determination of unknown conc. of binary mixture of two liquids.
- Determination of the strength of a solution pH metrically.
- Determination of the concentration of a solution conductometrically.
- Distinction between acid, ester, ketone using IR spectrophotometer.

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5. Synthesis & Green Chemistry experiments

- Preparation of aspirin.
- Preparation of a polymer phenol/urea formaldehyde resin
- Preparation of Nylon 66 polymer
- Preparation of ethyl-2-cyano-3-(4-methoxyphenyl)-propeonate (Microwave assisted reaction)
- Base catalysed aldol condensation by Green Methodology Acetylation of primary amines using eco-friendly method.

Note: Each student is required to perform two experiments from each of the 5 titles (presented bold) depending on his/her Branch and Aptitude.

Suggested Readings / Books

1. Vogel A-I, 'Quantitative Inorganic Analysis', 4th Edn., Longman Sc & Tech, **1980.**
2. Vogel A-I, Quantitative Organic Analysis, Oxford ELBS
3. dst.gov.in/green-chem.pdf (monograph of green chemistry laboratory experiments)
4. S. S. Dara, 'A Textbook on Experiments and Calculations in Engineering Chemistry', 9th Edn., S. Chand Publications, **2003**.
5. Sunita Rattan, 'Experiments in Applied Chemistry' 3rd Edn., S. K. Kataria & Sons Publications, **2015**.

BASICS OF COMPUTER PROGRAMMING LAB.

Subject Code: BCSE0-102 **L T P C**

0 0 4 2

1. Getting used to with the Computer System

To explore the part of the computer system such as system unit, input devices, output devices connected to the computer, the outside view of the system unit that includes the panels on front and ports at the rear, the inside view of the system unit that includes the motherboard, processor, expansion slots, various add-on cards, storage devices, power supply, fans, the booting process that includes switching on the system, execution of POST routine, then bootstrap loader, and loading of the operating system, and getting it ready for use, the graphical user interface (desktop) of operating system o to explain the various elements of the desktop such as taskbar, icons, short cuts, notification area, the desktop that includes selecting the wall paper, selecting the screen saver with or without password protection, selecting the screen resolution and color quality.

2. Working with Files & Folders

Practical knowledge to navigate with the drives, create new folders, move folders from one drive to another drive, move files from one folder to another folder, search files and folders, share files and folders, view and/or change the attributes of the files and folders

3. Setting the Environment

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Practical knowledge to work with date and time to create new user accounts, install new hardware and configuring existing hardware, install new software or remove existing installed software, configure network connections, manage security profile, practical view to work on the command prompt, open an application, folder, document or internet resource from the Run command, initialize storage media (formatting) To understand the menace of viruses, understand the working of virus guards and antivirus software

5. Exploring the Internet

Hand on to understand the working of the internet that include the use of protocols, domains, IP addresses, URLs, web browsers, web servers, mail-servers, etc. create email-account, sending mails, receiving mails, sending files as attachments, etc., login to a remote computer, search information using search engines

6. Documentation Tool

Practical Knowledge to familiarize with parts of documents, create and save a document, set page settings, create headers and footers, edit a document and resave it, use copy, cut and paste features, use various formatting features such as bold face, italicize, underline, subscript, superscript, line spacing, etc., use spelling and grammar checking feature, preview print a document, create a table with specified rows and columns, enter data in a table, select a table, a row, a column or a cell, inset new row and/or a column, delete a row and/or a column, split and merge a row, column or a cell, understand the mail-merge feature.

Practical Knowledge to familiarize with parts of spreadsheets, create and save a workbook with single and/or multiple worksheets, edit and format text as well numbers, apply operations on range of cells using built-in formulae, preview and print a worksheet, insert new row and/or column in a worksheet, delete a row and/or column in a worksheet, create a variety of charts, import and export data to or from worksheet

Hand on to familiarize with parts of Presentations, create and save a new presentation, apply design templates to a presentation, insert, edit and delete a slide, use different views of slides, use slide show from beginning or from the current slide, preview and print a presentation, check spellings in a presentation, add clip art and pictures in a slide, add chart, diagram and table in a slide, set animation for a selected slide and/or for entire presentation, create slide master and title master, create a custom show

Introduction to Various C Compilers: Turbo C, GCC, Borland etc.

Practical implementation of Programs using C

- Practical exercises to use various data types.
- Practical exercises using Conditional statements: if statements, if else statements, and nested statements
- Practical exercises using for loop, while loop, do while loop, Nested looping.
- Practical exercises using switch statements
- Practical exercises using arrays
- Practical exercises using strings and is functions
- Practical exercises using structures, unions, enumerations
- Practical exercises using functions
- Practical exercises using pointers
- Practical exercises to read and write the file content.

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B. ARCHITECTURE (1st YEAR)

Total Contact Hours = 28 **Total Marks = 800** **Total Credits = 25**

1st SEMESTER		Contact Hrs				Marks			Credits	Duration of Exam Hrs.
Subject Code	**Subject Name**	**L**	**S**	**T**	**P**	**Int.**	**Ext.**	**Total**		
BARC1-101	Architectural Design-I	2	4	-	-	40	60	100	6	3
BARC1-102	Building Construction-I	2	3	-	-	40	60	100	5	3
BARC1-103	Architectural Drawing - I	2	3	-		40	60	100	5	3
BARC1-104	History of Architecture - I	2	-	-	-	40	60	100	2	3
BARC1-105	Visual Communication - I	2	-	-	2	40	60	100	3	3
BARC1-106	Architectural Communication-I	1	-	-	2	40	60	100	2	3
BARC1-107	Building Sciences & Technology - I	1	-	-	-	40	60	100	1	3
BARC1-108	Model Making - I	-	-	-	2	60	40	100	1	No Exam (External Viva-voce)
Total	**Theory = 7 Labs = 3 Studio = 3**	**12**	**10**	**-**	**6**	**340**	**460**	**800**	**25**	

*Educational Tour of duration up to 04 days during the semester may be undertaken

B. ARCHITECTURE (1st YEAR)

Total Contact Hours = 26 **Total Marks = 800** **Total Credits = 25**

2nd SEMESTER		Contact Hrs				Marks			Credits	Duration of Exam Hrs.
Subject Code	**Subject Name**	**L**	**S**	**T**	**P**	**Int.**	**Ext.**	**Total**		
BARC1-209	Architectural Design - II	2	4	-	-	40	60	100	6	6 (Evaluation by External Viva-voce)
BARC1-210	Building Construction - II	2	3	-	-	40	60	100	5	3
BARC1-211	Architectural Drawing – II	2	3	-	-	40	60	100	5	3
BARC1-212	Visual communication-II	2	-	-	2	40	60	100	3	3
BARC1-213	Theory of Design	2	-	-	-	40	60	100	2	3
BARC1-214	Structure Design-I	1	-	1	-	40	60	100	2	3
BARC1-215	Building Sciences &Technology-II	1	-	-	-	40	60	100	1	3
BARC1-216	Structure System-I	1	-	-	-	60	40	100	1	No Exam (External Viva-voce)
Total	**Theory = 8 Labs = 1 Studio = 3**	**13**	**10**	**1**	**2**	**340**	**460**	**800**	**25**	

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* Educational Tour of duration up to 04 days during the semester may be undertaken

******After the completion of 2nd semester, the students shall have to undergo soft skill development of three weeks duration which shall be evaluated in 3rd semester.

B. ARCHITECTURE (2nd YEAR)

Total Contact Hours = 25 Total Marks = 800 Total Credits = 24

3rd SEMESTER		Contact Hrs				Marks			Credits	Duration of Exam Hrs.
Subject Code	**Subject Name**	**L**	**S**	**T**	**P**	**Int.**	**Ext.**	**Total**		
BARC1-317	Architectural Design-III	2	4	-	-	40	60	100	6	12 (Evaluation by External Viva-voce)
BARC1-318	Building Construction-III	2	3	-	-	40	60	100	5	3
BARC1-319	Visual Communication - III	1	-	-	4	40	60	100	3	No Exam (External Viva-voce)
BARC1-320	History of Architecture-II	2	-	-	-	40	60	100	2	3
BARC1-321	Structure Design-II	1	-	1	-	40	60	100	2	3
BARC1-322	Surveying &Levelling-I	1	-	-	2	40	60	100	2	3
BARC1-323	Building Science & Tech. - III	2	-	-	-	40	60	100	2	3
BARC1-324	Soft Skill Development	-	-	-	-	100	-	100	2	No Exam (Internal Viva-voce)
Total	**Theory = 7 Labs = 2 Studio = 2**	**11**	**7**	**1**	**6**	**380**	**420**	**800**	**24**	

*Educational Tour of duration up to 06 days during the semester may be undertaken

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B. ARCHITECTURE (2nd YEAR)

Total Contact Hours = 23 Total Marks = 800 Total Credits = 21

4th SEMESTER		Contact Hrs				Marks			Credits	Duration of Exam Hrs.
Subject Code	**Subject Name**	**L**	**S**	**T**	**P**	**Int.**	**Ext.**	**Total**		
BARC1-425	Architectural Design-IV	2	3	-	2	40	60	100	6	12 (Evaluation by External Viva-voce)
BARC1-426	Building Construction-IV	2	2	-	2	40	60	100	5	3
BARC1-427	Building Sciences &Technology-IV	2	-	-	-	40	60	100	2	3
BARC1-428	Visual Communication - IV	1	-	-	2	60	40	100	2	No Exam (External Viva-voce)
BARC1-429	Structure Design-III	1	-	1	-	40	60	100	2	3
BARC1-430	Design Philosophies-I	1	-	1	-	40	60	100	2	3 hours
BARC1-431	Structure System - II	1	-	-	-	60	40	100	1	No Exam (External Viva-voce)
BARC1-432	Educational Tour-I	-	-	-	-	100	-	100	1	No Exam (Internal Viva-voce)
Total	**Theory = 7 Labs = 3 Studio = 2**	**10**	**5**	**2**	**6**	**420**	**380**	**800**	**21**	

***Educational Tour-I (BARC1-432)** of duration up to 06 days during the semester shall be undertaken and evaluated

**After the completion of 4th semester, the students shall have to undergo on site construction training of five weeks duration which shall be evaluated in 5th semester

B. ARCHITECTURE (3rd YEAR)

Total Contact Hours = 23 **Total Marks = 800** **Total Credits = 24**

5th SEMESTER		Contact Hrs				Marks			Credits	Duration of Exam Hrs.
Subject Code	**Subject Name**	**L**	**S**	**T**	**P**	**Int.**	**Ext.**	**Total**		
BARC1-533	Architectural Design-V	2	3	-	2	60	40	100	6	18 (Evaluation by External Viva-voce)
BARC1-534	Building Construction-V	2	2	-	2	40	60	100	5	3
BARC1-535	On site construction Training	-	-	-	-	100	-	100	3	No Exam (Internal Viva-voce)
BARC1-536	Landscape Architecture	2	-	-	-	40	60	100	2	3
BARC1-537	Building Sciences &Technology-V	2	-	-	-	40	60	100	2	3
BARC1-538	History of Architecture-III	2	-	-	-	40	60	100	2	3
BARC1-539	Tall Buildings	1	-	1	-	40	60	100	2	3
BARC1-540	Design Philosophies-II	1	-	1	-	40	60	100	2	3
Total	**Theory = 7 Labs = 2 Studio = 2**	**12**	**5**	**2**	**4**	**400**	**400**	**800**	**24**	

* Educational Tour of duration up to 08 days during the semester may be undertaken

B. ARCHITECTURE (3rd YEAR)

Total Contact Hours = 25 **Total Marks = 800** **Total Credits = 21**

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6th SEMESTER		Contact Hrs				Marks			Credits	Duration of Exam Hrs.
Subject Code	**Subject Name**	**L**	**S**	**T**	**P**	**Int.**	**Ext.**	**Total**		
BARC1-641	Architectural Design-VI	2	3	-	2	60	40	100	6	18 (Evaluation by External Viva-voce)
BARC1-642	Building Construction-VI	2	2	-	2	40	60	100	5	3
BARC1-643	Building Sciences &Technology-VI	2	-	-	-	40	60	100	2	3
BARC1-644	Interior Design	1	-	-	2	40	60	100	2	3
BARC1-645	Estimating & Costing	1	-	-	2	40	60	100	2	3
BARC1-646	Design Philosophies-III	1	-	1	-	40	60	100	2	3
BARC1-647	Architectural Legislation	2	-	-	-	40	60	100	2	3
Total	**Theory = 7 Labs = 4 Studio = 2**	**11**	**5**	**1**	**8**	**400**	**400**	**800**	**21**	

* Educational Tour of duration up to 08 days during the semester may be undertaken

B. ARCHITECTURE (4th YEAR)

Total Contact Hours = 26 **Total Marks = 900** **Total Credits = 25**

7th SEMESTER		**Contact Hrs**				**Marks**			**Credits**	**Duration of Exam Hrs.**
Subject Code	**Subject Name**	**L**	**S**	**T**	**P**	**Int.**	**Ext.**	**Total**		
BARC1-748	Architectural Design-VII	2	5	-	2	60	40	100	8	No Exam (External Viva on Portfolio)
BARC1-749	Building Construction-VII	2	2	-	2	40	60	100	5	No Exam (External Viva on Portfolio)
BARC1-750	Housing	2	-	-	-	40	60	100	2	3
BARC1-751	Construction Management	2	-	-	-	40	60	100	2	3
BARC1-752	Town Planning	2	-	-	-	40	60	100	2	3
BARC1-753	Educational Tour-II	-	-	-	-	100	-	100	1	No Exam (Internal Viva-voce)
BARC1-754	Personality Development	1	-	-	-	100	-	100	1	No Exam (Internal Viva-voce)
Department Elective – I (Select any one)		1	-	1	-	40	60	100	2	
BARC1-761	Lighting & Illumination									**3**
BARC1- 762	Disaster Management for Buildings									**3**
Open Elective – I (Select any one)		**1**	**-**	**1**	**-**	**40**	**60**	**100**	**2**	**3**
Total	**Theory = 8, Labs = 2, Studio =2**	**13**	**7**	**2**	**4**	**500**	**400**	**900**	**25**	

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* **Educational Tour-II (BARC1-753)** of duration up to 08 days during the semester shall be undertaken and evaluated

*After the completion of 7th semester, the students shall have to undergo Practical training of 20 weeks' duration (Full semester) which shall be evaluated at the end of 8th semester

B. ARCHITECTURE (4th YEAR)

Total marks = 100 **Total Credits = 20**

8th SEMESTER		**Contact Hrs**				**Marks**			**Credits**	**Duration of Exam Hrs.**
Subject Code	**Subject Name**	**L**	**S**	**T**	**P**	**Int.**	**Ext.**	**Total**		
BARC1-855	Practical training of 24 weeks duration	-	-	-	-	40	60	100	20	No Exam (External Viva by Jury)
Total		-	-	-	-	40	60	100	20	

B. ARCHITECTURE (5th YEAR)

Total Contact Hours = 26 **Total Marks = 600** **Total Credits = 19**

9th SEMESTER		**Contact Hrs**				**Marks**			**Credits**	**Duration of Exam Hrs.**
Subject Code	**Subject Name**	**L**	**S**	**T**	**P**	**Int.**	**Ext.**	**Total**		
BARC1-956	Architectural Design-VIII	2	4	-	4	60	40	100	8	No Exam (External Viva on Portfolio)
BARC1-957	Research Methods & Dissertation Writing	1	1	-	2	40	60	100	3	3
BARC1-958	Urban Design	1	-	-	2	40	60	100	2	3
Department Elective – II (Select any one)		1	-	-	2	2	60	100	2	
BARC1 - 963	Landscape Design									3
BARC1 - 964	Building Maintenance									3
Department Elective – III (Select any one)		1	-	-	2	2	60	100	2	
BARC1- 965	Architectural Building Services									3
BARC1-966	Sikh Architecture									3
Department Elective – IV (Select any one)		**1**	**-**	**-**	**2**	**2**	**60**	**100**	**2**	
BARC1-967	Architecture Model Making									No Exam (External Viva on Portfolio)
BARC1-968	Vernacular Architecture									Duration of Exam
Total		**7**	**5**	**-**	**14**	**260**	**340**	**600**	**19**	

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* Educational Tour of duration up to 15 days during the semester may be undertaken
* The students must acquaint themselves with the planning and scheduling of Thesis project to be taken up in 10th Semester

B. ARCHITECTURE (5th YEAR)

Total Contact Hours = 30 **Total Marks = 600** **Total Credits = 21**

10th SEMESTER		**Contact Hrs**				**Marks**			**Credits**	**Duration of Exam Hrs.**
Subject Code	**Subject Name**	**L**	**S**	**T**	**P**	**Int.**	**Ext.**	**Total**		
BARC1-X59	Architectural Design-IX (Thesis Project)	10	-	-	10	60	40	100	15	No Exam (External Viva by Jury)
BARC1-X60	Professional Practice	1	-	1	-	40	60	100	2	3
Department Elective – V (Select any one)		2	-	-	2	40	60	100	2	
BARC1 – X69	Energy Efficient Buildings and Building Automation									3
BARC1 – X70	Advanced Construction									3
BARC1- X71	Architectural Journalism									3
Department Elective – VI (Select any one)		2	-	-	2	40	60	100	2	
BARC1-X72	Advanced Building Materials									3
BARC1-X73	Sustainable Architecture									3
BARC1- X74	Architectural Conservation									3
Total	Theory = 4, Labs = 3, Studio = NIL	**15**	**-**	**1**	**14**	**140**	**160**	**300**	**21**	

Overall

Semester	Marks	Credits
1st	800	25
2nd	800	25
3rd	800	24
4th	800	21
5th	800	24
6th	700	21
7th	900	25
8th	100	20
9th	600	19
10th	300	21
Total	**6600**	**225**

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ARCHITECTURAL DESIGN-I

Subject Code: BARC1-101 **L S T P C**
2 4 0 0 6

COURSE PREREQUISITES: The student should have an aptitude to visualize 2-D and 3-D objects.

COURSE OBJECTIVES:

- The student shall be able to learn the relationship between form and space.
- The student should be oriented towards development of visualization and expressional skills.

EXPECTED OUTCOMES: Student shall able to understand basic form and elements of Architectural Design,

CONTENTS

Unit-I (20 Marks)

- Parameters of Design Elements, Principles, Scale and Proportion
- Anthropometry and its application in design.
- Interrelationship of Architectural Form and Space

Unit-II (40 Marks)

- Synthesis of observations in design of an architectural form with a specific function. Exercise may include design like 2D Composition, Exhibition stall/Kiosk, Mural Seating Design, Roundabout Design Plaza Design including Soft-scape, Hard-scape, Furniture, Water body & small structure etc.

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RECOMMENDED TEXT AND REFERENCE BOOKS

RECOMMENDED BOOKS

1. V.S. Pramar, ‘Design Fundamentals in Architecture’, Somaiya Publications, **1973**.
2. Francis D.K. Ching, ‘Architecture: Form, Space, and Order’, Wiley Publications, 3rd Edn.
3. Pandya Yatin, ‘Elements of Space-Making, Mapin Publishing Pvt.’.
4. Chiara, Joseph De, ’Time Saver Standards for Building Types’, McGraw–Hill Professional Publishing, **2001**.
5. K.W. Smithies, ‘Principals of Design in Architecture’, Chapman & Hall, **1983**.
6. Ching, Francis D.K., ‘Architectural Form, Space and Order’, Van Nostrand Reinhold International Thomson Publishing, Inc.: New York, **1996**.
7. Harry N. Abrams, Rompilla, Ethel, ‘Color for Interior Design’.

INSTRUCTIONS TO THE PAPER SETTER

1. Three questions are to be set from Unit–I and students are required to attempt any two questions.
2. Two questions are to be set from Unit–II and students are required to attempt any one question.

BUILDING CONSTRUCTION-I

Subject Code: BARC1-102 **L S T P C**
2 3 0 0 5

COURSE PREREQUISITES: No Course Prerequisites

COURSE OBJECTIVES: To acquaint students about the handling and construction details of building materials.

EXPECTED OUTCOMES: The students shall be able to understand the process of building construction, the components of a building, skills and equipment used in shaping them with the help of basic construction details.

CONTENTS

Unit-I (20 Marks)

- Type of Bats and closers of Brick Masonry.
- Bonds in Brick work (English, Flemish, Rattrap Bond) – 4 ½”, 9”, 13 ½” Thick.
- L-Junction, T-Junction in Brick Masonry (4 ½”, 9”, 13 ½” Thick.)
- Attached and Detached piers in Bricks

Unit – II (20 Marks)

- Components of Arches, Types of Arches, Arches in Brick work (Flat, Segmental and Semi-Circular).
- Stone wall (Rubble & Ashlar)
- Construction of Brick Jalli wall

Unit – III (20 Marks)

- Lintels, Sills, Coping, Threshold details, Stepped brick foundation, Plinth detail and D.P.C. details.
- Section through a Single storey load bearing structure.

RECOMMENDED BOOKS

1. W.B. Mckay, ‘Building Construction’.
2. S.C. Rangwala, ‘Engineering Materials’.
3. B.C. Punmia, ‘Building Construction’.

REFERENCE BOOKS

1. Ching, D.K. Francis, ‘Building Construction Illustrated’.
2. Chudley, ‘Construction Technology’.
3. R. BARC1ry, ‘Construction of Buildings’.

INSTRUCTIONS TO THE PAPER SETTER

The examiner is required to set a total of six questions with two questions from each UNIT. The student is required to attempt any one question from each UNIT making a total of three questions.

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ARCHITECTURAL DRAWING – I

Subject Code: BARC1-103 **L S T P C**
2 3 0 0 5

COURSE PREREQUISITES: The students should have an aptitude to visualize 2D and 3D objects.

COURSE OBJECTIVES: The students should be able to learn the basics of good drafting, lettering techniques and visualization of geometrical forms through plan, elevations and sections.

EXPECTED OUTCOMES: The students shall be able to understand and draft 2-D and 3-D objects.

CONTENTS

Unit – I (10 Marks)

- Various types of lines used in Architectural Drawing.
- Lettering Techniques (Single and Double)
- Types of construction of plain and diagonal scales

Unit – II (30 Marks)

- Orthographic projections of point, line, planes and solids in various positions in first Quadrant.
- Sections of solids example Cube, cuboids, cone, cylinder, pyramid, prism etc.
- Interpenetration of simple platonic solids.

Unit – III (20 Marks)

- Isometric views of simple and complex forms.
- Axonometric views of simple forms.

RECOMMENDED BOOKS

1. N.D. Bhatt, 'Engineering Drawing'.
2. R.K. Dhawan, 'Engineering Drawing'.
3. P.S. Gill, 'Engineering Drawing'.

REFERENCE BOOKS

1. Ching Franc D.K., 'Architectural Graphics'.

INSTRUCTIONS TO PAPER SETTER

1. Two questions are to be set from Unit-I & III and students will be required to attempt one question from each unit.
2. Three questions are to be set from Unit-II, students have to attempt two questions.

HISTORY OF ARCHITECTURE – I

Subject Code: BARC1-104 **L S T P C**
2 0 0 0 2

COURSE PREREQUISITES: No prerequisites.

COURSE OBJECTIVES: The course is designed to arouse in the student a sense of curiosity and to sharpen his/her powers of observation. The importance of the timelessness of architecture shall be emphasized. The architectural study is to be linked with the social developments of civilizations, geographical and geological factors, materials and structures etc. the course shall include sketching and understanding of historical buildings, historical analyses and measured drawings. One/Two representative examples of each type must be covered during the class.

EXPECTED OUTCOMES:

- The student shall be able to understand basic chronology of historical development in the field of Architecture and civilization.
- Students should be able to acquaint themselves with the key historical buildings and their characteristic features.

CONTENTS

Unit – I

- A brief reference to the shelters of prehistoric times.
- River valley civilizations: Development of Architecture in Indus Valley, Nile Valley and plains of Tigris & Euphrates.
- Development of Architecture in Greek Civilization: Greek Orders, Temples, Optical Corrections, Theatres, Agora, Acropolis, etc.

Unit – II

- Development of Architecture during Roman period: Roman Orders, Temples, forums, basilicas, thermae, amphitheatres, etc.
- An overview of developments during the Vedic period
- Development of Buddhist Architecture: Ashokan pillars/ stambhas, Development of stupas, Development of rock cut architecture through the Hinayana & the Mahayana phase (chaityas & viharas).

Unit – III

- Genesis of Hindu Architecture during the Gupta & the Chalukyan period
- Development of Dravidian Architecture through different phases: Pallavas, Cholas, Pandyas, Vijainagar & Madura

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- Indo–Aryan Architecture: Orissa, Khajuraho & Gujarat
- Jain Architecture.

RECOMMENDED BOOKS

1. B. Fletcher, 'History of Architecture', CBS Publishers & Distributors, Delhi, **1986**.
2. P. Brown, 'Indian Architecture (Buddhist and Hindu Periods)', DB Taraporevala Sons & Co. Private Ltd., Bombay, **1971**.
3. J. Ferguson, 'History of Indian and Eastern Architecture', John Murray lbemarle Street. W. London, **1910.**
4. S. Grover, 'Buddhist and Hindu Architecture in India', CBS Publishers & Distributors, Delhi, **2003**.

REFERENCE BOOKS

1. M. Moffett, 'A World History of Architecture, Laurence King Publishing', **2003.**
2. C. Tadgill, 'The History of Architecture in India', Architecture Design & Technology Press, London, **1990**.
3. P.K. Acharya, 'Hindu Architecture in India and Abroad', Oriental, New Delhi, **1979.**

INSTRUCTIONS TO THE PAPER SETTER

1. **One compulsory question** containing 6 questions of 2 marks (12 marks), each requiring short answers, are to be set from the entire syllabus.
2. The examiner is required to set another six questions (two from each unit), out of which the students are required to attempt any four questions (selecting at least one from each unit).

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VISUAL COMMUNICATION-I

Subject Code: BARC1-105 **L S T P C**
2 0 0 2 3

COURSE PREREQUISITES: The student should have an aptitude of using pencil and draw freehand 2-D and 3D objects/forms.

COURSE OBJECTIVES: The student shall be able to learn the fundamental use and role of pencil and colour as a medium of rendering 2D & 3D forms.

EXPECTED OUTCOMES: The student shall be able to learn the art of using the potential of pencil and colour as a tool of graphic communication.

CONTENTS

Unit –I (10 Marks)

- Different stroke as in pencil using various grades (HB, B, 2B, 3B, 4B, 5B, 6B, Charcoal pencil).
- Rendering of textures of different building materials in pencil.

Unit –II (20 Marks)

- Free hand still life sketching in pencil of compositions of solids, cubes, cylinders and spheres showing the effect of light and shade on them.
- Free hands sketching in pencil, of scale elements like trees, shrubs, human figures, vehicles, lampposts etc.

Unit –III (20 marks)

- Introduction to colour theories and colour wheel.
- Various colour schemes, tints and shades.

RECOMMENDED BOOKS

1. Robert W. Gill, 'Rendering with Pen and Ink', Thames & Hudson London, **2008.**
2. Jaxtheimer, **'**How to paint and Draw'.

REFERENCE BOOKS

1. Jaccuelina, ‘Graphic Illustrations in Black and White’, Design Press, New York, **1991.**
2. Crowne Philip, ‘Architectural Rendering’, Rofovision S.A Switzerland ,**1991.**

INSTRUCTIONS TO THE PAPER SETTER

The examiner is required to set a total of six questions with two questions from each UNIT. The student is required to attempt any one question from each UNIT making a total of three questions.

ARCHITECTURAL COMMUNICATION – I

Subject Code: BARC1-106 **L S T P C**
1 0 0 2 2

COURSE PREREQUISITES: Basic knowledge of English as a language up to 12th standard.

COURSE OBJECTIVES: The objective is to help the students to become independent users of English language. Students should be able to understand spoken and written English language of varied complexity on most including some abstract topics; particularly for preparing Architectural reports. They must show awareness in the field and must be able to explain their views in a rational manner.

EXPECTED OUTCOMES: The students shall be able to converse fluently, without strain with international speakers of English in an accent and lexis that is widely understood across the globe. They will be able to prepare Architectural reports and texts on their own and shall be able to communicate in a professional manner.

- **Reading:** Reading texts of varied complexity; speed reading for global and detailed meaning; processing factual and implied meanings
- **Vocabulary:** Building up and expansion of vocabulary; active use of Architectural vocabulary
- **Grammar:** Revising and practicing a prescribed set of grammar items; using grammar actively while processing or producing language
- **Writing:** The qualities of good writing; Learning the prescribed written expressions of conventional use; writing business letters, emails; Architectural reports, summaries and various forms of descriptive and argumentative essays related to buildings; poetry and prose

CONTENTS

Unit –I (Reading)

The students will go through the reading texts themselves with the help of a dictionary or word power as given at the end of books. As they progress from one reading to another they should learn to read fast with greater degree of understanding of both concrete and abstract topics. While taking up the textbook lessons in the classroom, the teacher shall ensure that students can do the following:

- Identify the significant points and conclusions as given in the text.
- Handle large texts (even outside the prescribed book) with overall comprehension of the links between arguments and the finer distinction between stated and implied meanings.
- Generally, read the stance or the point of view of the writer and present it in the form of a summary
- Use the vocabulary learnt in the lessons (especially given in “word power‟) productively in various writing tasks as suggested at the end of each lesson.
- Profitably use the grammatical items as discussed at the end of each lesson while producing language for communication.

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- Besides the textbook, the teacher must insist that students extend their reading by taking up additional texts of their own choice

Unit –II (Writing)

The students must learn the language that expresses various cognitive functions that are frequently used in writing. With the help of the teacher who will give them adequate practice, the students should be able to:

- Convey information on concrete or abstract topics with clarity and precision.
- Write about objects or events with appropriate detail in both descriptive and narrative form.
- Explain ideas and build up arguments with adequate support in a convincing manner.
- Use language with some degree of flexibility in consideration to the reader.
- Produce effectively such forms of professional writing as business letter, emails, notes, memos, reports summaries etc.
- While teaching, the teacher must inculcate in students the habit of revising their writing. The teacher can also use and recommend the relevant sections of the following books for developing writing skills in students.

Unit –III (Architectural Reporting)

- The students must visit places of Architectural importance, buildings, gardens, monuments etc. and prepare visit reports. The parameters to be considered for report writing shall be location, history, concept and key elements of design
- Basic understanding and vocabulary of Architectural terms and features.
- Presentation of various site reports, case studies and methods of holding meetings.
- Preparation of press note of Architectural reports and events.

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RECOMMENDED BOOKS

1. Vandana R. Singh, 'The Written Word', Oxford University Press, New Delhi.
2. K.K. Ramchandran, et al, 'Business Communication', Macmillan, New Delhi.
3. Swati Samantaray, 'Business Communication and Communicative English', Sultan Chand, New Delhi.
4. S.P. Dhanavel, 'English and Communication Skills for Students of Science and Engineering (with audio CD)'.

INSTRUCTIONS TO THE PAPER SETTER

1. One compulsory question containing 6 questions of 2 marks (12 marks), each requiring short answers, are to be set from the entire syllabus
2. The examiner is required to set another six questions (two from each unit), out of which the students are required to attempt any four questions (selecting at least one from each unit).

BUILDING SCIENCE & TECHNOLOGY-I

Subject Code: BARC1-107 **L S T P C**
1 0 0 0 1

COURSE PREREQUISITES: No Course Prerequisites

COURSE OBJECTIVES: To make students aware about the importance of Building Science & Materials in Architecture.

EXPECTED OUTCOMES: The students shall be able to understand the various building materials used in construction of a building with study of their Constituents, Properties, Types, Uses & Market rates.

CONTENTS

Unit-I

- Introduction to building science, Relevance of Building science in Architecture, General Geology of Earth's crust, Mode of Rock formation.
- Geological criteria governing selection of sites.
- Introduction to Natural calamities – Earthquakes, Tsunami, Landslides, Floods, Volcanoes, Cyclones, Hurricanes etc.

Unit-II

- Terminology and tools used in Brick Masonry.
- Study of Properties, Types, Available market forms and uses of Bricks (Manmade & Machine made), Stones, Cement, Lime, Sand, Aggregates and Surkhi.
- Study of Structure and characteristics of timber, defects, seasoning, various uses and market forms of timber.

Unit – III

- Study of Properties and uses of Mortar (Lime mortar, Cement mortar, Mud mortar), Lean concrete, P.C.C. & D.P.C.
- Surface finishes – Pointing, Plastering (Brick masonry & Stone masonry),
- Market survey of Building materials mentioned above.

RECOMMENDED BOOKS

1. W.B. Mckay, 'Building Construction'.
2. S.C. Rangwala, 'Engineering Materials'.
3. B.C. Punmia, 'Building Construction'.

REFERENCE BOOKS

1. Ching, D.K. Francis, 'Building Construction Illustrated'.
2. Michell, 'Elementary Building Construction'.
3. National Building Code – **2005.**

INSTRUCTIONS TO THE PAPER SETTER

- **One compulsory question** containing 6 questions of 2 marks (12 marks), each requiring short answers, are to be set from the entire syllabus
- The examiner is required to set another six questions (two from each unit), out of which the students are required to attempt any four questions (selecting at least one from each unit).

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MODEL MAKING-I

Subject Code: BARC1-108 **L S T P C**
0 0 0 2 1

EXAM DURATION: NO EXAM (External Viva Voce only)

COURSE PREREQUISITES: No Course Prerequisites

COURSE OBJECTIVES: To acquaint the students with the knowledge of carpentry and joinery. To make the students aware of various model making techniques using different materials.

LEARNING OUTCOMES: Students should be able to understand carpentry and joinery techniques and various model making methods using different materials.

CONTENTS

Unit I

Introduction to Carpentry Joints:

- Measuring, cutting and sawing of natural wood in workshop.
- Tools used in carpentry.

- Different types of joints in carpentry and their models in wood.

Unit-II

Preparations of Model:

Introduction to various materials used in making Architectural models.

Exercise shall be based on preparation of block models and a detailed model of a small structure including Hardscape and Softscape and scale elements like lamp posts, trees, street furniture etc.

Unit-III

Development of Surfaces:

Methods for development of surfaces of solids and other forms in different materials (like clay, thermocole, mountboard, paper, acrylic sheet, ivory sheet etc. Sculpture making with **Plaster of Paris** using casting and carving and **Clay** using pinching coiling and slab techniques.

RECOMMENDED BOOKS

1. H.S. Bawa, 'Carpentry- A Complete Guide',
2. Miller, 'Carpentry and Construction'.

REFERENCE BOOKS

1. W.B. Mckay, 'Building Construction', Volume 3.

ARCHITECTURAL DESIGN-II

Subject Code: BARC1-209 **L S T P C**

2 4 0 0 6

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UNI. EXAM. DURATION: 6 Hrs. (3 + 3 Hrs.)

COURSE PREREQUISITES: The student should have the basic knowledge of anthropometric data and the relationship of form, space and function.

COURSE OBJECTIVES:

- They should be able to understand the design process of small scale buildings, function and standards.
- The student must be able to understand relationship between site and built form.

LEARNING OUTCOMES: Student shall be able to understand and appreciate the constraints in the Architectural design of a small scale building with reference to function, form and site.

CONTENTS

- Study and design of small scale buildings based on space standards like circulation, furniture-size, clearances, heights, light, ventilation etc.
- Systematic introduction and study of issues related to function and physical form in relation to site and surroundings. The design exercises may include:
- ▪ Study of habitable space / house
- ▪ Design of studio apartments or house
- ▪ Highway side/ roadside café/fast food outlets with landscape and parking.

RECOMMENDED/REFERENCE BOOKS

1. Chiara, Joseph De, 'Time Saver Standards for Building Types', McGraw–Hill Professional Publishing, **2001**.
2. Ching, D.K. Francis, 'Architectural Form, Space and Order', Van Nostrand Reinhold International Thomson Publishing, Inc.: New York, **1996**.
3. R. Scott, 'Design Fundamentals', Publisher-RoBARC1t E. Krieger Publishing Company.
4. E & OE- 'Architects Hand Book and Planning'.

INSTRUCTIONS TO THE PAPER SETTER

1. One compulsory question is to be set from the entire syllabus.
2. The topic of the project is to be displayed on College / Institute Notice Board ten days in advance.

NOTE:

Evaluation is to be done through viva voce by external examiner appointed by the university at college level. Answer sheets after the university exam shall be retained at college level for the viva-voce.

BUILDING CONSTRUCTION – II

Subject Code: BARC1-210 **L S T P C**
2 3 0 0 5

COURSE PREREQUISITES: Students should have knowledge of Basic Materials and their application in building construction.

COURSE OBJECTIVES: To acquaint the students with building components and their construction methods.

EXPECTED OUTCOMES: Students shall be able to know the detailing and sequence of activities for the execution of a building.

CONTENTS

Unit –I (20 Marks)

FOUNDATION AND DAMP PROOF COURSE

- Type of foundations and its important details.
- Application of Damp Proof Course, its material and laying methods.
- Detailing of Horizontal and Vertical D.P.C.

Unit –II (20 Marks)

DOORS AND WINDOWS

- Types of Doors, Design and Construction details of Framed, Ledged, Braced and Battened Door, Flush Door, Wire Mesh Door, Paneled Door.
- Types of Windows in Timber, Design and Construction Details of Casement, Bay, Clear storey, Corner window etc.

Unit – III (20 Marks

TYPES OF ROOFS AND FLOORS

- R.C.C, R.B.C Roof, Jack Arch Roof.
- Concepts of Water Proofing and Thermal Insulation of Roofs.
- Types of Floors.
- Section through double storey of load bearing and framed structure including stairs.

Note: Field visits to study the complete process of laying of foundation, D.P.C, construction details of Doors, Windows, Roofs and Floors to understand them in detail.

RECOMMENDED BOOKS

1. S.C. Rangwala, ‘Engineering Materials’.
2. B.C. Punmia, ‘Building Construction’.
3. W.B. Mckay, ‘Building Construction’.
4. Watson, Don A., ‘Construction Materials and Process’, McGraw Hill.

REFERENCE BOOKS

1. Ching, D.K. Francis, ‘Building Construction Illustrated’.
2. Chudley, ‘Construction Technology’.
3. R. BARC1ry, ‘Construction of Buildings’.

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INSTRUCTIONS TO THE PAPER SETTER

The examiner is required to set a total of six questions with two questions from each unit. The student is required to attempt any one question from each unit making a total of three questions.

ARCHITECTURAL DRAWING- II

Subject Code: BARC1-211 **L S T P C**
2 3 0 0 5

COURSE PREREQUISITES: The students should have a basic understanding of Orthographic projections and isometric views.

COURSE OBJECTIVES:

- The students should be able to visualize and convert his/her thoughts and ideas of design into 3-D forms.
- The students should be able to construct Perspective views from plan and elevations and show sciography in plan and elevations only.

LEARNING OUTCOMES: The students shall be able to draw perspectives of various forms and show sciography in plans and elevations.

CONTENTS

Unit – I (40 Marks)

PERSPECTIVE

1. Introduction to basic concepts of perspective making.
2. Construction of one-point perspective of simple and complex objects.
3. Construction of two-point perspective of simple and complex objects.
4. Construction of interior perspectives (one point).

Unit – II (20 Marks)

SCIOGRAPHY

1. Basics of sciography and its application in the field of architecture.
2. Construction of sciography (shades and shadows) in plan and elevation only.

RECOMMENDED BOOKS

1. Ching, D.K. Franc, 'Architectural Graphics'.
2. Robert W. Gill, 'Rendering with Pen and Ink'.

INSTRUCTIONS TO THE PAPER SETTER

1. Three questions are to be set form Unit-I and students shall be required to attempt any two questions.

Two questions are to be set from Unit-II and students shall have to attempt any one question.

VISUAL COMMUNICATION-II

Subject Code: BARC1-212 **L S T P C**
2 0 0 2 3

COURSE PREREQUISITES: The student should have an ability to draw and render freehand 2-D and 3D objects/forms in pencil and should be able to understand colour theories.

COURSE OBJECTIVES: To develop conceptual and perceptual skills of students in different colour media and techniques.

EXPECTED OUTCOMES: Teaching of the subject shall help students to understand the fundamental use of colour mediums to add realism in sketches and perspectives.

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CONTENTS

Unit –I (40 Marks)

- Use of various colouring mediums i.e., pencil colours, oil pastels, crayons and water colours etc.
- Outdoor free hand sketching of trees, shrubs, simple buildings, human figures, automobiles etc. in colour (water colours, pencil colours and poster colours).
- Sketching and rendering of various scenes such as milk booth, bus stop, cafeteria, petrol pump, village, and garden and like scene.

Unit –II (20 Marks)

- Writing styles in calligraphy.
- Rendering of plan, elevations and sections in any colour medium.
- Rendering of perspective views in all colour mediums.

RECOMMENDED BOOKS

1. Robert W. Gill, 'Rendering with Pen and Ink', Thames & Hudson London, **2008.**
2. Jaxtheimer, **'**How to Paint and Draw'.

REFERENCE BOOKS

1. Ching, D.K. Frank Francis, 'Architectural Graphics', 5th Edn., Van Nostrand Runhold, **2009**.
2. Crowne Philip, 'Architectural Rendering', Rofovision S.A. Switzerland, **1991.**

INSTRUCTIONS TO THE PAPER SETTER

The examiners are required to set five questions, three from UNIT-I and two from UNIT-II. The students are required to attempt two questions from UNIT-I and one question from UNIT-II making a total of three questions.

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THEORY OF DESIGN

Subject Code: BARC1-213 **L S T P C**
2 0 0 0 2

COURSE PREREQUISITES: Students should have understanding of parameters of design.
COURSE OBJECTIVES: The student should able to understand the role and importance of spatial organization and its implementation in Architectural Design.
LEARNING OUTCOMES: Student shall be able to understand the relationship and configuration of form and space.

CONTENTS

UNIT-I

- Study of forms
- Visual Properties of Forms.
- Regular and Irregular Forms.
- Transformation of Forms.
- Formal Collision of Geometry.
- Articulation of Forms

UNIT-II

- Study of spaces defining Space with Horizontal and Vertical Elements.
- Organization of Form and Space, Spatial Organization.
- Circulation elements its function and Configuration,
- Relationship of openings with space and surroundings.
- Quality of Architectural Space.

RECOMMENDED/REFERENCE BOOKS

1. Geoffery H. Baker, ‘Design Strategies in Architecture- (An approach to the analysis of Form)’, Taylor & Francis.
2. Ching, D.K. Francis, ‘Architecture: Form, Space, and Order’, Wiley Publications.
3. Pandya Yatin, ‘Elements of Space-Making’, 3rd Edn., Mapin Publishing Pvt.

INSTRUCTIONS TO THE PAPER SETTER

- **One compulsory question** containing 6 questions of 2 marks (12 marks), each requiring short answers, are to be set from the entire syllabus
- The examiner is required to set another six questions (three from each unit), out of which the students are required to attempt any four questions (selecting at least two from each unit).

STRUCTURE DESIGN-I

Subject Code: BARC1-214 **L S T P C**
1 0 1 0 2

COURSE PREREQUISITES

- Understanding of basic masonry structural members
- Understanding of the materials used in the masonry construction
- Understanding of the basic terms used in analyze and design of masonry structures

COURSE OBJECTIVES

- Understanding about the strength and behavior of masonry structures
- Understanding the concept of stability of masonry structures
- To understand the concept of loading, supports, reactions, stresses and their role in design
- Understanding the design concept of various members of the masonry structures

LEARNING OUTCOMES

- An ability to get confidence to analyze and design masonry structures
- An ability to apply theoretical knowledge to solve practical problems
- An ability to understand the analyze and design concepts

CONTENTS

UNIT – I

Concept of Stresses and strains; Simple stresses & strains, bending stresses, shear stressesetc, stress strain curves of ductile and brittle materials, Hooke’s law, elastic constants, numerical problems.

UNIT – II

Types of loads, supports and reactions, concept of shear force & bending moment, sigh conventions, shear force & bending moment diagrams for various types of beams and loading conditions.

UNIT – III

Types of walls, design of columns and walls in masonry, allowable stresses, area factor, shape factor, slenderness ratio, effective height & length, effective thickness, load factor, design examples.

UNIT – IV

Design of foundation in masonry work, loads on foundation, bearing capacity, depth of foundation, Rankine’s formula, footing sections, design examples.

UNIT – V

Design of retaining walls in masonry, loads, resultant pressure, stability, middle third rule, design examples.

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RECOMMENDED BOOKS

1. R.K. Bansal, 'Engineering Mechanics & Strength of Material', Laxmi Publishers Pvt. Limited, **1998.**
2. Sadhu Singh, 'Strength of Materials'.
3. Anand S. Arya, 'Masonry and Timber Structures', Nem Chand and Brothers, **2006**.
4. Frederick Putnam Spalding, 'Masonry Structures', Bibliolife, **2008**.

INSTRUCTIONS TO THE PAPER SETTER

- Eight questions of equal marks are to be set from the entire syllabus
- Students are required to attempt in all five questions
- Question paper is to be set covering entire syllabus by making parts may be from different UNITs

BUILDING SCIENCES AND TECHNOLOGY -II

Subject Code: BARC1-215 **L S T P C**
1 0 0 0 1

COURSE PREREQUISITES: No Course Prerequisites.

COURSE OBJECTIVES: To make the students aware about the basic types and characteristics of soil and also to acquaint them about various surface finishes applied to a building.

LEARNING OUTCOMES: Students shall be able to understand basic behaviour of soil w.r.t, foundations. The students shall also achieve the knowledge of various finishes to be applied to building surface.

CONTENTS

UNIT –I (Soil)

- **Type and characteristics of Soil**: Classification of soils: as per particle size, texture.
- **Bearing capacity of soil** – basic definitions, factors affecting bearing capacity of soils, different methods of calculation of bearing capacity of soil.
- Suitability of soil for foundations.

UNIT –II (Iron, Steel, Aluminium, Glass, Plastics)

- Classification, Composition, Properties, Applications and Market form of all the building materials.

UNIT –III (Water Proofing)

- **Water Proofing**: Water Proofing materials (liquid, semi-liquid and solid) – Composition, Properties, Applications.
- **Surface Finishes:** White wash, Distemper, Paints and Varnishes – Types, Applications, Suitability, Advantages and Disadvantages.

Note: Market surveys shall be done by the students for the complete range of Materials and finishes available in the market under different trade names to study their properties, uses etc.

RECOMMENDED BOOKS

1. K.R. Arora, 'Soil Mechanics and foundation Engineering'.
2. S.C. Rangwala, 'Engineering Materials'.

REFERENCE BOOKS

1. Singh Bharat and Parkash Shamsher, 'Soil Mechanics and Foundation Engineering'.
2. Parbin Singh, 'Engineering and Geology', S.K. Kataria and Sons.

INSTRUCTIONS TO THE PAPER SETTER

1. **One compulsory question** containing 6 questions of 2 marks (12 marks), each requiring short answers, are to be set from the entire syllabus

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2. The examiner is required to set another six questions (two from each UNIT), out of which the students are required to attempt any four questions (selecting at least one from each UNIT.

STRUCTURE SYSTEM-I

Subject Code: BARC1- 216 **L S T P C**
1 0 0 0 1

UNI. EXAM. DURATION: NO EXAM (EXT. VIVA-VOCE)
COURSE PREREQUISITES: No Course Prerequisites
COURSE OBJECTIVES: The teaching of this subject shall help the students:

- To be aware of basic principles applicable in various structural systems
- To understand the Role and Importance of Structures in a Built Environment.
- To create skill of applying the knowledge gained in building projects.

EXPECTED OUTCOMES:
The student shall be able to learn:

- The predominantly pictorial nature of an Architect's language.
- The physical-mechanical essence of the subject matter.
- The orientation of all Architectural efforts to Form and Space.

CONTENTS

UNIT –I

CELLULAR SYSTEM

1. Cell as a natural UNIT of space.
2. Cell transformation.
3. Polygonal Cellular Systems leading to evolution of Geodesic Domes
4. Applications of Cellular System in Building

UNIT –II

BULK ACTIVE STRUCTURE SYSTEM

Structure acting mainly through material bulk and continuity i.e. Bulk active structure system / Section active structure systems:

1. Slabs (One way & Two way)
2. Beams (Simply supported, Cantilever, Continuous, Vierendale Girders)
3. Grid (Skew & Square Grid)
4. Columns

UNIT –III

VECTOR-ACTIVE STRUCTURE SYSTEM

Structures acting mainly through Composition of Compression and Tension members such as Vector-active structure system /Co-active structure system:

1. Space frames
2. Trusses (Timber & Steel)
3. Domes (Ribbed & Geodesic)

RECOMMENDED BOOKS

1. H. Engel, ‘Structure Systems’.
2. Salvadori Mario, ‘Building of Building’.
3. Butler Robert B., ‘Architectural Engineering Design: Structural Systems’.
4. G.G. Schierle, ’Architectural Structure’.
5. Moore Fuller, ‘Understanding Structure’.

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ARCHITECTURAL DESIGN–III

Subject Code: BARC1-317 **L S T P C**
2 4 0 0 6

UNI. EXAM. DURATION: 12 HRS (2 DAYS) (6 + 6 Hrs. WITH 1 Hr. BREAK ON BOTH DAYS) (EXTERNAL VIVA VOCE)

COURSE PREREQUISITES: The students should have knowledge of relationship of forms, space, function and order.

COURSE OBJECTIVES: To make students understand the design process of small scale building projects with special emphasis on site analysis and site planning.

EXPECTED OUTCOME: Students should be able to understand and appreciate the constraints of the site in the evolution of design for small building projects.

CONTENTS

- Design of primary school, guest house, convenience shopping, dispensary, Road side restaurant/Dhaba without urban regulatory controls with emphasis on climatic aspects.
- Introduction to barrier free buildings/ Universal Design.
- Site analysis and site planning.
- Space planning and design development.
- Minimum two projects/Assignments should be handled individually by all students.

NOTE: All Assignments to be prepared manually and no computer aided design/ Presentation/Documentations should be accepted.

TEACHING METHODOLOGY

For all assignments the following methodology should be followed and all stages should be attempted individually.

- Library and Proto type Studies
- Site analysis and site planning
- Space planning
- Design development and volumetric studies (model)
- Preliminary design and volumetric study
- Final design with detailed volumetric study, (Detailed Model) and visual communications (3D Visualizations)

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GUIDELINES FOR PAPER SETTER

1. One compulsory question is to be set from the syllabus and covering the entire content.
2. Evaluation is to be done through viva voce by external jury comprising of two examiners appointed by the University at college and answer sheets should be retained at college level.
3. The topic of the project is to be displayed on College / Institute Notice Board ten days in advance.

RECOMMENDED BOOKS:

1. Ching, Frank (Francis D.K.), 'Architecture: Form, Space & Order', Publisher John Wiley, Hoboken, **2007**.
2. V.S. Parmar, 'Design Fundamentals', Somaiya Publisher Pvt. Ltd, Mumbai, **1997**.
3. Donald Watson, Michael J. Crosbie, 'Time Saver Standard', 8th Edn., NBC (National Building Code).
4. Site planning and landscape, Symonds.
5. Francis D.K. Ching, Site Planning.

BUILDING CONSTRUCTION -III

Subject Code: BARC1-318 **L S T P C**
2 3 0 0 5

COURSE PREREQUISITES: Students should have the knowledge of various components of a Building.

COURSE OBJECTIVES: To acquaint students about the handling of R.C.C. and familiarize the student with the working and details of the R.C.C. construction.

EXPECTED OUTCOMES: The students shall be able to understand the process of RCC construction, the components of a building, skills and equipment used in shaping them with the help of basic construction details.

CONTENTS

Unit-I

- R.C.C. Construction- Frame construction, advantages over load bearing construction, study of column grid, detailing of R.C.C. work with reinforcement for slabs, beams, columns, footing, staircases.
- Various types of Foundations in R.C.C.

Unit – II

- R.C.C. frame structure with infill walls of brick and various cement concrete products, such as hollow blocks, light weight concrete blocks, fly ash bricks etc.
- Introduction to various types of staircase and vocabulary related to construction details with special emphasis on RCC Staircase- Dog logged, open well, Cantilever Staircase.

Unit – III

- Section through R.C.C. framed double storied building through toilet and staircase showing the details of Foundation, Floor, Window, Lintel, Chajja, Roof, Terrace, Parapet and Coping.
- Types of formwork (shuttering) for concrete, scaffolding, shoring, etc.
- R.C.C. Form work and Shuttering details for-
    - Column (square and round)
    - Slab and Beam
    - Retaining Wall

Note: Field/Project visits to study the uses of R.C.C. materials in construction at various stages for better understanding, students must be taken to the under construction Site.

RECOMMENDED TEXT AND REFERENCE BOOKS

RECOMMENDED TEXT BOOKS

1. W.B. McKay, 'Building Construction'.
2. S.C. Rangwala, 'Engineering Materials'.
3. B.C. Punmia, 'Building Construction'.
4. P.N. Khanna, 'Oractical Civil Engineer's Handbook'.

RECOMMENDED REFERENCE BOOKS

1. Ching, D.K. Francis, 'Building Construction Illustrated'.
2. Chudley, 'Construction Technology'.
3. R. Barry, 'Construction of Buildings'.

INSTRUCTIONS TO THE PAPER SETTER

1. The examiner is required to set a total of six questions with two questions from each UNIT.
2. The student is required to attempt any one question from each UNIT making a total of three questions.

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VISUAL COMMUNICATION-III

Subject Code: BARC1-319 **L S T P C**
1 0 0 4 3

UNI. EXAM. DURATION: NO EXAM (EXTERNAL VIVA VOCE ONLY)

COURSE PREREQUISITES: The students should have cleared Soft Skill Development course.

COURSE OBJECTIVES: The students should be made aware of the role and importance of Computers in the field of Architecture.

EXPECTED OUTCOMES: Student shall be able to understand the use of Computer as an aid to drafting and presentation of architectural design projects.

CONTENTS

1. Advanced Introduction to Auto Cad, and Introduction to Auto Cad Revit
2. Advanced commands like layers, viewports, layer-iso and other 2D commands.
3. Drafting the complex and multi storied Plans, Sections, and Elevations.
4. Text writing and dimensioning of the Plans, Elevation and Sections
5. Advanced rendering in the Auto Cad, Photoshop and in other 2D Software**.**
6. 3-D Modelling on Auto cad of Single Storey and Multi Storey Buildings,
7. 3-D Modelling of Multiple Building in a Single Site, Camera View of the Buildings,

INSTRUCTIONS TO THE PAPER SETTER

The evaluation of student shall be based on the written questions to be set from the course and the practical conducted based on a specific problem given to assess and evaluate the knowledge of students related to course contents defined above.

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HISTORY OF ARCHITECTURE – II

Subject Code: BARC1-320 **L S T P C**
2 0 0 0 2

COURSE PREREQUISITES: Should have studied History of Architecture - I.

COURSE OBJECTIVES: The course is designed to arouse in the student a sense of curiosity and to sharpen his/her powers of observation. The importance of the timelessness of architecture shall be emphasized. The architectural study is to be linked with the social developments of civilizations, geographical and geological factors, materials and structures etc. the course shall include sketching and understanding of historical buildings, historical analyses and measured drawings. One/Two representative examples of each type must be covered during the class.

EXPECTED OUTCOMES:

- The student shall be able to understand basic chronology of historical development in the field of Architecture and civilization.
- Students shall be able to acquaint themselves with the key historical buildings of various periods of Architectural history and their characteristic features.

Unit – I

EARLY CHRISTIAN, BYZANTINE, ROMANESQUE & GOTHIC ARCHITECTURE

- Early Christian Architecture: Evolution of church forms – Outline of Architectural character – Example – Basilica of St. Peter’s, Rome and Bastistery of Constantine, Rome
- Byzantine Architecture - Development of the dome on pendentives in Byzantine Architecture. Example - St. Sophia, Constantinople
- Romanesque Architecture - Outline of architectural character in Italy, Examples: Pisa group, Italy; Abbaye aux Hommes, Caen

- Gothic Architecture- Religious and social influences - Evolution of vaulting and development of structural systems - Outline of Architectural character - Examples: Notre Dame, Paris, Reims Cathedral and Amiens Cathedral.

Unit – II

RENAISSANCE ARCHITECTURE IN ITALY

- Early Renaissance, High Renaissance, Mannerism, Baroque, Rococo Italian Renaissance - The idea of rebirth and revival of art - Outline of the Architecture during the early Renaissance, High Renaissance and Baroque Periods - Features of typical Renaissance palaces designed by Renaissance Architects, Study of the contribution of the following architects: Brunelleschi, Alberti, Bramante, Michaelangelo, Raphael Santi, Palladio, Bernini, Borromini.

Unit – III

ISLAMIC ARCHITECTURE – IMPERIAL & PROVINCIAL STYLES, MUGHAL ARCHITECTURE

- Influences on Islamic Architecture - Evolution of the Islamic Arch – Salient features of an Indian mosque. Development of the Imperial style by the kings of the Slave Dynasty-Example – Qutab Minar Complex, Varieties of squinches, Arches and Domes
- Development of the provincial styles in different regions – Punjab, Bengal, Jaunpur, Gujarat, Deccan
- Mughal Architecture- Development of the Mughal style under the different rulers - Babur, Humayun, Akbar, Jahangir, Shahjahan, Aurangazeb - Important examples –Humayuns Tomb,Delhi, Fatehpur Sikhri (layout, Buland Darwaza, Diwan-i-Khas, Tomb of Salim Chisti & Jami masjid), The Taj Mahal, Agra

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RECOMMENDED TEXT AND REFERENCE BOOKS

RECOMMENDED TEXT BOOKS

1. B. Fletcher, 'History of Architecture', CBS Publishers & Distributors, Delhi, **1986**.
2. P. Brown, 'Indian Architecture (Islamic Period)', D.B. Taraporevala Sons & Co. Private Ltd., Bombay, **1971**.
3. J. Ferguson, 'History of Indian and Eastern Architecture', John Murray Albemarle Street. W. London, **1910.**
4. S. Grover, 'Islamic Architecture in India', CBS Publishers & Distributors, Delhi, **2003**.

RECOMMENDED REFERENCE BOOKS

1. M. Moffett, 'A World History of Architecture', Laurence King Publishing, **2003.**
2. C. Tadgill, 'The History of Architecture in India', Architecture Design & Technology Press, London, **1990**.
3. P.K. Acharya, 'Hindu Architecture in India and Abroad', Oriental, New Delhi, **1979.**
4. Mark M. Jarzombek, Vikramaditya Prakash, Francis D.K. Ching, 'A Global History of Architecture', John Wiley & Sons, New Jersey, **2011.**
5. Subhash Parihar, 'Islamic Architecture of Punjab (1206-1707)', Aryan Books International, **2015.**

INSTRUCTIONS TO THE PAPER SETTER

1. One compulsory question containing 6 questions of 2 marks (12 marks), each requiring short answers, are to be set from the entire syllabus.
2. The examiner is required to set another six questions (two from each unit), out of which the students are required to attempt any four questions (selecting at least one from each unit).

STRUCTURE DESIGN-II

Subject Code: BARC1-321 **L S T P C**
1 0 1 0 2

COURSE PREREQUISITES: The student should have studied Structure Design-I
COURSE OBJECTIVES: To acquaint the students about the strength, stability, stresses and behaviour of concrete structures
EXPECTED OUTCOMES: Students shall be able to analyse and design concrete structure

CONTENTS

UNIT-I

Basic Design Concepts

- Design Philosophies,
- Partial safety factors for materials,
- Characteristics strength, load, design load and factored load,
- Basic assumption in analysis,
- Under, Over and Balanced section.

Columns

- Classification of columns
- Short and slender columns
- IS 456:2000 code provisions
- Slenderness ratio, reinforcement
- Design of short columns under axial loading
- Compression and uniaxial eccentricity

UNIT-II

Beam

- Types of beams
- Deep and Slender beams
- Guidelines for selecting member sizes
- IS 456 code provisions sections
- Design of singly and doubly-reinforced beams

Slab

- Slab systems with uses
- One-way slab and Two-way slab (Theory only)
- Reinforcement detailing
- IS 456: 2000 code provisions
- Curtailment of bars

UNIT-III

Staircase

- Types of staircase
- Different types of effects of loading
- IS 456:2000 code provisions
- Waist slab

RECOMMENDED TEXT AND REFERENCE BOOKS

1. M.L. Gambhir 'Concrete Technology'. Tata McGraw Hill.
2. Pillai Menon, 'Design of Concrete Structure', Tata McGraw Hill.
3. S.S. Bhavikatti, 'Design of Concrete Structure'.

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INSTRUCTIONS TO THE PAPER SETTER

1. One compulsory question containing 6 questions of 2 marks (12 marks), each requiring short answers, are to be set from the entire syllabus.
2. The examiner is required to set another six questions (two from each unit), out of which the students are required to attempt any four questions (selecting at least one from each unit).

Note: Indian Code of Practice IS: 456-2000 is permitted in examination.

SURVEYING AND LEVELLING-I

Subject Code: BARC1-322 **L S T P C**
1 0 0 2 2

COURSE PREREQUISITES: No Prerequisite

COURSE OBJECTIVES: To acquaint the students about the basics of surveying.

EXPECTED OUTCOMES: Students shall be able to draw Map, Plan and calculate area, volume and earthwork.

CONTENTS

UNIT-I

Introduction: -Definition, Basic Principle of surveying, Scale, Map, Errors.

Chain and Compass Survey: Principle of chain surveying, Measurement of distance with chain and tape, Direct & Indirect Ranging, offsets, selection of base line and stations, Tape corrections, obstacles in chaining, Bearing and its measurement with Prismatic & surveyors compass, Calculation of angels from bearings, local attractions and its elimination, adjustment of closing error by graphical method.

UNIT-II

Theodolite & Plane Table survey: - Temporary & permanent Adjustment, Measurement of horizontal and vertical angel, Adjustment of closing error by Bowditch and Transit rules, different equipment in plane tabling, different methods of plane tabling, Strength of Fix, Two and three point problems.

UNIT-III

Levelling & Contouring: - Types of levels, methods of levelling, Sensitivity of bubble tube, setting out grade lines, Temporary & permanent Adjustment, different method of contouring, Setting out contour gradient, Simple earthwork, calculations of areas and volumes.

Minor Instruments: - Box sextant, Hand level, Abney level, Plane meter, Ghat tracer, Tangent Clinometers, etc.

RECOMMENDED TEXT AND REFERENCE BOOKS

1. S.K. Duggal, ‘Surveying’, Vol. I & II, Tata McGraw Hill.
2. B.C. Punmia, Ashok Kumar Jain and Arun Kumar Jain, Surveying Vol. I and II, Laxmi Publications.
3. R. Agor, ‘Surveying’, Khanna Publishers.
4. S.S. Bhavi Katti, ‘Surveying & Levelling’, Volume I & II.

INSTRUCTIONS TO THE PAPER SETTER

1. One compulsory question containing 6 questions of 2 marks (12 marks), each requiring short answers, are to be set from the entire syllabus.
2. The examiner is required to set another six questions (at least one from each unit), out of which the students are required to attempt any four questions (selecting at least one from each unit).

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BUILDING SCIENCE AND TECHNOLOGY - III

Subject Code: BARC1-323 **L S T P C**
2 0 0 0 2

COURSE PREREQUISITES: Nil.

COURSE OBJECTIVES: To expose the students to the elements of climate and related design principles so as to achieve energy conservation in buildings through passive techniques.

EXPECTED OUTCOMES: The student shall be able to apply the concepts of climatology in architectural design projects.

CONTENTS

Unit–I

- **Climatology**: Tropics, Climatic zones and their classification, Concept of macro & macro climate, Elements of climate, Climatology data needed for designing of buildings.
- **Thermal Comfort**: Concept of thermal comfort, Human heat balance and comfort, Relationship of climatic elements with thermal comfort, Heat stress index, Effective temperature and Bio-climatic chart.

Unit–II

- **Heat flow through buildings**: Concept of U- value, Heat balance equation of buildings, Convection, Conduction, Radiation, Conductance, Resistance, Transmittance etc.
- **Solar Radiation**: Solar radiation, Position of sun and methods of recording it, Solar penetration inside buildings, Solar charts, Design of shading devices, Solar azimuth angle, Solar altitude angle, Shadow angle protector.

Unit–III

- **Wind**: Study of diurnal and seasonal variations, Ventilation – Introduction and its mechanism, Air movement within and around buildings, Wind direction, speed and its impact on design of window openings, Effect of wind on design and siting of buildings.
- **Orientation**: Importance of orientation, Site selection and site planning, Application of climatic factors on design of indigenous shelters for various climatic zones.

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RECOMMEMDED TEXT AND REFERENCE BOOKS

RECOMMEMDED TEXT BOOKS

1. Koensberger, Ingersoll, Mayhew, Szokolay, 'Manual of Tropical Housing & Building', **1974**.
2. Krishan A. Baker, 'Climate Responsive Architecture', McGraw Hill Education (Asia) Co. and China Architecture & Building Press, **2004/2005.**
3. 'Energy Efficient Building in India', TERI.

RECOMMEMDED REFERENCE BOOKS

1. Lippsmeier, Georg, 'Building in the Tropics', Callwey Verlag, Munchen, **1980**.
2. Gideon S. Golany, 'Design fir Arid Regions', Publication Van Nostrand Reinhold, New York, **1983**.
3. B. Givoni, 'Man,Climate & Architecture', Von Nostrand Reinhold Company New York, **1981**.
4. 'Research Notes on Climate', C.B.R.I., Roorkee.
5. C.P. Kukreja, 'Tropical Architecture', Tata McGraw Hill Publishing Company, **1978**.
6. Martin Evans, 'Housing, Climate & Comfort', Architectural Press, **1980**.

INSTRUCTIONS TO THE PAPER SETTER

1. One compulsory question is containing 6 questions of 2 marks (12 marks), each requiring short answers are to be set from the entire syllabus.

2. The examiner is required to set another six questions (two from each UNIT), out of which the students are required to attempt any four questions (selecting at least one from each UNIT).

SOFT SKILL DEVELOPMENT

Subject Code: BARC1-324 **L S T P C**
0 0 0 0 2

UNI. EXAM. DURATION: NO EXAM (INTERNAL VIVA VOCE)
COURSE PREREQUISITES: The students should have a basic understanding of computer.
COURSE OBJECTIVES: The students should utilize their semester break to make themselves aware of the role and importance of Computers in the field of Architecture.
EXPECTED OUTCOME: Student shall be able to understand the Auto Cad as a Computer Aided Drafting Technique.

CONTENTS

1. Introduction to Auto Cad and Units.
2. Basic commands like copy, paste, stretch, offset, move fillet, extend, trim and other 2D commands.
3. Drawing the basic Plans, Sections, and Elevations.
4. Basic Text writing and dimensioning of the Plans, Elevation and Sections.
5. Basic hatching of the elements in the Plans, Elevations and Sections.
6. Introduction to Layers and line type settings.

NOTE:
The small building plans which have been prepared by the student during this training period shall be evaluated by the subject teacher in the start of semester.

RECOMMENDED REFERENCE BOOKS

1. AutoDesk , 'Auto Cad Manual 2012'.

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ARCHITECTURAL DESIGN–IV

Subject Code: BARC1- 425 **L S T P C** .
3 2 0 2 6

UNI. EXAM. DURATION: 12 Hrs. (2 DAYS) (6 + 6 Hrs. WITH 1 Hr. BREAK ON BOTH DAYS) (EXTERNAL VIVA VOCE)
COURSE PREREQUISITES: The students should have knowledge of climate of the region.
COURSE OBJECTIVES: To make students appreciate the elements of vernacular/rural Architecture of states of Punjab, Himachal Pradesh, Jammu & Kashmir and Rajasthan with respect to the climatic conditions.

- To understand significance and documentation of measured drawings.

EXPECTED OUTCOME: Students should be able to learn the significance of contextual factors in architecture through design of climate responsive architecture.

CONTENTS

- Study of relationship between Climate and Regional Architecture.
- Study of the Social and Physical environment and methods of construction in Vernacular/Rural Architecture, emerging out of the traditional way of life of the people in a given place with emphasis on topography.

- Study of Historical Settlements/buildings of distinct Architectural characteristics including detailing with physical planning and other geomorphic factors, local materials, construction techniques, spatial analysis etc.
- Design exercises based on the detailed study of a vernacular settlement as above with documentation of measured drawings.
- Minimum two projects/assignments should be handled by students during the semester including detailed study of a representative settlement.

NOTES:

- All buildings should have accessibility to the physically challenged persons.
- All Assignments to be prepared manually and no computer aided design/ Presentation/ Documentations should be accepted.
- The students may undertake a tour of max. 7 days for conducting Study/ Documentation.

TEACHING METHODOLOGY

Study shall be done in groups to clearly bring out the existing settlement pattern, socio-economic conditions, pattern of life, building typology, materials/building technology used and important architectural features. The end product shall be a well-documented report and drawings.

- Selection of relevant site.
- Study and documentation including measured drawings.
- Site and climatic analysis for design projects.
- Library and case studies
- Design development and volumetric studies (model)
- Preliminary design and volumetric study.
- Final design with detailed volumetric study and visual communications (3D Visualizations)

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GUIDELINES FOR PAPER SETTER

1. One compulsory question is to be set from the syllabus and covering the entire content.
2. Evaluation is to be done through viva voce by external jury comprising of two examiners appointed by the University at college and answer sheets should be retained at college level.
3. The topic of the project is to be displayed on College / Institute Notice Board ten days in advance.

RECOMMENDED REFERENCE BOOKS:

1. Ching, Frank Francis D.K., 'Architecture: Form, Space & Order', John Wiley, Hoboken, **2007**.
2. V.S. Parmar, 'Design Fundamentals', Somaiya Publisher Pvt. Ltd, Mumbai, **1997**.
3. Scott Van Dyke, 'Form, Line to Design', Van Nostrand Reinhold, **1990**.
4. R. Scott, 'Design Fundamentals', Robart E. Krieger Publishing Company E & OE-Architects Hand Book and Planning.
5. Donald Watson, Michael J. Crosbie, 'Time Saver Standard', 8th Edn.

BUILDING CONSTRUCTION -IV

Subject Code: BARC1- 426 **L T P C**
2 2 0 2 5

UNI. EXAM. DURATION: 12 HRS. (2 DAYS) (6 + 6 HRS. WITH 1 HR. BREAK ON BOTH DAYS) (EXTERNAL VIVA VOCE)

COURSE PREREQUISITES: Students should have the basic knowledge of Timber/Wood and its use in Building.

COURSE OBJECTIVES:

1. To acquaint students about the details of Timber in Construction.
2. To familiarize the students with traditional/Contemporary construction methods of a single storied building in timber.

EXPECTED OUTCOMES: The students shall be able to understand Timber construction details and components of a building.

CONTENTS

Unit-I

- Introduction to the nature and characteristics of Timber construction, its advantages and limitations.
- Walls in timber: Various types of timber frame walls, with details of joints and cladding, Dhajji walls construction.
- Cladding with Timber and Timber products in Interior and Exterior (Wall paneling, Timber partitions, counters etc.)
- Sliding and sliding-folding Doors.

Unit–II

Floors and Staircases

- Timber/Wood/Puraquet flooring construction
- Wooden Staircases construction

Unit-III

Roofs and Trusses

- Introduction to different types of timber Roofs e.g. Flat, Couple, Close Couple, Collar, Lean to roof and Double Lean-to roofs, mansard roof.
- Principles of Construction and Details of King Post and Queen Post Trusses with Gutters, Eaves and Ridge Details (with / without Soffit) and Roof Coverings.
- North Light truss in Timber

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Note: Field/ Project visits to study the uses of Timber in construction at various stages for better understanding, students must be taken to the under construction Site.

RECOMMENDED TEXT AND REFERENCE BOOKS

RECOMMENDED TEXT BOOKS

1. W.B. Mckay, ‘Building Construction’.
2. S.C. Rangwala, ‘Engineering Materials’.
3. B.C. Punmia, ‘Building Construction’.

RECOMMENDED REFERENCE BOOKS

1. Ching, D.K. Francis, ‘Building Construction’, Illustrated.
2. Chudley, ‘Construction Technology’.
3. R. Barry, ‘Construction of Buildings’.

INSTRUCTIONS TO THE PAPER SETTER

1. The examiner is required to set a total of six questions with two questions from each UNIT.
2. The student is required to attempt any one question from each UNIT making a total of three questions.

BUILDING SCIENCE AND TECHNOLOGY - IV

Subject: BARC1- 427 **L S T P C**

2 0 0 0 2

COURSE PREREQUISITES: No Prerequisites

COURSE OBJECTIVES: To provide a basic understanding of water supply, sanitation, waste water, and solid waste management system in buildings.

EXPECTED OUTCOME: Teaching of the subject shall help students to understand the importance and role of water supply and sanitation services in Buildings.

CONTENTS

Unit–I

WATER SUPPLY

- Role, Importance, Necessity, Sources of Water supply (Flow Diagram).
- **Quantity of Water:** Types of demands, domestic, commercial, industrial water demand, fire demand, per capita demand, prediction of population, hydrological cycle, rainfall and run off, rainfall measurement.
- **Quality of Water:** Impurities in water, Hardness in water, Standards of water quality, Methods of treatment (Sedimentation, Filtration, Coagulation etc).
- **Collection/ Storage of Water:** Different types of intakes, conveyance of water, capacity and location of Reservoirs.
- **Pipes and Fittings:** Types of pipe material**,** Sizes and their jointing details, water supply fittings like Ferrule, Stopcock, Bibcock etc.
- **Water Distribution System:** Classification of distribution, pressure in distribution systems, storage and distribution resources, layout of distribution system, appurtenances, water supply plumbing- Individual building, fixtures and water storage in building. Hot and Cold water supply in multistoried buildings with special reference to National Building Code.

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Unit –II

SANITATION

- **Sewerage and Sewage Disposal:**
  Basic definitions, methods of Sewage Collection, types of sewers and their layout, classification of sewerage system, sewer sections, sewer materials and joints, sewer appurtenances, Storm water drainage.
- **Drainage of Buildings:**
  Principles of Building drainage, Different types of pipes, traps, sanitary fittings, plumbing systems of drainage: single stack system, one pipe system, two pipe system, pipe sizes and gradients. Complete layout of Water supply and sanitary system in a building.
- **Disposal in Unsewered Areas:**
  Different types of pits, septic tank, design of septic tank, disposal of septic tank effluent. Brief description and analysis of sewage, Oxygen demand and Natural methods of sewage disposal.

Unit–III

LAYOUT PLAN showing Water Supply and Sanitation

A complete layout of Water supply (Hot and Cold) and sanitation system of a double storeyed residential building having minimum plot area of 500 Sq. yards.

RECOMMENDED TEXT AND REFERENCE BOOKS

1. R. Birdi, ‘Water Supply and Sanitation’.
2. R. Barry, ‘Building Services’, John Wiley and Sons Ltd., **1998**.
3. G.S. Bindra, J.S. Bindra, ‘Water Supply and Sanitation’.
4. Shah S. Charanjit, ‘Water Supply and Sanitation’, Galgotia Publishing, New Delhi, **2008**.
5. National Building Code 2005.

INSTRUCTIONS TO THE PAPER SETTER

1. One compulsory question containing 6 questions of 2 marks (12 marks), each requiring short answers, are to be set from the entire syllabus.

2. The examiner is required to set another four questions (two each from Unit I and Unit-II), out of which the students are required to attempt any three questions (selecting at least one from each unit).
3. Two questions should be set from Unit-III with attached sketch plans.

VISUAL COMMUNICATION-IV

Subject Code: BARC1-428 **L S T P C**
1 0 0 2 2

UNI. EXAM. DURATION: NO EXAM (EXTERNAL VIVA VOCE)
COURSE PREREQUISITES: Student should have cleared the course of Visual Communications-III.
COURSE OBJECTIVES: The students should be able to visualize, draft and render his/her small design projects into 3-D forms.
EXPECTED OUTCOME: The students shall be able to draw perspectives of small design projects and show sciography through Computer Aided Techniques.

CONTENTS

UNIT-I

- 3-D Modelling on 3-D Max.
- 3-D Modelling on Google Sketch Up

UNIT-II

Rendering of the View on any of the following Software:

- 3D- Max,
- Photoshop,
- V-ray and
- Any other Software.

INSTRUCTIONS TO THE PAPER SETTER

The evaluation of student shall be based on the written questions to be set from the course and the practical conducted based on a specific problem given to assess and evaluate the knowledge of students related to course contents defined above.

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STRUCTURE DESIGN-III

Subject Code: BARC1-429 **L S T P C**
1 0 1 0 2

COURSE PREREQUISITES: The student should have studied Structure Design-I.
COURSE OBJECTIVES: To acquaint the students about the strength, stability, stresses and behaviour of steel structures.
EXPECTED OUTCOMES: Students shall be able to analyse and design steel structures
CONTENTS

Unit-I

CONNECTIONS

- Types of Connections
- Types of Rivets
- Types of Riveted Joints
- Failures of Riveted Joints
- Types of welds
- Failure of welds
- Comparison between riveted and welded connections

STEEL FOUNDATIONS (Theory Only)

- Slab Base
- Gusset Base
- Grillage Foundation

Unit-II

STEEL BEAMS

- Types of sections
- Laterally supported and un-supported beams
- Design of steel beams
- Web buckling and web crippling

Unit-III

TENSION AND COMPRESSION MEMBERS

- Types of Tension members
- Failures in Tension members
- Lug Angle, Splices and gusset plate (Theory Only)
- Types of sections in compression
- Length and slenderness ratio
- Encased column
- Built-up Column (Theory Only)

RECOMMENDED TEXT AND REFERENCE BOOKS

1. S.K Duggal, 'Design of Steel Structure', Tata McGraw Hill.
2. Ram Chandra, 'Design of Steel Structure', Standard Book House.
3. S.S. Bhavikatti, 'Design of Steel Structure', I.K. International Publishing House Pvt. Ltd.

INSTRUCTIONS TO THE PAPER SETTER

1. One compulsory question containing 6 questions of 2 marks (12 marks), each requiring short answers, are to be set from the entire syllabus.
2. The examiner is required to set another six questions (two from each unit), out of which the students are required to attempt any four questions (selecting at least one from each unit).

Note: Indian Code of Practice IS: 800-2007 is permitted in examination.

DESIGN PHILOSOPHIES-I

Subject Code: BARC1-430 **L S T P C**
1 0 1 0 2

COURSE PREREQUISITES: The student should have studied the concept of Form and Space.

COURSE OBJECTIVES: To develop conceptual and perceptual skills of students to appreciate the basic principles / philosophy of design used in 20th century movements and assess their contributions.

EXPECTED OUTCOME: Student shall be able to understand the basic concepts of designing the buildings done in 20th-Century Architecture.

CONTENTS

Unit –I

- Chicago School of Architecture (1880-1910)- Dankmar Adler and Louis Sullivan
- Art Nouveau Architecture (1890-1920) - Antoni Gaudi, Joseph Maria Olbrich
- New York School of Skyscraper Architecture (1900-30) - Famous New York Skyscrapers

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Unit –II

- Early Modernist Architecture (1900-30)
- Expressionist Architecture (1910-25)
- Social Housing Architecture (1918-30)
- Art Deco Architecture (1925-1940)
- International Style of Modern Architecture (1940-70)

Unit –III

Great masters

- Louis Sullivan
- Walter Gropius
- Frank Lloyd Wright
- Le- Corbusier
- Ludwig Mies van der Rohe

RECOMMENDED TEXT AND REFERENCE BOOKS

1. ‘20th Century World Architecture’, Phaidon Publication.
2. Jean-Louis Cohen, ‘The Future of Architecture Since 1889’, Phaidon Publication.
3. Peter Gössel, Gabriele Leuthäuser, ‘Architecture in the 20th Century’, Taschen Publications.
4. Klaus-Jürgen Sembach, Art Nouveau, Taschen Publications.
5. Magdalena Droste, ‘Bauhaus’, Taschen Publications.

INSTRUCTIONS TO THE PAPER SETTER

1. One compulsory question containing 6 questions of 2 marks (12 marks), each requiring short answers, are to be set from the entire syllabus.
2. The examiner is required to set another six questions (two from each unit), out of which the students are required to attempt any four questions (selecting at least one from each unit).

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STRUCTURE SYSTEM-II

Subject Code: BARC1-431 **L S T P C**
1 0 0 0 1

UNI. EXAM. DURATION: NO EXAM (EXTERNAL VIVA VOCE)

COURSE PREREQUISITES: The student should have an understanding of the mechanism of forces through Cellular Structure System, Bulk Active Structure System & Vector Active Structure System.

COURSE OBJECTIVES: The teaching of this subject shall help the students:

- To learn about basic principles applicable in various structural systems.
- To understand the Role and Importance of Structure in Built Environment.
- To apply the knowledge gained in an applied project and to make buildings structurally safe.

EXPECTED OUTCOMES: Emphasis shall be laid on learning by doing by making of 3-D models to give the students an idea of different spatial experience.

The student shall be able to learn:

- The predominantly pictorial nature of an Architect's language.
- The physical-mechanical essence of the subject matter.
- The orientation of all Architectural efforts to Form and Space.

CONTENTS

Unit–I

Form Active Structure System:

- Cable Structures (Roofs, Bridges etc.)
- Tents Structures
- Pneumatic Structure

Unit–II

Surface active Structure System:

- Shells
- Folded Plates

Unit-III

- Biomimicry

RECOMMENDED REFERENCE BOOKS:

1. H. Engel, ‘Structure Systems’.
2. Salvadori Mario, ‘Building of Building’.
3. B. Butler Robert, ‘Architectural Engineering Design: Structural Systems’.
4. G. Schierle, ‘Architectural Structure’.
5. Moore Fuller, ‘Understanding Structure’.
6. Michael Pawlyn, ‘Biomimicry in Architecture’.

EDUCATIONAL TOUR-I

Subject Code: BARC1- 432 **L S T P C**
0 0 0 0 1

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UNI. EXAM. DURATION: NO EXAM (INTERNAL VIVA-VOCE)

OBJECTIVES: The main aim is to explore, study, analyse and understand the contemporary/traditional/historical architectural characteristics and details of areas, places relevant to the syllabi. The duration of tour shall be up to 06 days.

GENERAL GUIDELINES FOR THE TEACHER

Study of building materials and details through sketches and photographs to be made as an individual student activity and is to be submitted in a report form. Study of concepts/ construction techniques and architectural characters for different sites/ buildings visited to be submitted in groups of students. Viva voce of individual student for both the submissions will be conducted by the teacher in-charge, who accompanied the tour, as part of the internal assessment.

NOTE: The Evaluation shall be done on the work done by the students in the form of handmade Sketches and Report of the Tour.

ARCHITECTURAL DESIGN – V

Subject: BARC1-533 **L S T P C**
2 3 0 2 6

UNI. EXAM. DURATION: 18 Hrs. (3 DAYS) (6 + 6 + 6 Hrs. WITH 1 Hr. BREAK ON ALL DAYS) (EXTERNAL VIVA VOCE)

COURSE PREREQUISITES: The student should have the knowledge of Design fundamentals and spatial organisation

COURSE OBJECTIVES: To understand the constraints of designing multi use buildings in an urban setting with respect to building norms, climate and client’s expectations.

- To understand design limitations due to building bye laws and site conditions.

- To understand the limitations of designing for Hilly Areas.
- To integrate services and structure system in the design project.
- To understand the importance and role of design elements in evolving architectural character.

EXPECTED OUTCOMES: Student shall be able to understand and appreciate the concept of Structure and services in the Architectural design of a medium scale building with reference to function, form and site.

CONTENTS

1. Design of multi storied residential and commercial buildings upto max. 5 stories integrating architecture, structure, form and building services along with urban context of site. e.g. Hotels, Hostels, Resorts etc.
2. Areas of concern/ focus:
   - ➢ Behavioral aspects and user satisfaction
   - ➢ Socio cultural aspects
   - ➢ Designing for the differently abled
   - ➢ Building byelaws and rules including fire safety provisions as per NBC.
   - ➢ Appropriate structural systems and constructional techniques
   - ➢ Climate responsive design
   - ➢ Site Planning and Urban Context

NOTE:

1. At least one design project shall have parking facility in Basement/Stilt.
2. All Assignments to be prepared manually and no computer aided design/ Presentation/Documentations should be accepted.

METHODOLOGY

For all assignments the following methodology should be followed and all stages should be attempted individually.

- Library and Proto type Studies
- Site analysis and site planning
- Space planning
- Design development and volumetric studies (model)
- Preliminary design and volumetric study (model)
- Final design with detailed volumetric study, (Detailed model) and visual communications (3D Visualizations)

GUIDELINES FOR PAPER SETTER

1. One compulsory question is to be set from the syllabus and covering the entire content.
2. Evaluation is to be done through viva voce by external jury comprising of two examiners appointed by the University at college and answer sheets should be retained at college level.
3. The topic of the project is to be displayed on College / Institute Notice Board ten days in advance.

RECOMMENDED TEXT AND REFERNCE BOOKS

1. Joseph De Chiara, Michael J. Crosbie, ‘Time Saver Standards for Building Types’, McGraw Hill Professional, **2001**.
2. Julius Panero, Martin Zelnik, ‘Human Dimension and Interior Space’, Whitney Library of Design, **1975.**
3. Joseph De Chiara, Julius Panero, Martin Zelnik, ‘Time Saver Standards for Interior Design and Space Planning’, McGraw Hill, **2001**.
4. Ernst Neuferts, ‘Architects Data’, Blackwell, **2002.**
5. Ramsey et. al, ‘Architectural Graphic Standards’, Wiley, **2000.**

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6. Sam F. Miller, 'Design Process: A Primer for Architectural and Interior Design', Van Nostrand Reinhold, **1995.**
7. NBC (National Building Code).

BUILDING CONSTRUCTION-V

Subject Code: BARC1-534 **L S T P C**
2 2 0 2 5

COURSE PREREQUISITES: No Prerequisites

COURSE OBJECTIVES: To make students understand various construction details in metals i.e. Steel, Aluminum.

EXPECTED OUTCOMES: Teaching of the subject shall help students to draw the construction details of structural Steel, Aluminium in their uses in various building elements including industrial buildings

CONTENTS

Unit-I

- Introduction to framed construction in steel, characteristics of steel sections, methods of jointing. Applications in various types of structures and different parts of buildings components.
- Details of Steel floorings in industrial buildings.
- Mezzanine floors.
- Steel stairs – straight flight and spiral.

Unit-II

- Trusses in steel. - Constructional details of Simple Truss, North Light Truss, tubular truss, lattice girder, etc.
- Fixing details of various roof coverings at valleys & gutters etc.
- False ceilings, incorporating services such as air conditioning, lighting, etc.

Unit-III

- Construction of various types of doors & windows in Steel & Aluminium
- Lightweight partitions in Steel and Aluminum. Thermal and Acoustic insulation of spaces and metal cladding for facades.
- Metal and gypsum false ceiling.

TEACHING METHODOLOGY

- Field visits to study the uses of metals in construction industry and process of laying of Steel Trusses.
- Study of Joinery of metals in workshop.
- Preparing Construction plates on above topics.
- Market study of the products available under different trade names with details of their manufacture, specification and performance.

RECOMMENDED TEXT AND REFERENCE BOOKS

1. Don A. Watson, 'Construction Materials and Processes', McGraw Hill Co., University of Michigan, **1972**.
2. W.B. McKay, 'Building Construction', Vol. 1, 2, 3, 4, Longmans, U.K., **1981**.
3. Alanwerth, 'Materials', The Mitchell Pub. Co., Ltd. London, **1986**.
4. R. Chudley, 'Building Construction Handbook', British Library Cataloguing in Publication Data, London, **1990**.
5. R. Barry, 'Building Construction', East West Press, New Delhi, **1999**.

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INSTRUCTIONS TO THE PAPER SETTER

1. The examiner is required to set a total of six questions with two questions from each UNIT.
2. The student is required to attempt any one question from each UNIT making a total of three questions.

ON SITE CONSTRUCTION TRAINING

Subject Code: BARC1- 535 **L S T P C**
0 0 0 0 3

UNI. EXAM. DURATION: NO EXAM (INTERNAL VIVA VOCE)

COURSE PREREQUISITES: Students should have knowledge of building and structural components, materials and basic construction techniques.

COURSE OBJECTIVES: To make student understand, analyse and appreciate the entire context and intricacies of construction of buildings at site.

EXPECTED OUTCOME: Students should be able to understand process of planning, progress and management of construction process.

CONTENTS

GUIDELINES FOR TRAINING

- All the students of the fourth Semester of B. Arch course, after appearing in the annual exam shall be required to undergo on site construction training for a period of **five weeks**. On Site Training is compulsory and all students shall be required to complete it during the vacation. Training shall be on an actual site/ a live project where construction is already in process.
- Before completion of the fourth Semester student is required to select the Architect/ Construction Company/ Builder / Developers / Contractor, where he intends to undergo onsite training. The consent, in writing of the concerned shall be obtained prior to going for training and submitted to the Training Co-ordinator appointed by the HOD of the Department of Architecture.
- Training primarily shall focus on giving student firsthand experience of what actually happens on the site of construction after Architect has prepared and issued the drawings.

During the training students should learn/ understand the following:

- Drawings required for construction
- Planning and management of Construction
- Interpretation of drawings, specifications etc.
- Materials Used along with specification
- Structure and structural drawings
- Services and Service drawings
- Construction Technologies Used
- Interpretation of working drawings at site
- Material and store Management
- Recording of Progress of work
- Machinery and manpower used
- Role of Architect, Client and Contractor
- Anything special and specific to the project related to construction

Evaluation

- At the end of the training, student shall be required to submit two copies (one colored and one black and white) of the Reports containing his/her work during training. Report shall explain, illustrate and showcase the project, brief write up of the project detailing out

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scope, site, design and other essential/salient features, diary of what work done during the training, working drawings and details of construction, materials, building technologies, planning and management of construction and manpower, process of managing ,materials, machinery and construction, management of stores and materials, anything special to the project etc. as detailed out in the objectives given above etc.

- Report shall be submitted at the start of the next semester and shall be evaluated by an external jury comprising of minimum two experts appointed by the University. The evaluation shall be coordinated by the Training Coordinator who shall also be internal examiner. Student would be required to make a presentation of the report and the work done during training.
- Evaluation shall be done in the start of this semester and made on the basis of work done, understanding developed, learning made, recording of various aspects of construction etc in the following manner:
  i. Attendance- 15 % marks
  ii. Progress Record by Training Co-ordinator- 15 %
  iii. Evaluation made by Site In-charge -20%
  iv. Report- Contents and Quality by External/Internal Experts- 30%
  v. Presentation made and Viva- Voce by External Experts- 20%

NOTE:

- One faculty member shall be appointed as Training Co-ordinator who shall be responsible for managing the entire context of training.
- Before proceeding for the OST, students shall be briefed by the Training coordinator about the manner they should undergo training at site in order to understand, analyze and appreciate the entire context and intricacies of construction of buildings.

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LANDSCAPE ARCHITECTURE

Subject Code: BARC1-536 **L S T P C**
2 0 0 0 2

COURSE PREREQUISITES: NIL

COURSE OBJECTIVES: To acquaint students with the uses and Importance of landscape design in architecture.

EXPECTED OUTCOMES: To make students understand the elements of Landscape Design and its application in Architectural Design solutions.

CONTENTS

Unit-I

- Introduction to landscape architecture.
- Elements of Landscape design and its relation to the built environment.
- Plant characteristics, plant propagation and impact of climate, soil and manure.
- Structure, Color, Form, Foliage of various types of Trees, Shrubs, Cacti Bushes and Creepers etc.
- Identification and study of a few Indian plants and trees.

Unit – II

Study on comparative basis of development of landscape design through:

- **Garden styles** – formal and informal; History of garden styles viz. Italian, French, Mughal and Japanese, Chinese, English.
- **Site Planning**: meaning, purpose and methodology; site surveys: types, relevance, components; Functional and technical factors in site planning; Principles and goals of landscape design; types of landscape styles – hard and soft landscape, wet and dry

landscape. Landscape design elements: types, materials, use and relevance. Hard and soft landscape, water as an important element

Unit–III

- Detailed study of water and vegetation as elements of landscape in nature and in landscape design.
- Preparation of a landscape scheme, landscape project at house level, neighborhood level etc.

NOTE: Study of Indian plants and trees should be done in detail and the Scrap book must be prepared.

RECOMMENDED REFERENCE BOOKS:

1. W. Reid Grant, 'Landscape Graphics'.
2. Littlewood Michael, 'Landscape Detailing'.
3. Harris and Dines, 'Time Saver Standard for Landscape Architecture' - Plants of India.
4. Tony Russel & Catherine Cutler, 'Trees-An Illustrated Identifier and Encyclopedia'.
5. Simonds, 'Landscape Architecture'.
6. Laurie Michael, 'Introduction to Landscape Architecture'.
7. Watts Rajnish, Dhillon Harjit, Chhattar Singh, 'Trees of Chandigarh'.
8. Krishan Pradip, 'Trees of Delhi'.
9. D.K. Bose, S.P. Sharma, B. Chaudhaury, 'Tropical Garden Plants in Colors'.
10. M.S. Randhawa, 'Flowering Trees and Shrubs of India'.
11. M.S. Randhawa, 'Beautifying India'.

INSTRUCTIONS TO THE PAPER SETTER

1. One compulsory question containing 6 questions of 2 marks (12 marks), each requiring short answers, are to be set from the entire syllabus
2. The examiner is required to set another six questions (two from each unit), out of which the students are required to attempt any four questions (selecting at least one from each unit).

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BUILDING SCIENCE AND TECHNOLOGY-V

Subject Code: BARC1-537 **L S T P C**
2 0 0 0 2

COURSE PREREQUISITES: No Prerequisites

COURSE OBJECTIVES: To provide the basic understanding of Electrical Layout, Fire Safety and Acoustics for different volumes of buildings

EXPECTED OUTCOMES: Teaching of the subject shall help students to understand the importance and role of Electrical Layouts, Fire Safety and Acoustics in Buildings.

CONTENTS

Unit –I

ELECTRICAL SERVICES

- Electricity- Basic principles of Electrical Circuits; Ohm's and Kirchhoff's laws.
- Design of simple electrical circuits – Series and Parallel.
- Wires – Specifications, Current carrying capacity; fittings and conduits.
- Wiring systems- Materials, Types/Methods of wiring, their advantages and disadvantages, safety and precautions.
- Electrical equipment used in buildings; Electrical meters, main switch box, distribution boards, Circuit breakers, fuses etc. and their layout.
- Types of Switches, Sockets and Fixtures.

- Protection against Earth leakage, Overload, Short circuit, Lightening and other safety measures for buildings.

Unit –II

ACCOUSTICS

- Introduction to acoustics, basic principles and concepts for design.
- Fundamentals of sound- terminology, basic principles governing transmission, reverberation, absorption, reflection etc., behavior of sound with respect to various surfaces in an enclosed space.
- Factors influencing hearing conditions- shapes, layouts, sitting arrangements of auditoriums, lecture halls, multipurpose halls.
- Acoustic materials, applications, advantages and disadvantages.
- Sound absorbing materials, single and in combination for various frequencies of sound.
- Reverberation time, sound levels and their calculations.
- Construction and planning measures for good acoustical design.
- Acoustical defects and remedies.
- Design considerations for various buildings including Class Room, Lecture Theatre, Auditorium, OAT, etc.

Unit–III

FIRE SAFETY

- Fire- Classification of fire, classification of building according to the fire load, Causes and Spread of fire as per NBC.
- Fire Detection/Warning – Equipment including Smoke detectors, heat detectors, Alarm systems, fire dampers, fire doors and means of escape etc.
- Firefighting equipment and types of fire extinguishers.

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Exercise: Incorporating layouts of relevant services in a multipurpose hall showing Electrical Layout, Fire Safety Plan and Acoustical details.

RECOMMENDED TEXT AND REFERENCE BOOKS

1. R. Barry, 'Building Services', John Wiley and Sons Ltd., **1998**.
2. 'Time Saver Standards – Building Service', McGraw Hill, New York, **2001**.
3. National Building Code 2005.
4. Edward, 'Lighting Design'.
5. J.B. Gupta, 'Electrical Installation, Estimating and Costing', S.K. Kataria & Sons, New Delhi, **2002**.

INSTRUCTIONS TO THE PAPER SETTER

1. One compulsory question containing 6 questions of 2 marks (12 marks), each requiring short answers, are to be set from the entire syllabus.
2. The examiner is required to set another six questions (two from each unit), out of which the students are required to attempt any four questions (selecting at least one from each unit).

HISTORY OF ARCHITECTURE-III

Subject Code: BARC1-538 **L S T P C**

2 0 0 0 2

COURSE PREREQUISITES: Should have studied the course of History of Architecture - II.

COURSE OBJECTIVES: The course is designed to introduce students to the cross currents between theory and practice in different cultures.

1. To understand the political, social, geological and intellectual influences in Architecture and to study the evolution of city planning through time.
2. To inculcate in the students, the importance of the development of world Architecture from Neo classical style up to Industrial revolution and Rajput and Sikh Architecture in India.

EXPECTED OUTCOMES

- The student shall be able to understand basic chronology of historical development as per the contents of syllabus.
- Students shall be able to acquaint themselves with the key historical buildings of various periods of Architectural history and their characteristic features.

CONTENTS

Unit-I

Neoclassic Architecture

- Developments and building examples from Italy

Industrial Revolution

Industrial Revolution and its impact on the development of new towns. e.g. Tony Garnier's Industrial city.

- Influence of new construction materials, industrial techniques and functional needs on building typology and architectural form through building examples.
- Advances in steel construction like the Great Exhibition.
- Development of the high-rise building.

Unit- II

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Sikh Architecture

- Introduction to elements of Sikh Architecture with special reference to Gurudwaras, Palaces, Forts & other Secular structure.
- Building Examples: Golden Temple Amritsar, and other prominent structure of Punjab, Khalsa college Amritsar, Gobindgarh Fort, Qila Mubarak Patiala.
- Traditional Planning of Sikh towns.

Unit-III

Rajput Architecture

- Introduction to elements of Rajput Architecture with special reference to Forts and palaces of Jaipur, Jodhpur, Jaisalmer, Orchha, Datia, etc.

Colonial architecture

- Influence of climate and materials on architectural expression.
- Introduction to colonial Architecture and town planning in India with special reference to Planning of New Delhi by Edwin Lutyens.
- Examples of Colonial buildings in Calcutta, Bombay, Madras and New Delhi.

RECOMMENDED TEXT AND REFERENCE BOOKS

RECOMMENDED TEXT BOOKS

1. B. Fletcher, 'History of Architecture', CBS Publishers & Distributors, Delhi, **1986**.
2. J. Ferguson, 'History of Indian and Eastern Architecture', John Murray Albemarle Street. W. London, **1910.**
3. P.S. Arshi, 'Sikh Architecture in Punjab', Intellectual Publishing House. New Delhi, **1985.**
4. G.S. Ghurye, 'Rajput Architecture'.

RECOMMENDED REFERENCE BOOKS

1. M. Moffett, 'A World History of Architecture', Laurence King Publishing, **2003.**
2. C. Tadgill, 'The History of Architecture in India', Architecture Design & Technology Press, London, **1990**.
3. Ramesh Chander Dogra, Urmila Dogra, 'The Sikh World–An Encyclopedia Survey of

Sikh Religion and Culture', UBSPD Publishers, **2006**.
4. Robert Tavernor, 'Palladio and Palladianism'.
5. Andrea Palladio, Adolph Placzek, 'The Four Books of Architecture'.
6. David Watkin, 'A History of Western Architecture. London: Laurence King', **1996**. ISBN 1856690822

INSTRUCTIONS TO THE PAPER SETTER

1. One compulsory question containing 6 questions of 2 marks (12 marks), each requiring short answers, are to be set from the entire syllabus.
2. The examiner is required to set another six questions (two from each unit), out of which the students are required to attempt any four questions (selecting at least one from each unit).

TALL BUILDINGS

Subject Code: BARC1-539 **L S T P C**
1 0 1 0 2

COURSE PREREQUISITES: No Prerequisites

COURSE OBJECTIVES: To make students understand the technology, environment, infrastructural, economic, social and ecological aspects of high rise construction

EXPECTED OUTCOME: Teaching of the subject shall enable students to understand and appreciate the context of planning, designing, construction and services in high rise buildings.

CONTENTS

Unit-I

- High rise buildings – Definitions, Need, Role and Importance in the urban Context.
  – Approach, Planning and Designing.
  – Siting and its impact in the Urban Context.
  – Advantages and Disadvantages

Unit-II

- High rise buildings – Materials, Construction and Structural Systems.
  – Provision related to fire safety
  – Horizontal and vertical circulation
  – Services and service core.

Unit- III

- High rise buildings – Norms and Standards as per NBC/ Bye-Laws.
  – Study of selective iconic building in the World.
  – Study of selective iconic building in the India.
  – Energy Efficiency and sustainability.

NOTE: The above course contents should be supported with built examples.

RECOMMENDED TEXT AND REFERENCE BOOKS

RECOMMENDED TEXT BOOKS

1. 'Structural Analysis and Design of Tall Buildings/Taranath', Bungale S – 1st. New Delhi, Tata McGraw Hill Education Limited, **1988**.
2. D.K. Ching, 'Building Construction Illustrative'.
3. Engels, 'Structure System'.
4. Jashwant B. Mehta, 'Tall Buildings'.

RECOMMENDED REFERENCE BOOKS

1. 'Advances in Tall Buildings/Beedle', Lynn S – 1st. New York, Van Mostranad Reinhold, **1987**.

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2. Cost in place concrete in tall buildings/Council of Tall Buildings-1st. New Delhi: Tata Mcgraw Hill Education Limited, **1991**.
3. William, 'Tall Buildings: Museum of the Modern Art/Rily'.

INSTRUCTIONS TO THE PAPER SETTER

1. One compulsory question containing 6 questions of 2 marks (12 marks), each requiring short answers, are to be set from the entire syllabus.
2. The examiner is required to set another six questions (two from each unit), out of which the students are required to attempt any four questions (selecting at least one from each unit).

DESIGN PHILOSOPHIES-II

Subject: BARC1-540	L S T P C
	1 0 1 0 2

COURSE PREREQUISITES: The student should have studied Design Philosophies-I

COURSE OBJECTIVES: To develop conceptual and perceptual skills of students to appreciate the basic principles / philosophy of design used in contemporary Indian architecture so as to assess their contributions in modern, regional, cost effective and technological approach towards building.

EXPECTED OUTCOME: Teaching of the subject shall help students to understand the approach of master architects towards design of buildings in India.

CONTENTS

Unit–I

Post-Independence influence of Modern Masters in India

- Le- Corbusier
- Louis I. Kahn

Unit–II

Indian Modern Architects- philosophy and works in India and abroad

- A.P. Kanvinde
- B.V. Doshi
- C.M. Correa
- Joseph Allen Stein

Unit–III

Architects who incorporated Regionalism, Technological advancements and Cost Effectiveness in Indian Architecture

- Laurie Baker
- U.C. Jain
- Raj Rewal
- Hafeez Contractor

RECOMMENDED TEXT AND REFERENCE BOOKS

1. Bhatt, Vikram and Peter Seriver, 'Contemporary Indian Architecture', After the Masters, Ahmedabad, **1990.**
2. Charles M. Correa, 'The New Landscape', Bombay Strand Books, **1985**.
3. Frampton, Kenneth, 'Modern Architecture: A Critical History', Thames & Hudson, U.K., **2007**.
4. Giedion Sigfried, 'Space, Time and Architecture', Harvard University Press, **2009**.

INSTRUCTIONS TO THE PAPER SETTER

1. One compulsory question containing 6 questions of 2 marks (12 marks), each requiring short answers, are to be set from the entire syllabus.

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2. The examiner is required to set another six questions (two from each unit), out of which the students are required to attempt any four questions (selecting at least one from each unit).

ARCHITECTURAL DESIGN – VI

Subject Code: BARC1-641 **L S T P C**
2 3 0 2 6

UNI. EXAM. DURATION: 18 HRS (3 DAYS) (6 + 6 + 6 HRS. WITH 1 HR. BREAK ON ALL DAYS) (EXTERNAL VIVA VOCE)

COURSE PREREQUISITES: The student should have the knowledge of Design fundamentals, spatial organisation, structure and services

COURSE OBJECTIVES

- To understand the constraints of designing recreational buildings in an urban or rural setting with respect to socio-cultural, climate and development norms.
- To emphasize the role of design in evolving expression. To focus on design detail as vital part of architectural expression.
- To understand design limitations due to site surroundings and local bye laws.
- To explore computer aided presentation techniques involving 2D and 3D drawings and models as required.

EXPECTED OUTCOME

- Students should be able to understand and appreciate the constraints of combining varying structural spans in complex building typologies and interweaving them with structure, site and architectural form and expressions.
- Students should be able understand and appreciate the interrelationship between form and scale.

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CONTENTS

Design of mixed use and large span structures such as Art and crafts centres, Performing arts centre, Cultural centre, Museum and exhibition centre in urban areas, etc.

METHODOLOGY

For all assignments the following methodology should be followed and all stages should be attempted individually.

- Library and Proto type Studies
- Site analysis and site planning
- Space planning
- Design development and volumetric studies (model)
- Preliminary design and volumetric study (model)
- Final design with detailed volumetric study, (Detailed model) and visual communications (3D Visualizations)

GUIDELINES FOR PAPER SETTER

1. One compulsory question is to be set from the syllabus and covering the entire content.
2. Evaluation is to be done through viva voce by external jury comprising of two examiners appointed by the University at college and answer sheets should be retained at college level.
3. The topic of the project is to be displayed on College / Institute Notice Board ten days in advance.

RECOMMENDED TEXT AND REFERENCE BOOKS

1. Joseph De Chiara, Michael J. Crosbie, 'Time Saver Standards for Building Types', McGraw Hill Professional, **2001**.

2. Julius Panero, Martin Zelnik, 'Human Dimension and Interior Space', Whitney Library of Design, **1975.**
3. Joseph De Chiara, Julius Panero, Martin Zelnik, 'Time Saver Standards for Interior Design and Space Planning', McGraw Hill, **2001**.
4. Ernst Neuferts, 'Architects Data', Blackwell, **2002.**
5. Ramsey et al, 'Architectural Graphic Standards', Wiley, **2000.**
6. Sam F. Miller, 'Design Process: A Primer for Architectural and Interior Design', Van Nostrand Reinhold, **1995.**
7. Rewal, Raj, 'Humane Habitat at Low Cost', Architectural Research Cell, **2000**.
8. Steele, James, 'The Complete Works of Balakrishna Doshi: Rethinking Modernism for the Developing World', Super Book House, Mumbai, **1990**.

BUILDING CONSTRUCTION-VI

Subject Code: BARC1-642 **L S T P C**
2 2 0 2 5

COURSE PREREQUISITES: Students should have knowledge of drawings for construction and proficiency in 2D CAD Software.

COURSE OBJECTIVES: To acquaint students about the role of working drawings in execution of the building.

EXPECTED OUTCOMES: The student shall be able to draw the drawing good for construction.

CONTENTS

Unit-I

- Working Drawings of previous semester design project incorporating the following details:
  - Demarcation plan/ Excavation Plan
  - Grid and Foundation Plan/ details
  - All floor Plans/ details
  - Terrace plan
  - Elevation/ Sections
  - Joinery Details (Door/Windows schedule and Detail)

Unit–II

- Detailed Working Drawings of following utilities and service areas:
  - Toilet Details
  - Kitchen Details
  - Staircase details
  - Plumbing/ Sanitary layout
  - Fire Fighting Plan
  - Electrical layout

Unit–III

- Construction details of Basement and its treatment
- Extension, Expansion and Construction Joints, their details and treatments
- Commercial Kitchen- Study
- Case studies/detailing of Public Toilets

NOTE:

Site visits to construction sites

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RECOMMENDED TEXT AND REFERENCE BOOKS

1. Don A, Watson, 'Construction Materials and Processes', McGraw Hill Co., University of Michigan, **1972**.
2. W.B. McKay, 'Building Construction', Vol. 1, 2, 3, 4, Longmans, U.K., **1981**.
3. Alanwerth, 'Materials', The Mitchell Pub. Co., Ltd. London, **1986**.
4. R. Chudley, 'Building Construction Handbook', British Library Cataloguing in Publication Data, London, **1990**.
5. R. Barry, 'Building Construction', East West Press, New Delhi, **1999**.

INSTRUCTIONS TO THE PAPER SETTER

1. The examiner is required to set a total of six questions with two questions from each UNIT.
2. The student is required to attempt any one question from each UNIT making a total of three questions

BUILDING SCIENCE & TECHNOLOGY-VI

Subject Code: BARC1-643 **L S T P C**
2 0 0 0 2

COURSE PREREQUISITES: The student should have the basic knowledge of elementary building services

COURSE OBJECTIVES: To develop an understanding of the advanced building services such as HVAC, lifts, escalators, Building automation systems, BIM and their application in the design proposals of multi-storeyed buildings.

- The thrust shall be on understanding the use and application of the services and not the calculation or numerical part.

EXPECTED OUTCOMES: Student shall be able to understand the use and application of various advanced building services for the design assignments.

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CONTENTS

Unit-I

Heating, Ventilation and Air-conditioning Systems

- Introduction & Principles Fundamentals of Air Conditioning System Design, Refrigeration Cycle
- Comfort cooling systems & their working- Unitary air conditioning- Window ac & Split ac., Package ac system, Evaporative cooling systems, Cooling load for air conditioning
- Central air conditioning their parts - A.H.U., Cooling plant, Cooling tower
- Air Distribution Systems - fans, filters, fan coil units, ductwork, outlets, dampers
- Methods of Heating and Cooling
- Natural and Artificial Ventilation

Unit-II

Mechanical Transportation Systems

- Horizontal and vertical mechanical transportation system in building - Lifts (Elevators), Escalators, Vehicular elevators and Walkways
- Design Standards – Lifts Lobby, Lift Cards etc.
- Elevators (Lifts) – Types, Control and operation, Carrying Capacity, Rated Load, Rated Speed, RTT etc., Principles of functioning, control and operation of lifts. Machine room and its equipment, lift well and pit
- Escalators and Conveyers – Functioning, Installation, Suitability and Planning requirements

Unit–III

Intelligent Buildings

Introduction to Intelligent Buildings - definitions, building elements, descriptions, definitions and components, historical overview

Energy and Intelligent Buildings - Energy consumption in buildings, micro climate, human comfort in buildings, energy conservation in buildings, active and passive systems, advanced building energy management systems

Building Automation - Intelligent control of building components, automating building services, system integration and optimization with building envelope

Communication systems, safety and security systems

Performance Evaluation and Standards - Building performance evaluation and intelligent building standards

TEACHING METHODOLOGY

•Site visits of buildings where various systems related to the syllabus have been installed, their working and merits and demerits of the system.

•Specialized lectures from technical people in the field.

RECOMMENDED TEXT AND REFERENCE BOOKS

1. Peter Burberry, 'Mitchell's Building Construction: Environment & Services', 8th Edn., Longman, **1997**.
2. B. Stein and J. Reynolds, 'Mechanical and Electrical Equipment for Buildings', 10th Edn., Wiley & Sons Inc., **2005**.
3. R Rush, 'The Building Systems Integration Handbook', American Institute of Architects, **1991**.
4. R.P. Parlour, 'Building Services: A Guide to Integrated Design: Engineering for Architect', Integral Publishing, **2008**.
5. E. Reid, 'Understanding Buildings: A Multi-Disciplinary Approach', MIT.
6. William H. Severns and Julian R. Fellows, 'Air-conditioning and Refrigeration', John Wiley and Sons, London,**1988**.
7. A.F.C. Sherratt, 'Air-conditioning and Energy Conservation', The Architectural Press, London, **1980**.
8. ASHRAE Publications.
9. National Building Code of India (Latest Edition), Bureau of Indian Standards.

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INSTRUCTIONS TO THE PAPER SETTER

1. One compulsory question containing 6 questions of 2 marks (12 marks), each requiring short answers, are to be set from the entire syllabus
2. The examiner is required to set another six questions (two from each unit), out of which the students are required to attempt any four questions (selecting at least one from each unit).

INTERIOR DESIGN

Subject Code: BARC1-644 **L S T P C**
1 0 0 2 2

COURSE PREREQUISITES: The student should have the basic knowledge of Design principles and elements

COURSE OBJECTIVES: To introduce the students to the discipline of Interior Design and to develop basic skills required for handling simple interior design projects

EXPECTED OUTCOMES: Student shall be able to understand and appreciate the discipline of Interior design and its relation with Architectural Design.

CONTENTS

Unit-I

- Objectives, Purpose, Role and Importance of Interior Design
- Elements of Interior Design, Role in interiors
- Aesthetic Order, functional Value and Psychological impact of various elements of Interior Design
- Principles of Interior Design and their application in the context of buildings

Unit-II

- Application of Colour, Texture, Landscaping, Artificial and Natural Lighting in the Building interiors
- Furniture, Furnishings, Fabrics, Murals, Paintings, Sculpture, Lighting Fixtures, Floor coverings, Wall coverings and related materials
- Study of furniture and ergonomics

Unit-III

Design exercises with simple spatial layouts of furniture, wall panelling, flooring, illumination, ceiling details and air conditioning features in buildings

Note: Studio exercises shall be supplemented with workshops and site-visits.

RECOMMENDED TEXT AND REFERENCE BOOKS

1. M. Pratap Rao, 'Interior Design: Principles and Practice', 3rd Edn., Standard Pub., **2004**.
2. Francis D.K. Ching, 'Interior Design Illustrated', V.N.R. Pub., NY, **1987**.
3. Yatin Pandya, 'Elements of Spacemaking'.
4. Massey, Anne, 'Interior Design', **1900**.
5. Litchfield, Fredrick, 'Illustrated History of Furniture from the earliest to the present time'.
6. Arnold Friedmann and Others, 'Interior Design: An Int. to Architectural Interiors', Elsevier, New York, **1979**.
7. E. William Miller, 'Basic Drafting for Interior Designers', Van Nostrand Reinhold, New York, **1981**.
8. John Kurtich and Garret Eakin, 'Interior Architecture', Van Nostrand Reinhold, New York, **1993**.

MRSPTU

INSTRUCTIONS TO THE PAPER SETTER

1. One compulsory question containing 6 questions of 2 marks (12 marks), each requiring short answers, are to be set from the entire syllabus
2. The examiner is required to set another six questions (two from each unit), out of which the students are required to attempt any four questions (selecting at least one from each unit).

ESTIMATING AND COSTING

Subject Code: BARC1 – 645 **L S T P C**
1 0 0 2 2

COURSE PREREQUISITES: No Prerequisites

COURSE OBJECTIVES: To make the students understand the factors affecting cost of buildings and methods of preparing estimates of architectural projects.

EXPECTED OUTCOME: Students shall be able to understand the process of preparing estimates, tenders and other activities related execution.

CONTENTS

UNIT-I

Estimating & Costing

- Estimate & Types of Estimate.

- Methods of Estimates--Approximate & detailed methods of Estimate including Plinth area method, Carpet/Floor Area method, Cubic Content method.
- Preparing estimates of quantities of materials for various items of work e.g. earthwork, brickwork, flooring, roofing etc. - units of measurements and payments.
- Analysis of rates of material and labour required for various items of work.
- Bill of Quantities-Methods of taking out the quantities of R.C.C. construction.
- Case study/practical exercise in preparing a detailed estimate of a two storeyed residential building with respect to the quantities of material and labour required as well as analysis of rates for material and labour.

UNIT-II

Specifications

- Introduction, importance, Role, Functions and Types of Specifications
- Detailed Specifications for various basic building materials.
- Studio exercise related to specifications for small building project, standard P.W.D. specifications.
- Writing specifications for civil works as:
    - Damp Proof Course
    - Brick Masonry
    - Concreting
    - Flooring
    - Plastering & Pointing
    - Timber Doors & Windows
    - Steel Doors & Windows
    - Painting and Varnishing
    - Services, Sanitary Fixtures & Electric Wiring

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UNIT- III

- Tenders- Type, Process, Scrutiny and Selection of Contractor, Pre-Qualification and Registration of Contractor.
- Valuation - Purpose, Objective, Types and Method of valuation.
- Arbitration and Reconciliation Act.

RECOMMENDED TEXT AND REFERENCE BOOKS

1. P.W.D. Specifications.
2. B.N. Dutta, ‘Estimating & Costing in Civil Engineering’.
3. A. Agarwal, A.K. Upadhay, ‘Civil Estimating, Costing and Valuation’, S.K. Kataria Sons, **2009.**
4. Nanavati Roshan, ‘Estimating, Costing and Valuation’, U.B.S. Publishers, Distributers Pvt. Ltd. New Delhi.
5. Indian Arbitration Act.
6. M. Chakraborty, ‘Estimating, Costing & Specification and Valuation in Civil Engineering and Service Tax Manual’.

INSTRUCTIONS TO THE PAPER SETTER

1. One compulsory question containing 6 questions of 2 marks (12 marks), each requiring short answers, are to be set from the entire syllabus.
2. The examiner is required to set another six questions (two from each unit), out of which the students are required to attempt any four questions (selecting at least one from each unit).

DESIGN PHILOSOPHIES-III

Subject Code: BARC1-646 **L S T P C**
1 0 1 0 2

COURSE PREREQUISITES: The student should have studied the course of Design Philosophies-II.

COURSE OBJECTIVES: To develop conceptual and perceptual skills of students to appreciate the theories of Program, Function and Philosophies used in Contemporary architecture

EXPECTED OUTCOME: Teaching of the subject shall help students to understand the approach of eminent architects towards designing of buildings.

CONTENTS

Unit –I

- Theoretical issues in contemporary architecture through, Seminars on any one work of practicing Indian and International architects.
- Structural Expressionism (High-Tech Architecture)
  - Renzo Piano
  - Richard Rogers

Unit –II

Deconstructivism

- Frank O. Gehry
- Rem Koolhaas
- Zaha Hadid

Unit –III

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Neo Futurism

- Santiago Calatrava Valls
- Norman Foster
- Tadao Ando

RECOMMENDED TEXT AND REFERENCE BOOKS

1. Philip Johnson, 'Deconstructivist Architecture, Museum of Modern Art'.
2. Colin Davies, 'High Tech Architecture', Rizzoli.
3. Zaha Hadid, Aaron Betsky, 'Zaha Hadid: Complete Works', Rizzoli.
4. Alexander Tzonis, 'Santiago Calatrava: Complete Works', Rizzoli.

INSTRUCTIONS TO THE PAPER SETTER

1. One compulsory question containing 6 questions of 2 marks (12 marks), each requiring short answers, are to be set from the entire syllabus.
2. The examiner is required to set another six questions (two from each unit), out of which the students are required to attempt any four questions (selecting at least one from each unit).

ARCHITECTURAL LEGISLATION

Subject Code: BARC1-647 **L S T P C**
2 0 0 0 2

COURSE PREREQUISITES: No Prerequisites

COURSE OBJECTIVES: To make students familiar with the role and importance of Legal Framework in designing the Built Environment for orderly growth of Human Settlements.

EXPECTED OUTCOMES: Student will be able to understand the Legal Framework in Architectural Practice.

CONTENTS

Unit- I

- Architectural Legislation – Introduction, Need, Role and Importance.
- Punjab Municipal bye-laws – Introduction, Contents related to Site planning, architectural design and services.
- PUDA bye-laws – Introduction, Contents related to Site planning, architectural design and services.

Unit- II

- Development Controls, need, importance, typologies
- Development Controls – Chandigarh Capital City
- Submission Drawings - Documents, Drawings and procedure for approval.
- Completion/ Occupation Certificate for Buildings - Documents, Drawings and procedure
- Chandigarh Periphery Control Act- Intent, Content and important provisions.

Unit- III

- National Building Code - Definitions, architectural controls, zoning, parking etc.
- National Building Code – Provisions related to multi-storied buildings.
- Disability Act
- Preservation and Conservation of Heritage Buildings, Heritage Regulations

RECOMMENDED TEXT AND REFERENCE BOOKS

1. Building Bye Laws - Chandigarh Administration
2. Town Planning – Rangwala
3. Building Bye Laws- PUDA
4. Municipal Building Bye Laws
5. National Building Code
6. Readers Volume in Town planning by Institute of Town Planners, INDIA

INSTRUCTIONS TO THE PAPER SETTER

1. One compulsory question containing 6 questions of 2 marks (12 marks), each requiring short answers, are to be set from the entire syllabus.
2. The examiner is required to set another six questions (two from each unit), out of which the students are required to attempt any four questions (selecting at least one from each unit).

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ARCHITECTURAL DESIGN – VII

Subject Code: BARC1-748 **L S T P C**
2 5 0 2 8

UNI. EXAM. DURATION: NO EXAM (VIVA VOCE BY EXTERNAL JURY ON PORTFOLIO)

COURSE PREREQUISITES: The student should have the knowledge of Codes for Transportation/Building and Safety codes besides understanding of the fundamentals of architecture, space planning, services and structure.

COURSE OBJECTIVES: To students understand the design of large building/urban projects involving complex circulations and circulatory system specific safety standards (structural system and building services to evolve iconic architecture.

EXPECTED OUTCOMES:

- Students should be able to understand and appreciate the with complex functional, circulation and safety requirements.

CONTENTS

1. Planning and designing of large Complexes such as Hospitals, Healthcare Buildings

2. Planning and designing of Traffic Nodes- Bus Terminal, Railway Station, Airport
3. Light Industrial Buildings involving manufacturing display etc.

TEACHING METHODOLOGY:

Minimum Two projects should be done by the student. The Projects selected should be based on realistic contexts.

For all assignments the following methodology should be followed and all stages should be attempted individually.

- Library and Proto type Studies
- Site analysis and site planning
- Space planning
- Design development and volumetric studies (model)
- Preliminary design and volumetric study.
- Final design with detailed volumetric study and visual communications (3D Visualizations)

NOTE:

1. All Building should have safety design features as per norms.
2. Evaluation is to be done through viva voce by external jury comprising of two examiners appointed by the University at college and answer sheets should be retained at college level

RECOMMENDED TEXT AND REFERNCE BOOKS

1. Ching, Frank (Francis D.K.), 'Architecture: Form, Space & Order', John Wiley, Hoboken, **2007**.
2. V.S. Parmar, 'Design Fundamentals', Somaiya Publisher Pvt. Ltd., Mumbai, **1997**.
3. Scott Van Dyke, 'Form, Line to Design', Van Nostrand Reinhold, **1990**.
4. R Scott, 'Design Fundamentals', Robart E. Krieger Publishing Company, E & OE-Architects Hand Book and Planning.
5. Donald Watson, Michael J. Crosbie, 'Time Saver Standard, 8th Edn.

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BUILDING CONSTRUCTION-VII

Subject Code: BARC1-749 **L S T P C**
2 2 0 2 5

UNI. EXAM. DURATION: NO EXAM (EXTERNAL VIVA ON PORTFOLIO)

COURSE PREREQUISITES: Students should have studied the methodology of Construction for different types of buildings.

COURSE OBJECTIVES: To acquaint the students with advanced building construction technology.

EXPECTED OUTCOME: Students shall be able to know the latest trends/ methods of construction.

CONTENTS

Unit-I

- Prefabricated and precast building construction and details.
- Modular Construction- Objectives, basic principles, planning and structural modules.
- Tubular construction system and details.

Unit-II

- Design and Construction details in interior such as show room/shops, Banks, Hotels, Offices, Public buildings, restaurants, etc.
- Construction of structural & non-structural cladding & curtain wall.

- Materials and Construction details of Wall Paneling, False Ceiling including Thermal and Acoustics treatments.

Unit-III

- Construction details for earth quake resistant structures (Low rise)
- Construction details of passive methods of environment control in buildings
- Construction details of swimming pool/ Terrace Garden.

NOTE: Evaluation is to be done through viva voce by external examiner appointed by the University at college level.

RECOMMENDED TEXT AND REFERENCE BOOKS

1. Don A. Watson, 'Construction Materials and Processes', McGraw Hill Co., University of Michigan, **1972**.
2. W.B. Mckay, 'Building Construction', Vol. 1, 2, 3, Longmans, U.K., **1981**.
3. 'Practice of Architectural Working Drawings', John Wiley & Sons Publication.
4. R. Chudley, 'Building Construction Handbook', British Library Cataloguing in Publication Data, London, **1990**.
5. R. Barry, 'Building Construction', East West Press, New Delhi, **1999**.

HOUSING

Subject Code: BARC1-750 **L S T P C**
2 0 0 0 2

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COURSE PREREQUISITES: The student should have the basic understanding of Housing in India.

COURSE OBJECTIVES: To create awareness about the salient features of Housing, issues, causes and consequences of housing problems and to impart knowledge about the possible solutions.

EXPECTED OUTCOMES: The students will be able to understand various aspects, issues and considerations affecting housing problems and their solutions in today's context.

Unit-I

- Introduction, Role and Importance in the context of social and economic context
- Typologies, Comparative Advantages and Disadvantages
- Need and Demand
- Shortage, Problems and solutions in the Indian Context
- Housing Cost, Components and Strategies for minimizing Cost.

Unit-II

- Institutions involved in Providing Housing in India
- Housing Finance and Institutions involved in Financing Housing in India
- Affordable Housing
- Land, its role and importance in Housing
- Slums – Definition, Characteristics, Causes and solutions in the Indian Context.

Unit-III

- Housing policies in India.
- Housing through Five year plans.
- Role of private Sector in Housing.
- Low Cost Housing.
- Housing Survey

RECOMMENDED TEXT AND REFERENCE BOOKS

1. Babur Mumtaz and Patweikly, 'Urban Housing Strategies', Pitman Publishing, London, **1976**.
2. Geoffrey K. Payne, 'Low Income Housing in the Development World', John Wiley and Sons, Chichester, **1984.**
3. John F.C. Turner, 'Housing by People', Marison Boyars, London, **1976**.
4. Martin Evans, 'Housing, Climate and Comfort', Architectural Press, London, **1980**.
5. Forbes Davidson and Geoff Payne, 'Urban Projects Manual', Liverpool University Press, Liverpool, **1983**. Patrik Schumacher: **2004**, Digital Hadid.
6. O.P. Miglani, 'Urban Housing in Developing Economy'.
7. A.K. Jain, 'Urban Housing and Slums'.
8. Thomas Poulose, 'Innovative Approaches to Housing for the Poor'.
9. 'Five Year Plans', Government of India Publications.
10. 'Readers Volume on Housing', of Institute of Town Planning.
11. S.C. Rangwala, 'Town Planning'.
12. Laurie Baker, 'The Manual of cost cuts for strong acceptable Housing'.

INSTRUCTIONS TO THE PAPER SETTER

1. One compulsory question containing 6 questions of 2 marks (12 marks), each requiring short answers, are to be set from the entire syllabus.
2. The examiner is required to set another six questions (two from each unit), out of which the students are required to attempt any four questions (selecting at least one from each unit).

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CONSTRUCTION MANAGEMENT

Subject Code: BARC1-751 **L S T P C**
2 0 0 0 2

COURSE PREREQUISITES: The students should have knowledge about the different stages of construction activities

COURSE OBJECTIVES: To make student understand and appreciate the role and importance of management in building construction.

EXPECTED OUTCOME: The students shall be able to handle and manage the project efficiently

Unit-I

- **Project Management**- Concept, Background, Purpose, Aim, Objectives, Scope and its Significance
- **Traditional Management Systems**- Advantages and limitations
- **Role of Architect** in Construction/Project Management
- **Resources** of Construction Industry.
- **Construction** stages, Construction team, Equipment Management

Unit-II

- **Project Management Techniques**- Network, CPM, PERT
- **CPM Analysis**- Critical Path, Float Computation Result Sheet etc.
- **PERT**- Introduction, Theory and Network analysis
- **Cost Time** analysis in Network Planning
- **Financing of Project**, Depreciation and Break even Cost analysis
- **Cost Control**- Budget, Accounting System, Problems

Unit-III

- **Quality and Safety**- Objectives, Issues, Organizing for Quality and Safety

- **Stages of Inspection** and Quality control
- **Planning of Temporary Services** at the site.
- **Security of Materials** and Manpower at building site.
- **Computer Application** in Construction Management

TEACHING METHODOLOGY

Teaching in the subject will be a combination of Expert lectures and visits to Construction /Project Sites and discussions with Project Managers

Students would be required to do a case study of an ongoing construction project

RECOMMENDED TEXT AND REFERENCE BOOKS

1. R.L. Peurify, 'Construction Planning, Equipment and Methods', International Book Company.
2. L.S. Srinath, 'PERT &CPM Principles and Applications', EWP Limited New Delhi.
3. B.C. Punmia & K.K. Khandelwal, 'Project Planning and Control with PERT\CPM', Laxmi Publications, New Delhi, **2009**.
4. Mukhopadyay, S.P. 'Project Management for Architects and Civil Engineers', IIT, Kharagpur, **1974**.
5. P.S Gahlot & B.M. Dhir, 'Construction Planning & Management'.
6. P.N. Modi, 'PERT and CPM', Standard Book House, New Delhi, **2009**.

INSTRUCTIONS TO THE PAPER SETTER

1. One compulsory question containing 6 questions of 2 marks (12 marks), each requiring short answers, are to be set from the entire syllabus.
2. The examiner is required to set another six questions (two from each unit), out of which the students are required to attempt any four questions (selecting at least one from each unit).

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TOWN PLANNING

Subject Code: BARC1- 752 **L S T P C**
1 0 2 0 3

COURSE PREREQUISITES: No Prerequisites

COURSE OBJECTIVES: To make students understand the role and importance of Town Planning in the Evolution of Human Settlements and Urban Forms in the Historical and Modern Context.

EXPECTED OUTCOMES: Teaching of the subject shall help students to understand the importance and role of Town Planning in the Historical and Modern Context.

CONTENTS

Unit-I

- Town Planning - Introduction, Role, Importance and Scope.
- Planning Principals - Nile Valley, Greek and Roman Periods.
- Town Planning in India - Indus Valley (Mohenjedaro), Islamic (Fatehpur Sikri), Medieval (Jaipur) and Colonial Period (New Delhi).
- Human Settlements - Classification based on Road Pattern, Form, space, use & Population.

Unit- II

- Towns and Cities in India – Issues, Problems and strategies for development.
- Urbanization – Introduction, Definition, pattern, causes and effect in India.
- Master Plan – Objectives, Contents, Role, Importance, Methodology and critical evaluation.

- Regional Plan - Objectives, Contents, Role, Importance, Methodology and critical evaluation.
- Smart Cities – Intent, Content, Scope, Approach, Methodology and critical Appraisal.

Unit- III

- Planning Concepts- Garden City, Linear City, Industrial City and Sustainable City, Compact city and TOD.
- Study of New Towns in India – Chandigarh, Gandhi Nagar, Bhubaneswar and Raipur.
- Development Authorities – Role and Importance in Urban Development.
- Neighborhood – Introduction, Concept, Objective, Principle and case study.

RECOMMENDED TEXT AND REFERENCE BOOKS

1. S.C. Rangwala, 'Town Planning'.
2. Paul D. Spreiregan, 'Urban Design: The Architecture of Towns and Cities'.
3. Arthur B. Gallion, 'The Urban Pattern: City Planning and Design'.
4. S.P. Gupta, 'The Chandigarh: An Overview'.
5. S.C. Agarwal, 'Architecture and Town Planning'.
6. 'Report of National Commission on Urbanization', Govt. of India.
7. 'The Punjab Regional and Town Planning and Development Act', **1995.**
8. 'Senses of India', **2011.**
9. 'Readers Volume in Town planning by Institute of Town Planners, INDIA'.

INSTRUCTIONS TO THE PAPER SETTER

1. One compulsory question containing 6 questions of 2 marks (12 marks), each requiring short answers, are to be set from the entire syllabus.
2. The examiner is required to set another six questions (two from each unit), out of which the students are required to attempt any four questions (selecting at least one from each unit).

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EDUCATIONAL TOUR-II

Subject Code: BARC1- 753 **L S T P C**
0 0 0 0 1

UNI. EXAM. DURATION : NO EXAM (INTERNAL VIVA VOCE)

OBJECTIVES

The main aim is to explore, study, analyse and understand the contemporary / traditional / historical architectural characteristics and details of areas, places, buildings in different parts of India and abroad. The duration of tour shall be up to 08 days.

GENERAL GUIDELINES FOR THE TEACHER

Study of building materials and details through sketches and photographs to be made as an individual student activity and is to be submitted in a report form. Study of concepts/ construction techniques and architectural characters for different sites/ buildings visited to be submitted in groups of students. Viva voce of individual student for both the submissions will be conducted by the teacher in-charge, who accompanied the tour, as part of the internal assessment.

NOTE:

The Evaluation shall be done on the work done by the students in the form of handmade Sketches and Report of the Tour.

PERSONALITY DEVELOPMENT

Subject Code: BARC1-754 **L S T P C**
1 0 0 0 1

UNI. EXAM. DURATION: NO EXAM (INTERNAL VIVA VOCE ONLY)
COURSE PREREQUISITES: Nil
COURSE OBJECTIVES: The purpose of this course is to build confidence and inculcate various soft skills and to help Students to identify and achieve their personal potential.
EXPECTED OUTCOME: Student shall be able to convey his/her ideas through oral/ visual presentations

CONTENTS

1. Self-analysis SWOT
2. Time management
3. Creative chain story telling
4. Vocabulary games
5. Attitude assessment
6. Goal Setting
7. Problem Solving
8. Motivation
9. Article review
10. Team building exercise
11. Critical Thinking
12. Event Management
13. Business situation handling
14. Leadership Qualities
15. Reviews
16. Public Speaking/Presentation

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METHODOLOGY

The entire program is designed in such a way that every student will participate in the class room activities. The activities shall be planned to bring out the skills and talents of the students which they will be employing during various occasions in their real life.

NOTE:

The students should be evaluated through various assignments prepared and related to the following:

1. Group activities + individual activities.
2. Collaborative learning.
3. Interactive sessions.
4. Ensure Participation.
5. Empirical Learning.

RECOMMENDED TEXT AND REFERENCE BOOKS

1. Covey Sean, ‘Seven Habits of Highly Effective Teens’, Fireside Publishers, New York, **1998**.
2. Carnegie Dale, ‘How to Win Friends and Influence People’, Simon & Schuster, New York, **1998**.
3. Thomas A. Harris, ‘I am ok, You are ok’, Harper and Row, New York, **1972**
4. Daniel Coleman, ‘Emotional Intelligence’, Bantam Book, **2006.**
5. D.K. Kansal, ‘Holistic Personality Development’, Sports & Spiritual Science Publication, New Delhi, **2011**.
6. S. Vivekananda, ‘Personality Development’, Advaita Ashrama Publications, Kolkata, India, **2007.**

7. Nirali Prakashan, ‘Communication Skills & Personality Development’.

LIGHTING AND ILLUMINATION

Subject Code: BARC1- 761 **L S T P C**
1 0 1 0 2

COURSE PREREQUISITES: No Prerequisites

COURSE OBJECTIVES: To introduce methods of determining qualitative & quantitative lighting requirements both for interiors and exteriors

EXPECTED OUTCOME: Teaching of the subject shall help students to understand the importance and role of Lighting and its uses in various architectural projects.

CONTENTS

Unit- I

- Basic anatomy and functions of the eye. Adjustments made by the eye, Age-related defects and their design implications.
- Visual arc, Visual acuity, resolution angle, Contrast, Colour Contrast, Colour Adaptation, Visual performance and its relationship to Contrast, Size of task and Illuminance. Central and peripheral vision.
- Photometric terms used in the lighting industry and their interrelationship. Measurement of these terms.
- Colour Specification with Munsel and CIE system, Additive and Substractive colour mixing.

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Unit-II

- Lamp Properties; Effect of voltage & Temperature fluctuation on functioning of lamps, lamp cost, Lumen Loss, Lamp photo metrics, etc. Brief history of lamps.
- Lamps – Incandescent, Discharge sources. High intensity discharge sources. Fiber optics, Induction Lamps, LED lamps. Recent developments in lamp technology.
- Luminaire properties like intensity distribution for ceiling luminaries & floodlights, LOR, ULOR, DLOR, IP rating, Glare control methods, Aesthetics and applications.

Unit- III

- Quantitative lighting design of a simple space manually using lumen methods. Lighting design-using computers.
- Design principles used for lighting of various types of internal spaces. Design principles used for lighting of various external situations.
- Day lighting, Importance and method to calculate illumination due to daylight using daylight factor, day lighting practices. Integration with electric lighting.

RECOMMENDED TEXT AND REFERENCE BOOKS

1. R. Barry, ‘Building Services’, John Wiley and Sons Ltd., **1998**.
2. ‘Time Saver Standards – Building Service’, McGraw- Hill, New York, **2001**.
3. National Building Code, **2005.**
4. Edward, ‘Lighting Design’.

INSTRUCTIONS TO THE PAPER SETTER

1. One compulsory question containing 6 questions of 2 marks (12 marks), each requiring short answers, are to be set from the entire syllabus.
2. The examiner is required to set another six questions (two from each unit), out of which the students are required to attempt any four questions (selecting at least one from each unit).

DISASTER MANAGEMENT FOR BUILDINGS

Subject Code: BARC1-762 **L S T P C**
1 0 1 0 2

COURSE PREREQUISITES: Nil

COURSE OBJECTIVES: The course would focus on natural and man-made hazards, Disasters Reduction and Management.

EXPECTED OUTCOMES: To make the students understand the various Pre and Post-disaster design and management measures to make buildings safe against Earthquakes.

CONTENTS

Unit –I

- Disasters: Introduction, Typologies, Causes, Effects and prevention.
- Pre- disaster and Post- disaster management- problems, issues and options
- Disaster mitigation, Need, importance and strategies
- Role of Architects and Planners in creating Safe Buildings/Cities

Unit-II

- Earthquake: Causes, Effects, Problems & design issues
- General Principles of designing RCC & Masonry buildings against Earthquake
- Special construction techniques to make buildings safe against Earthquake
- Study of Earthquake Zones in India-- features and Design/ construction requirements

Unit –III

- Introduction, Causes, Effects of Fire, Floods, Cyclones, Landslide, Tsunami, Avalanche etc.
- General requirements, principles and measures for making safe building design against Fire, Floods, Cyclones, Landslide, Tsunami Avalanche, etc.
- Special Technique for constructing safe buildings for above mentioned disasters

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RECOMMENDED TEXT AND REFERENCE BOOKS

1. H.N. Srivastava & G.D. Gupta, ‘Management of Natural Disasters in Developing Countries’, Daya Publishing House, New Delhi, **2006**.
2. Lusted, Marcia Amidon, ‘Natural Disasters’, ABDO Publishing Company, U.S.A., **2011**.
3. Roxanna Mcdonald; Introduction to Man-made and Natural Disasters and Their Effects on Buildings, Taylor & Francis, 2003.
4. Ramroth, William G. Jr.; Planning for Disaster – How Natural & Man-made Disasters Shape The Built Environment; Kaplan Publishing, USA, 2007.
5. Donovan, Jenny; Designing to Heal: Planning and Urban Designing Response to Disaster and Conflict; CSIRO Publishing, Australia, 2013.
6. Pauw, C. De & Lauritzen, E.K.; Disaster Planning, Structural Assessment, Demolition and Recycling, Taylor & Francis, UK, 2005.

INSTRUCTIONS TO THE PAPER SETTER

1. One compulsory question containing 6 questions of 2 marks (12 marks), each requiring short answers, are to be set from the entire syllabus.
2. The examiner is required to set another six questions (two from each unit), out of which the students are required to attempt any four questions (selecting at least one from each unit).

PRACTICAL TRAINING

Subject Code: BARC1- 855 **L S T P C**
0 0 0 0 20

UNI. EXAM. DURATION : NO EXAM (VIVA VOCE BY EXTERNAL JURY)
COURSE PREREQUISITES: The student should have knowledge of designing, drafting and detailing.
COURSE OBJECTIVES: To make student learn the intricacies of Architectural Profession by joining and working with practicing Architects/Architectural firms for one complete semester.
EXPECTED OUTCOMES: Practical Training Programme shall help students to understand the practical approach of towards designing of buildings.

CONTENTS

Practical Training Manual:

- The total marks shall be suitably apportioned to assess on regular basis the monthly reports, office work and work done outside office hours.
- Students are required to send/ submit monthly progress reports of work done by them in the office in which they are working according to a prescribed schedule. These reports shall be assessed/marked regularly by the Practical Training Coordinator (PTC).
- On the conclusion of training, the work done by the student shall be examined and evaluated through a viva- voce to be conducted jointly by the HOD, PTC and External Jury (min. 2 members), who will be appointed by the University.

Work to be done by the student:
During training, students are required to do two distinct types of work in order to make optimum utilization of the period of training.

1. **Work to be done during office hours:**
   - The work to be done during office hours will include:
   - Drafting, Tracing, Sketch designs, Presentation drawing, Perspectives, Models, documentation etc.
   - Working Drawing and details
2. **Work to be done during extra - office hours:**
   - The work to be done during extra - office hours will include:
   - Preparing a study report on Building design, Analysis incorporating Site visits, recording Observations etc.

Distribution of Marks

1. **Internal Assessment: (40 Marks)**
   Internal Assessment shall consist of periodical reports as given below:
   - Joining Report and Monthly Progress reports (5 nos.)
2. **University Examination (60 Marks)**
   University examination shall consist of Final Viva–Voce on the best of their training work including:
   - **Building Study Report (30 marks)**
     This includes a building design analysis for a study report which the students are required to do in extra office hours. The study should comprise of multifaceted aspects of any building or a complex in the final stage of construction.
     This shall put under following heads:
     - ➢ Design Concept
     - ➢ Space Usage
     - ➢ Circulation

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- Climate responsiveness
- Façade Treatment & Architectural Expression
- Built in Furniture
- Services
- Construction Techniques
- Materials used etc.
- Conclusions

Format for the Building Study Report should be:

- Size of report – A4, Portrait format
- No. of Pages – 40-60 approx.
- Color of Page - White or light colored
- Mode of Presentation - Hand written or Typed in Times New Roman, Headings – 14, Body Text – 12, line spacing 1.5; margin 4 cm on left and 2.5 cm on the other sides.
- **Prints (30 marks)**

The number of prints to be submitted should be 15 to 20. The prints should cover the important projects done during the training.

NOTE:

1. Each print will be accepted for evaluation only if signed by the trainee in the appropriate column, and duly attested by the employer.
2. Evaluation is to be done through viva voce by external jury comprising of two examiners appointed by the University at college level.

INSTRUCTIONS TO THE PRACTICAL TRAINING COORDINATOR

Based on the above guidelines a detailed program shall be drawn each year by the Practical Training Coordinator, which shall be approved by the HOD before it is implemented. The intention will be to update the program on regular basis, incorporating new details, with focus on making continuous qualitative improvement of the practical training.

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ARCHITECTURAL DESIGN – VII

Subject Code: BARC1-956 **L S T P C**
2 4 0 4 8

UNI. EXAM. DURATION: NO EXAM (VIVA VOCE BY EXTERNAL JURY ON PORTFOLIO)

COURSE PREREQUISITES: The student should have the knowledge of Design fundamentals and spatial organisation.

COURSE OBJECTIVES: To make students aware and understand the complexity and methodology to handle large projects involving urban environment and prevailing building regulations.

EXPECTED OUTCOMES: Student shall be able to understand and appreciate the concept of Planning and other allied services required in the large scale building.

CONTENTS

The design problems will include Public Buildings with diverse activities involving:

- **Urban Design Studio** dealing with issues such as campus planning/designing buildings in Historic context, related to urban development and renewal/design or ecologically sensitive control. This project will be dealt in two parts:
  - (a) Study of an existing urban environment to identify its typical characteristics and problems.
  - (b) Design solution to issues/problems identified above.
- **Campus designing** - University, Professional Institutes, Integrated Campus etc.

- **Capital Complex**-Secretariat, High Court, Assembly.

TEACHING METHODOLOGY

Minimum Two projects should be done by the student. The Projects selected should be based on realistic contexts.

- Library and Proto type Studies
- Site analysis and site planning
- Space planning
- Design development and volumetric studies (model)
- Preliminary design and volumetric study.
- Final design with detailed volumetric study and visual communications (3D Visualizations)

The design submitted shall include complete project drawings, perspective, models and details. Teaching focus will be to promote design concept based on Site, Urban design, Landscaping, Traffic and Transportation, Climate, Energy, Services, Safety and compliance with Building Regulations etc. All buildings should have accessibility to the physically challenged persons

NOTE: External marks shall be awarded through viva- voce conducted by the External Jury appointed by the University of the Work done by the student during the semester.

Special lectures to be conducted on urban morphology and issues of urban renewal, as well as social & economic aspects of housing in urban areas. Concerned specialists to be involved in each of the two studio exercises.

RECOMMENDED TEXT AND REFERNCE BOOKS

1. Ching, Frank Francis D.K., ‘Architecture: Form, Space & Order’, John Wiley, Hoboken, **2007**.
2. V.S. Parmar, ‘Design Fundamentals’, Somaiya Publisher Pvt. Ltd, Mumbai, **1997**.
3. Scott Van Dyke, ‘Form, Line to Design’, Van Nostrand Reinhold, **1990**.
4. R. Scott, ‘Design Fundamentals’, Robart E. Krieger Publishing Company E & OE-Architects Hand Book and Planning.
5. Donald Watson, Michael J. Crosbie, ‘Time Saver Standard’, 8th Edn.
6. Neufert, Ernst; ‘Architect’s Data’, 3rd Edn., Wiley–Blackwell, U.K., **2002**.
7. ‘National Building Code of India’, Bureau of Indian Standards, New Delhi, **2005**.

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RESEARCH METHODS & DISSERTATION WRITING

Subject Code: BARC1-957 **L S T P C**
1 1 0 2 3

COURSE PREREQUISITES: Nil

COURSE OBJECTIVES: To enable the student to analyze and evaluate architectural projects etc. and also understand architectural research with special emphasis on India.

EXPECTED OUTCOMES: The student shall be able to analyze and write reports on architectural projects.

CONTENTS

Unit –I

- **Introduction**: An introduction to architectural evaluation in general and definition, purpose, scope and its applications to Architecture, fine arts literature etc.
- **Techniques:** Techniques of analysis and evaluation employed in buildings, projects competitions etc. methods of appraisal / evaluation of building complexes and exhibitions.

Unit - II

- **Appraisal / evaluation**: Value of appraisal / evaluation reports and reviews in the field of architecture fine-arts, literature, their scope and merits.
- **Report and review writing**: Techniques of report and review writing, their application to architectural publications.

Unit –III

- **Architectural Research**: An introduction to Architectural Research in general and in profession, its purpose and scope. Architectural research in India from earliest time to the present era. Research methods, evaluation of results and its application.

TEACHING METHODOLOGY

Students are expected to complete sufficient number of projects related to this course, with regular critical remarks and assessment from the teacher and peer students, during the semester. Group Discussions between the students must be given due credit.

RECOMMENDED TEXT AND REFERENCE BOOKS

1. Lean Van Schaik, ‘Research in Architecture by Architects’.
2. Eugene Raskin, ‘Architecture and People’.
3. Attoe Wayne, ‘Architecture and Critical Imaginations’.
4. Collin Peters, ‘Architecture Judgement’.

INSTRUCTIONS TO THE PAPER SETTER

1. One compulsory question containing 6 questions of 2 marks (12 marks), each requiring short answers, are to be set from the entire syllabus.
2. The examiner is required to set another six questions (two from each unit), out of which the students are required to attempt any four questions (selecting at least one from each unit).

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URBAN DESIGN

Subject Code: BARC1- 958 **L S T P C**
1 0 0 2 2

COURSE PREREQUISITES: No Prerequisites

COURSE OBJECTIVES: To create awareness and promote understanding of the nature, role and importance of Urban Design in the making of quality Built Environment and Human Settlements

EXPECTED OUTCOMES: Teaching of the subject shall help students to understand the importance and role of Urban Design in the Historical and Modern Context.

CONTENTS

Unit-I

- Introduction, Role, Scope and Importance of **Urban Design**
- Distinction between **Urban Design, Architecture and Town Planning**
- **Elements of Urban Design-** Pattern, Grains, Texture, Density etc, their role and
- importance.
- **Determinants of Urban Form –** Landform, Climate, Symbolism, Activity Pattern,
- Socio-cultural Factors, Materials, Techniques etc. and their role and importance.
- **Imagability -** Elements their role and importance including Paths, Nodes, Landmarks, Edges, Districts etc.
- **Designing Cities-** Role and importance of Communication, Utilities, Landscape
- Features, Transport, Visual Expression, Size, Contrast, Urban Character etc.

Unit- II

- **Shapes of the Cities-** Comparative advantages and Disadvantages

- **Urban Spaces**-Typology including Street, Square, Precinct, Piazza, Mall etc
- **Urban Spaces-** Elements, identification, characteristics and role in shaping the spaces
- Changing Role, Importance and Pattern of **Urban Spaces** in historical perspective-
- **Greek, Romans, Medieval and Contemporary cities.**
- **Design Principles** involving Scale and Enclosures

Unit-III

- **Development Controls-** Role and Importance in Urban Design.
- **Urban Design study of selected Capital Cities-** Chandigarh, Delhi, Jaipur, Raipur & Gandhi Nagar
- **Design Concept of Sustainable & Green City in modern context**
- **Legal and Institutional framework** for Urban Design including Delhi Urban Art
- Commission- Objectives, Constitution, Role, Importance, Impact etc

TEACHING METHODOLOGY

- Emphasis shall be laid on understanding of evolution of Cities and Buildings.
- Continuous evaluation shall be made of student’s work based on various assignments and sketching.
- Teaching in the subject will be a combination of Expert lectures, specific case studies and field visits of historical and contemporary cities.
- Students would be required to do, in groups, a case study of a city to make them understand the various aspects of urban design.
- The study will be illustrated with maps, visuals, photographs and sketches.

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GUIDELINES FOR PAPER SETTER

1. One compulsory question containing 6 questions of 2 marks (12 marks), each requiring short answers, are to be set from the entire syllabus.
2. The examiner is required to set another six questions (two from each unit), out of which the students are required to attempt any four questions (selecting at least one from each unit).

RECOMMENDED BOOKS:

1. Spreiregan Paul D., ‘Urban Design: The Architecture of Towns and Cities’.
2. Gallion Arthur B, ‘The Urban Pattern: City Planning and Design’.
3. S.P. Gupta, ‘The Chandigarh: An Overview’.
4. S.C. Agarwal, ‘Architecture and Town Planning’.
5. ‘Institute of Town Planner (India)’, – Readers Volume.

LANDSCAPE DESIGN

Subject Code: BARC1-963 **L S T P C**
1 0 0 2 2

COURSE PREREQUISITE: Nil

COURSE OBJECTIVES: To enable the student to analyze and understand various landscape design projects, understand the concepts of Ecology, Site-structure relationship, and contemporary Landscape work in India.

EXPECTED OUTCOMES: The student shall be able to understand the process of Landscape Design and its application in Architectural Design solutions.

CONTENTS

Unit –I

- Introduction and historical backdrop of the evolution of landscape design as a process of interface between Man and Nature.
- Introduction to ecology and its importance to Landscape Designers.

- A brief history of gardens world over – and their relevance in their time, context and social needs.
- Advanced knowledge of basic elements of landscape such as earth, rock, water and vegetation, in the context of their environmental aspects and concerns.

Unit II

- Site analysis and site- structure unity.
- Environmental Impact Assessment techniques.
- National environmental policy and Bio-diversity significance in urban areas.
- Basic knowledge of contour/mapping and various methods of documentation of physical features, topography and landscape elements.

Unit –III

- Contemporary landscape design work/projects in India.
- Case studies of varied urban situations with typical different landscape characters in and around Chandigarh region to analyze and assess their present landscape status by applying knowledge and techniques acquired as above.

NOTE:

- Landscape Design proposal based on above-mentioned analysis as a studio exercise.
- Related expert lectures/workshops should be organized.

TEACHING METHODOLOGY

Students are expected to complete sufficient number of projects related to this course, with regular critical remarks and assessment from the teacher and peer students, during the semester. Group Discussions between the students must be given due credit.

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RECOMMENDED REFERENCE AND TEXT BOOKS:

1. Reid Grant W., 'Landscape Graphics'.
2. Littlewood Michael, 'Landscape Detailing'.
3. Harris and Dines, 'Time Saver Standard for Landscape Architecture'- Plants of India.
4. Tony Russel & Catherine Cutler, 'Trees- An Illustrated Identifier and Encyclopedia'.
5. Simonds, 'Landscape Architecture'.
6. Laurie Michael, 'Introduction to Landscape Architecture'.
7. Watts Rajnish/Dhillon Harjit/Chhattar Singh, 'Trees of Chandigarh'.
8. Krishan Pradip, 'Trees of Delhi'.
9. D.K. Bose, S.P. Sharma, B. Chaudhaury, 'Tropical garden plants in colors'.
10. M.S. Randhawa, 'Flowering Trees and Shrubs of India'.
11. M.S. Randhawa, 'Beautifying India'.

INSTRUCTIONS TO THE PAPER SETTER

1. One compulsory question containing 6 questions of 2 marks (12 marks), each requiring short answers, are to be set from the entire syllabus.
2. The examiner is required to set another six questions (two from each unit), out of which the students are required to attempt any four questions (selecting at least one from each unit).

BUILDING MAINTENANCE

Subject Code: BARC1-964 **L S T P C**
2 0 0 0 2

COURSE PREREQUISITES: Nil

COURSE OBJECTIVES: Students should know the role of maintenance in buildings

EXPECTED OUTCOMES: The students shall be able to understand the Role and importance of the building maintenance in built environment.

CONTENTS

Unit-I

- Maintenance- Introduction, Need, Scope, Importance& Role of an Architect.
- Maintenance-Economic and Social significance
- Distress in structures
- Causes of distress, defects and decay
- Role of climatic elements
- Classification of maintenance works

Unit – II

- Various defects in Buildings (Masonry, Load bearing and Framed structure) from foundation to parapet level including services
- Diagnostic Techniques

Unit – III

- Prevention measures/Defects due to poor design and construction
- Treatment methods/Repair materials
- Retrofitting

NOTE: Teaching will be a combination of Case studies and field visits to buildings in deteriorating conditions.

RECOMMENDED TEXT AND REFERENCE BOOKS

1. A.C. Panchdhari, 'Maintenance of buildings', New Age International (P) Limited, Publishers, New Delhi, **2003**.
2. 'Maintenance Manual of CPWD', Director General (Works) CPWD, Nirman Bhawan, New Delhi, **2003.**
3. R. Chudley, 'The Maintenance and Adaptation of Buildings', Longman Technical Services, London, **1981**.
4. W.H. Ransom 'Building Failures: Diagnosis and Avoidance', E. & F.N. Spon, London, **1987**.
5. A.C. Panchdhari, 'Water & Sanitary Installation', New Age International (P) Limited,
6. Publishers, New Delhi, **2005**.
7. Hutchinson, Barton and Ellis, 'Maintenance & Repair of Buildings', Butterworth & Co. (Publishers) Ltd., UK, **1975**.
8. P.S. Gahlot and Sanjay Sharma, 'Building Repair and Maintenance Management'.

INSTRUCTIONS TO THE PAPER SETTER

1. One compulsory question containing 6 questions of 2 marks (12 marks), each requiring short answers, are to be set from the entire syllabus.
2. The examiner is required to set another six questions (two from each unit), out of which the students are required to attempt any four questions (selecting at least one from each unit).

LOW COST BUILDING DESIGN AND CONSTRUCTION

Subject Code: BARC1-965 **L S T P C**
1 0 2 0 3

COURSE PREREQUISITES: Nil

COURSE OBJECTIVES: To make the student aware of the use of conventional and non-conventional resources for low-cost construction

EXPECTED OUTCOMES: The student shall be able to understand the Low Cost Building Techniques in architecture.

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CONTENTS

Unit –I

- An introduction to the building designs adopted in different climatic zones of the country, resulting in varied vernacular expressions.
- Use of cost- effective technologies by using local materials, up gradation of traditional technologies, prefabrication etc**.**

Unit II

- Need for low cost construction in rural and urban sectors
- Innovations of building techniques for low cost construction.
- Analysis of space norms for low cost buildings.

Unit –III

- Study of usage pattern of low cost buildings adopted by the habitants.
- Comparative analysis of building materials and costing**.**
- Achieving Economy through Planning & Design**.**

TEACHING METHODOLOGY

Teaching in this subject shall be a combination of Expert lectures from architects practicing/having experience in designing buildings in hill areas. The students should visit any hill settlement.

RECOMMENDED REFERENCE AND TEXT BOOKS:

1. Timothy J. Waite, 'Cost-Effective Home Building: A Design and Construction Handbook', Nahb Research Center.
2. A.K. Lal, 'Handbook of Low Cost Housing'.
3. Gautam Bhatia, 'Laurie Baker- Life, Works and Writing'.

INSTRUCTIONS TO THE PAPER SETTER

1. One compulsory question containing 6 questions of 2 marks (12 marks), each requiring short answers, are to be set from the entire syllabus.
2. The examiner is required to set another six questions (two from each unit), out of which the students are required to attempt any four questions (selecting at least one from each unit).

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SIKH ARCHITECTURE

Subject Code: BARC1-966 **L S T P C**
1 0 2 0 3

COURSE PREREQUISITES: The student should have the knowledge of terminology and contents of Sikh architecture as studied in the course of History of Architecture-III.

COURSE OBJECTIVES:

- To understand the development of Sikh Architecture in Historical, Religious, social and environmental context
- To understand the secular buildings related to Sikh rulers such as Forts, palaces, institutions and their landscape elements

EXPECTED OUTCOMES: The student shall be able to understand the development of Sikh architecture in the form of Gurdwaras, Forts and Palaces in various regions of Punjab.

CONTENTS

Unit –I

- Evolution of Sacred Sikh Architecture – Salient features of a Gurdwara
- Varieties of Arches, Domes, Capitals and other building elements
- Building examples: Golden Temple, Amritsar, 5 Takhts of Sikhism and other historical Gurdwaras of India

Unit –II

- Forts, Palaces, Institutions and Landscape elements developed under Sikh rulers in prominent cities like Amritsar, Patiala, Nabha, Kapurthala, Gobindgarh, Anandpur Sahib

Unit –III

- Contemporary examples of Sikh Gurdwaras built in late 20th and 21st Century
- Study of design of Khalsa Heritage Memorial complex at Anandpur Sahib

TEACHING METHODOLOGY

Teaching in this subject should be a combination of Lectures and visits to few prominent Historical Gurdwaras, Forts and palaces of the region.

RECOMMENDED REFERENCE AND TEXT BOOKS:

1. Arshi, Pardeep Singh, ‘Sikh Architecture in the Punjab’, Intellectual Pub. House, **1986**.
2. Mehar Singh, ‘Sikh Shrines in India’, Publications Division, Government of India, New Delhi, **1974.**
3. Madanjit Kaur, ‘The Golden Temple: Past and Present, Amritsar’, **1983.**
4. Brown, Percy, ‘Indian Architecture (Islamic Period)’, 5th Edn., Bombay, **1965**.
5. V.N. Datta, ‘Amritsar: Past and Present. Amritsar’, **1967.**
6. Edwardes, Michael, ‘Indian Temples and Palaces’, London,**1969.**
7. Darshan Singh, ‘The Sikh Art and Architecture’, Department of Guru Nanak Sikh Studies, Panjab University, **1987**.
8. W.G. Archer, ‘Paintings of the Sikhs’, London, **1966.**
9. Kanwarjit Singh Kang, ‘Mural Paintings in the Nineteenth Century, Punjab’, Ph.D. Thesis, Panjab University, Chandigarh, **1978.**

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INSTRUCTIONS TO THE PAPER SETTER

1. One compulsory question containing 6 questions of 2 marks (12 marks), each requiring short answers, are to be set from the entire syllabus.
2. The examiner is required to set another six questions (two from each unit), out of which the students are required to attempt any four questions (selecting at least one from each unit).

ARCHITECTURE MODEL MAKING

Subject Code: BARC1- 967 **L S T P C**
1 0 2 0 3

UNI. EXAM. DURATION : NO EXAM (VIVA VOCE BY EXTERNAL EXAMINER)

COURSE PRE REQUISITES: The student should have studied Model Making-I (BARCI-108).

COURSE OBJECTIVES: The teaching of this subject shall help the students to learn different materials used in models.

COURSE OUTCOMES: The student shall be able to prepare models of Architectural projects and develop their own preferred technique for the same.

CONTENTS

Unit –I

Study and practice of various methods and materials used in the preparation of models for the following purposes:

a) Quick study models for developing a design idea.
b) Block models for study and development of site plans and layouts.
c) Presentation models of single building or group of buildings.

Unit-II

a) Detailed models showing various features of architectural design such as doors, windows, projections, structures etc.

b) Detailed models of buildings, with removable roof-tops, showing interior layout, furniture, fittings etc.

Unit-III

a) Detailed models of site plans showing:

- roads
- contours
- landscape elements
- lamp-posts
- human figures etc

TEACHING METHODOLGY

- Students should be shown the work and techniques of professional model makers through slides as well as site visits.
- Models should be made of existing buildings/complexes as well as design projects. More emphasis should be laid on the demonstration and practice of various skills/methods/techniques/systems rather their theoretical aspect.

NOTE: Evaluation shall be done through viva- voce conducted by the External Examiner appointed by the University of the Work done by the student during the semester.

RECOMMENDED TEXT AND REFERENCE BOOKS

1. 'Architectural Model Making', Nick Dum Laurence King Publishing, **2010.**
2. Megan Werner, 'Model Making', Princeton Architectural Press, **2011.**

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VERNACULAR ARCHITECTURE

Subject Code: BARC1- 968 **L S T P C**
1 0 2 0 3

COURSE PRE REQUISITES: Students should have the knowledge of elements of vernacular/rural architecture of state of Punjab, Himachal Pradesh, Jammu &Kashmir, Rajasthan with respect to climatic conditions.

COURSE OBJECTIVES: To understand the importance of the instinctive attitude of vernacular design and embody the sustainable and creative aspect in contemporary design.

EXPECTED OUTCOMES:

- The student shall be able to understand basic vernacular settlement development as per the contents of syllabus.
- Students shall be able to acquaint themselves with the various vernacular settlements in different parts of India as well as abroad.

CONTENTS

Unit- I

- **Vernacular Architecture**- Meaning, Role, Importance & basic Theories.
- **Determinants of Vernacular Architecture**- Role and importance of social, cultural, political, economic, climatic, technological factors**.**

Unit- II

- **Vernacular Architecture in the Plains of Northern India:** Building typologies, construction materials and techniques, architectural elements and art forms, functional and aesthetic aspects of vernacular dwellings and the settlement pattern in the plains of Punjab and Rajasthan.

- **Vernacular Architecture in the Hills of Northern India:** Building typologies, construction materials and techniques, architectural elements and art forms, functional and aesthetic aspects of vernacular dwellings and the settlement pattern in the Hills of Northern India.

Unit- III

- Relevance and interpretation of vernacular architecture in today's context. Approach and works of architects Laurie Baker, Hassan Fathy.
- Settlement pattern, building material/ technology and socio–economic structure in a village of Punjab, Study and analysis of spatial organization, building material/technology, public places, housing, aesthetics of a village in Punjab.
- **Illustrated Case studies** - Vernacular settlements/Building typology from various regions in India and abroad.

RECOMMENDED REFERENCE AND TEXT BOOKS:

1. Langenbach, Randolph & Yang, Minja, 'Don't Tear It Down! Preserving the Earthquake Resistant Vernacular Architecture of Kashmir', Oinfroin Media, **2009**.
2. Schoenauer, Norbert, '6000 Thousand Years of Housing', W.W. Norton, New York, **2000**.
3. Thomas Carter, Elizabeth Collins Cromle, 'Invitation to Vernacular Architecture: A Guide to the Study of Ordinary Buildings and Landscapes', University of Tennessee Press, **2005**.
4. Oliver, Paul, 'Dwellings: The Vernacular House World Wide', Phaidon Press, **2003**.
5. Sanjay Udamale, 'Architecture for Kutch', English Edition, Mumbai, **2003**.
6. L. Asquith, Lindsay Asquith (Editor), Marcel Vellinga (Editor), 'Vernacular Architecture in the 21st Century: Theory, Education and Practice', Taylor & Francis Group, UK, **2006**.
7. Oliver, Paul, 'Built to Needs', Architectural Press, **2006**.
8. Kulbushan Jain & Meenakshi Jain, 'Architecture of the Indian Desert', Aadi Centre, Ahmedabad, **2000**.
9. Oliver, Paul, 'Encyclopedia of Vernacular Architecture of the World', Cambridge University Press, **1997**.
10. Pramar, V.S. Haveli, 'Wooden Houses & Mansions of Gujarat', Mapin Publishing Pvt. Ltd., Ahmedabad, **1989**.
11. G.H.R. Tillotsum, 'The Tradition of Indian Architecture - Continuity & Controversy – Change since 1850', Oxford University Press.
12. Kagal, Carmen, 'Vistara – The Architecture of India', The Festival of India, **1986**.
13. Rappoport, Amos, 'House, Form & Culture', Prentice Hall Inc, University of Michigan, **1989.**
14. James Steele, 'Fathy- Architectural Monographs', St. Martin's Press, **1988**.
15. Gautam Bhatia, Laurie Baker, 'Life, Work, Writings, New Delhi, India', Penguin Books, **1994**, ISBN 0-14-015460-4.

INSTRUCTIONS TO THE PAPER SETTER

1. One compulsory question containing 6 questions of 2 marks (12 marks), each requiring short answers, are to be set from the entire syllabus
2. The examiner is required to set another six questions (two from each unit), out of which the students are required to attempt any four questions (selecting at least one from each unit).

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ARCHITECTURAL DESIGN -IX (THESIS PROJECT)

Subject Code: BARC1- X59 **L S T P C**
10 0 0 10 15

Uni. Exam. Duration: NO EXAM (Viva Voce by External Jury)
COURSE PREREQUISITES: Students should have knowledge about design development and other intricacies of complete project
COURSE OBJECTIVES: To make student synthesis and use knowledge of various disciplines gained during entire study in an architectural project of his choice.
EXPECTED OUTCOMES: Students should be able to handle projects of any scale independently.

CONTENTS

Thesis project will comprise of the following:

- An Illustrated Report-which will include the validity and scope of the chosen project, methodology, prototype studies, site analysis, client's and architect's briefs, delineation of programme and design criteria.
- A fully worked-out Design Proposal-including consideration of site planning, structure, services, and any other aspect/specific to the project.

A. Stages of Work:

1. **Approval of Project:**
   - The intent of the thesis project as well as the criteria for selection of the project will be introduced to the students around the 10th week of the previous semester, i.e. 9th Semester B.Arch.
   - Before the closing of the 9th Semester, students will be required to submit brief write-up on three projects out of which one will be approved.
2. **Rough Report** comprising of all analytical aspects of the project including Synopsis, Library studies, Prototype studies, Site analysis, Delineation of Building Program, etc.
3. **Evolution of Design:** Shall be worked out in minimum of four stages. Viva Voce shall be conducted by the external examiners for each stage.
4. **Final Report** including Evolution of Design, Final Report, Drawings and Model, to be evaluated by jury comprising of H.O.D, Thesis Co-ordinator, External examiners (min. two) and Thesis Guide through a University Examination.

NOTE:

- Students will be required to submit two identical copies of the final report along with a soft copy, on a standard format prescribed in the thesis programme issued by the Thesis Coordinator.
- The report must also include A-3 size copies of all final drawings and at least two photographs of the final model/models.
- The original copy of the report, the final drawings and models will be returned to the student after the declaration of the result. The photocopy along with the soft copy of the report and drawings will be retained for reference in the college library.

B. SCHEDULE OF SUBMISSIONS/EXAMIATION

(Note: Commencement of the semester is considered as 0 week)

Stages of Work			Time allocated
1.	Sessional Work		
(a)	Rough Report		
	i)	Introduction& topic finalization	1 week
	ii)	Synopsis	2 weeks

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	iii)	Preliminary Library studies	2 weeks
	iv)	Site analysis, Prototypes additional library studies	2 weeks

(b)	Evolution of Design		
	i)	Design Criteria and Concept	2 weeks
	ii)	Design Proposal Stage-I	2 weeks
	iii)	Design Proposal Stage-2 (incorporating structures & services)	2 weeks
	iv)	Pre-final Design	2 weeks
(c)	Draft Final report (Incorporating improvements suggested in Rough Report, Design Criteria and explanatory sketches of Evolution of Design).		1 week
2.	External Examination		4 weeks

NOTE:

- Students are required to submit the Final Report, all final drawings and model/s in the standard format prescribed in the Thesis Programme.
- Submission will be made one day before the date of examination.

D. Teaching and Evaluation System:

1. The thesis studio will be conducted under the overall coordination of the Thesis Coordinator. Each student will be assigned a Thesis Guide (from amongst the faculty) who will supervise the progress of the student's work on a regular basis.
2. The H.O.D, the Thesis Coordinator and the concerned Thesis Guide will do approval of the thesis project/topic.
3.
   i. All stages of sessional work will be evaluated jointly by the H.O.D., External examiner/s, Thesis Coordinator and the concerned Thesis Guide.
   ii. Jury for the External Examination will comprise the H.O.D, Thesis Coordinator, the concerned Thesis Guide and two External Examiners appointed by the University.
   iii. Marks awarded at each stage will be based on the average of those awarded by all jury members. The decision of the H.O.D. will be final in case of dispute/discrepancy.
   iv. Students will be required to attend weekly reviews for their sessional and attendance.
   v. In view of the practical and creative nature of the thesis projects, the presence of the candidate at the viva voce examinations at all the prescribed stages shall be mandatory. If candidate fails to appear in the viva voce examination at any stage, the thesis project submitted by him/her shall not be accepted.
   vi. Candidate who fails to clear the thesis examination either in the periodic assessment or in the final examination can only be allowed to reappear with the regular batch of thesis students in the next academic year.

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ENERGY EFFICIENT BUILDINGS AND BUILDING AUTOMATION

Subject Code: BARC1-X69 **L S T P C**
1 0 2 0 3

COURSE PREREQUISITES: Nil

COURSE OBJECTIVES:

- After successful completion of this course, student should be able to understand global issues related to the use and consumption of fossil fuel energy and applications of renewable and nonrenewable energy resources, provide efficient lighting systems, design passive architecture and evaluate overall performance improvement of buildings.

- Understand Building automation and the issues related to the control system in a building.

EXPECTED OUTCOMES: The student shall be able to comprehend issues and concerns related to Energy efficient building design and its automation.

CONTENTS

Unit –I

- **Energy Sources**: Introduction to renewable & non- renewable energy sources
- **Global Scenario**: Global availability of renewable & non- renewable energy sources
- **Energy Consumption in various building typologies**: Analysis of energy consumption in terms of energy load through heating/ cooling/ventilation/ lighting & other loads

Unit-II

- **Energy efficient measures:** Study of different energy-efficient principles of a building and their various application techniques in different climatic zones prevailing in India including solar active and passive features.

Unit –III

- Introduction to Building automation in general and understanding the issues related to the control system in a building.
- Basic concept of computerized control systems, network designed to monitor and control various systems for lighting, ventilation, alarms & security, communication, etc.
- Issues related to illumination and lighting. Systems to allow / control Natural light. Aperture/openings and shading devices control systems based on automated systems.
- Issues related to ventilation air handling with automated systems of control of apertures and artificial ventilation-air conditioning.
- Issues related to systems of communication (mechanical systems),

NOTE: The students have to take individual or group design projects dealing with at least one or more than one of the above studied technique/s.

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RECOMMENDED REFERENCE AND TEXT BOOKS:

1. Seymour Jarmal, ‘The Architects Guide to Energy Conservation’.
2. R.G. Stein, ‘Architecture and Energy’.
3. David Anink, Chiel Boonstra, John Mak, ‘Handbook of Sustainable Building’.
4. Peter F. Smith, ‘Eco- refurbishment’.
5. Arvind Krishan, Simos Yanas, Nick Baker, S.V. Szokolay, ‘Climate Responsive Architecture: A Design Handbook for Energy Efficient Buildings’, Edn., Tata McGraw Hill, **2001**
6. Roy McAlister, ‘The Solar Hydrogen Civilization’, American Hydrogen Association, **2003.**
7. Reinhold A. Carlson, Robert A. Di Giandomenico, ‘Understanding Building Automation Systems (Direct Digital Control, Energy Management, Life Safety, Security, Access Control, Lighting, Building Management Programs)’.
8. ‘Building Automation: Control Devices and Applications’, In Partnership with NJATC, **2008.**
9. ‘Building Control Systems, Applications Guide (CIBSE Guide)’, The CIBSE, **2000.**
10. McGowan, McGowan, J. John, ‘Building Automation Online’.
11. John E. Traister, ‘Security/Fire Alarm Systems: Design, Installation, and Maintenance’. **1995.**

INSTRUCTIONS TO THE PAPER SETTER

1. One compulsory question containing 6 questions of 2 marks (12 marks), each requiring short answers, are to be set from the entire syllabus.

2. The examiner is required to set another six questions (two from each unit), out of which the students are required to attempt any four questions (selecting at least one from each unit).

BUILDING ECONOMICS

Subject Code: BARC1-X70 **L S T P C** **Duration: 24 Weeks**
2 0 2 0 4

COURSE PREREQUISITES: Students to have knowledge and understanding of the building anatomy and its context in Architecture

COURSE OBJECTIVES: To make students understand and appreciate the role and importance of economy in the built environment

EXPECTED OUTCOMES: Students to have skill and capability to design cost effective buildings

Unit-I

- Building Economics-Introduction, Definition, Role, Scope, Importance and Principles
- Cost of Building- Components and their impact on Cost
- Cost of Building- Typologies including Life Cycle Cost, Construction Cost, Maintenance
- Cost Management- Aims, Objectives, Need, Principles, Procedure, Cost Analysis.

Unit-II

- Cost Reduction -Using Site Planning and Architectural Design
- Cost Reduction –Using Specification, Space optimization and Structural Innovations
- Space Norms- Role, importance, Principles involved in defining Space Norms with special reference to National Building Code.
- Cost Analysis- Low Rise and High Rise Buildings

Unit-III

- Technology – Role, Importance, Use in making buildings cost- effective
- Building Technologies – Typologies including Modular construction, Pre- Engineered Buildings etc. their merits and demerits
- Mass Production and Standardization- Need, Principles, Role and Importance in promoting cost effectiveness
- Materials- Role, Importance, Analysis, Innovation/ up-gradation in making buildings cost- effective
- Construction Techniques- Principles involved, Impact on building cost with specific reference to few innovative techniques with comparative merits and Demerits

RECOMMENDED TEXT AND REFERENCE BOOKS

1. TERI, 'Sustainable Buildings- Design Manual', Vol- I & II.
2. National Building Code, **2005.**
3. A.K. Lal 'Hand book of Low Cost of Housing', New Age Publishers.
4. 'Readers Volume on Housing' – Institute of Town Planners, India.
5. 'Report of Govt. of India on Housing Shortage'.
6. Journal of IIA, **2013.**

INSTRUCTIONS TO THE PAPER SETTER

1. One compulsory question containing 6 questions of 2 marks (12 marks), each requiring short answers, are to be set from the entire syllabus.
2. The examiner is required to set another six questions (two from each unit), out of which the students are required to attempt any four questions (selecting at least one from each unit).

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ARCHITECTURAL JOURNALISM

Subject Code: BARC1- X71 **L S T P C**
1 0 2 0 2

COURSE PREREQUISITES: No Prerequisites.

COURSE OBJECTIVES:

- To develop the skill of students who have an inclination towards writing
- To enable the students to record, report, analyze and Evaluate architecture in its Theoretical and Practical form.

EXPECTED OUTCOMES: Teaching of the subject shall help students to Record, Report, Analyse and Evaluate an architectural project.

CONTENTS

Unit-I

- Introduction of Journalism in general
- Theories of journalism, Techniques and processes
- Contemporary Architectural journalism, Digital Journalism, Architecture, Arts and Journalism / Media

Unit- II

- Phrasing and summarizing a given report
- Editing given material
- Writing original reports on design projects
- Writing Editorials for Magazines and Journals

Unit-III

- Reporting activities like seminars, Panel discussions, Conferences etc.
- Thesis or Research Report writing
- Writing Captions for Pictures, Programmes and Events
- Organizing material for publication in Newspapers, magazines etc.

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TEACHING METHODOLOGY

- The students should be exposed to the work of professional Art and Architecture critics/journalists.
- Various forms of architectural journalism should be studied from Architecture Magazines.
- Report writing should be presented to a panel to be chaired by the teacher for Discussion, criticism and consequential changes.

RECOMMENDED BOOKS:

1. Joseph Wilkes, ‘Encyclopedia of Architecture, Design, Engineering & Construction’, John Wiley & Sons, New York, **1988**.
2. ‘Architectural Press, U.S.,’ vol.1.
3. ‘Criticism, Architectural’, vol. 2.
4. ‘The Architecture Critic; A Survey of Newspaper Architecture Critics in America. New York’, Columbia University, **2001**.
5. Bender, Thomas, ‘Architecture and the Journalism of Ideas’.
6. Morrone, Francis, ‘Do Architecture Critics Matter?’.
7. Ockman, Joan, ‘Current Criticism’, The Architect's Newspaper issue 19.
8. Majd Musa, ‘Architectural Criticism and Journalism’, **2007**.

INSTRUCTIONS TO THE PAPER SETTER

1. One compulsory question containing 6 questions of 2 marks (12 marks), each requiring short answers, are to be set from the entire syllabus.

2. The examiner is required to set another six questions (two from each unit), out of which the students are required to attempt any four questions (selecting at least one from each unit).

HILL ARCHITECTURE

Subject Code: BARC1-X72 **L S T P C**
1 0 2 0 3

COURSE PREREQUISITES: Nil

COURSE OBJECTIVES: The objective of this course is to impart a comprehensive knowledge of historical aspects and present day concerns related to Hill Architecture.

EXPECTED OUTCOMES: The student shall be able to comprehend issues and concerns related to hill architecture.

CONTENTS

Unit –I

- Historical perspective of hill architecture and its unique attributes and concerns.
- Major hill settlements in various regions of the world.
- A broad view of traditional hill architecture of medieval European settlements and other places.

Unit -II

- Traditional hill settlements of India.
- An overview of vernacular hill architecture of Himachal Pradesh.
- Building types, techniques and materials of vernacular architecture of Himachal Pradesh.
- Lessons from vernacular architecture and their time tested indigenous technology.

Unit –III

- Modern buildings on the hills in India.
- Constraints of climate, topography and availability of materials.
- Design factors such as access, circulation and gradients.
- Structural aspects of modern buildings and necessary safeguards.
- Environmental and ecological concerns and safeguards.

TEACHING METHODOLOGY

Teaching in this subject shall be a combination of Expert lectures from architects practicing/having experience in designing buildings in hill areas. The students should visit any hill settlement.

RECOMMENDED REFERENCE AND TEXT BOOKS:

1. Oliver, Paul, ‘Built to Needs’, Architectural Press, **2006.**
2. Oliver, Paul, ‘Encyclopedia of Vernacular Architecture of the World’, Cambridge University Press, **1997**.
3. Oliver, Paul, ‘Dwellings: The Vernacular House World Wide’, Phaidon Press, **2003**.
4. Jay Thakkar, ‘Matra: Ways of measuring built form of Himachal Pardesh’, CEPT University.

INSTRUCTIONS TO THE PAPER SETTER

1. One compulsory question containing 6 questions of 2 marks (12 marks), each requiring short answers, are to be set from the entire syllabus.
2. The examiner is required to set another six questions (two from each unit), out of which the students are required to attempt any four questions (selecting at least one from each unit).

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SUSTAINABLE ARCHITECTURE

Subject Code: BARC1-X73 **L S T P C**
1 0 2 0 3

COURSE PREREQUISITES: Nil
COURSE OBJECTIVES: The course would focus on Sustainable Issues, Concept & design Strategies to be followed.
EXPECTED OUTCOMES: To make the students understand about Principles and Concepts of Sustainable Architecture for the built environment.

CONTENTS

Unit – I

INTRODUCTION

1. Sustainable Development - Introduction, definitions, objectives and scope
2. Man & Environment - Introduction, issues and options
3. Human settlements - Planning, Growth, Development, Problems
4. Global warming - Introduction, Causes, Effects and Remedies, Carbon Credits.
5. Sustainable Design - Concept, Objectives, Principles, Approach to Sustainable Design
6. Architect - Role in Sustainable Development.

Unit – II

ISSUES IN SUSTAINABLE DEVELOPMENT

- Energy - Role, Importance in buildings
- Sources of Energy- Non- renewable and renewable – Role and Importance
- Site (Topography / Air – Condition / Surrounding)
- Sustainable Materials – Production and use
- Quality of indoor/outdoor environment

Unit – III

Concept & Design strategies in Sustainable Development

- Built Environment- Sustainable Construction, Ecological Buildings, Green Building
- Building Rating System
- ECBC Code
- Sustainability Assessment - LEED, Life Cycle Assessment, GRIHA
- Climate responsive and Solar Passive Strategies in Indian Climates
- Recycling/Reuse
- India's approach to sustainable Development.

RECOMMENDED TEXT AND REFERENCE BOOKS

1. Koensberger, Ingersoll, Mayhew, Szokolay, 'Manual of Tropical Housing & Building, **1974.**
2. C.P. Kukreja,'Tropical Architecture', Tata McGraw-Hill Publishing Company, **1978**.
3. Martin Evans, 'Housing, Climate & Comfort', Architectural Press, **1980**.
4. Georg Lippsmeier, 'Building in the Tropics', Callwey Verlag, Munchen, **1980**.
5. Gideon S. Golany, 'Design for Arid Regions', Van Nostrand Reinhold, New York, **1983.**
6. B. Givoni, 'Man, Climate & Architecture', Von Nostrand Reinhold Company, New York, **1981**.
7. 'Reserch Notes on Climate', C.B.R.I, Roorkee.
8. Krishan A, Baker, 'Climate Responsive Architecture', McGraw-Hill Education (Asia) Co. and China Architecture & Building Press, **2004/2005.**
9. 'Energy Efficient Buildings in India', TERI.

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INSTRUCTIONS TO THE PAPER SETTER

1. One compulsory question is containing 6 questions of 2 marks (12 marks), each requiring short answers are to be set from the entire syllabus.
2. The examiner is required to set another six questions (two from each UNIT), out of which the students are required to attempt any four questions (selecting at least one from each UNIT).

ARCHITECTURAL CONSERVATION

Subject Code: BARC1-X74 **L S T P C**
1 0 2 0 3

COURSE PREREQUISITES: The student should have studied vernacular Architecture and history of Architecture.

COURSE OBJECTIVES: To promote understanding and importance of the Historical buildings and their Preservation and conservation.

EXPECTED OUTCOMES: Student shall be able to understand the principle, objective, role of conservation and prepare the methodology to execute the conservation work.

CONTENTS

Unit-I

- Heritage- Introduction, Definition, Role, Importance, Scope and Limitations
- Study of basic historical styles in Indian Architecture.
- Study of ornamentation and detailing in historical buildings in various styles.
- Study of construction methods and structural analysis of various historical building styles e.g. Arches Domes, Vaults and Shikharas etc.

Unit-II

- Study of finishes in historical buildings.
- Effects of weathering/ pollution on historical buildings.
- Study of landscaping style/ Plantation around historical buildings.
- Knowledge of plantation/ water features in Mughal Garden and Hindu Temples.

Unit-III

- Methods of studying and documenting historical monuments in the context of guidelines issued by UNESCO, INTACH.
- Methods of saving monuments from vandalism.
- Institutional framework to protect Heritage
- **Role of Historic Building/Area/City in Present Context:**

Understanding Historic City/complex by doing a study of its Heritage Components, various aspects for spatial Planning, the role of conservation and relevance of historic buildings/areas in present context.

TEACHING METHODOLOGY

- Emphasis shall be laid on understanding of Architectural Conservation. Continuous evaluation shall be made of student’s work based on various assignments and sketching.
- Teaching in the subject will be a combination of Expert lectures, specific case studies and field visits of historical and contemporary buildings/complexes.
- Students would be required to do, in groups, a case study of a historical building to make them understand the various aspects of Architectural Conservation. The study will be illustrated with maps, visuals, photographs and sketches.

RECOMMENDED REFERENCE BOOKS:

1. Oliver Paul, ‘Encyclopaedia of Vernacular Architecture of world’.

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2. Jay Thakkar, ‘Matra: Ways of measuring Built form of Himachal Pradesh’, CEPT University.
3. Bernard M. Feilden, ‘Conservation of Historic Buildings’, 3rd Edn., Architectural Press, **2003**.
4. Latham, Derek, ‘Creative Re-use of Buildings’, Donhead, **2007.**
5. A.G.K. Menon & B.K. Thapar, ‘Historic Towns and Heritage Zones’, INTACH.
6. ‘International Charters for Conservation and Restoration’, ICOMOS.
7. Yogeshwar K. Parajuli, ‘Bhaktapur Development Project – Experience in Preservation and Restoration in a Medieval Town’, **1974-85**.
8. Divay Gupta, ‘Identification and Documentation of Built Heritage in India’, INTACH, **2007**.
9. Petruccioli, Attilio, ‘After Amnesia – Learning from The Islamic Mediterranean Urban Fabric’, ICAR, **2009**.

INSTRUCTIONS TO THE PAPER SETTER

1. One compulsory question containing 6 questions of 2 marks (12 marks), each requiring short answers, are to be set from the entire syllabus
2. The examiner is required to set another six questions (two from each unit), out of which the students are required to attempt any four questions (selecting at least one from each unit).

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B.Tech. Textile Engineering
SEMESTER-3RD

Total Contact Hours = 23 **Total Marks =900** **Total Credits = 21**

Subject Code	Subject	Periods			Credits	Ext.	Int.	Total
		L	T	P				
BTEX1-301	Fundamentals of Textile Machines and Processes	3	0	0	3	60	40	100
BTEX1-302	Textile Fiber – I	3	1	0	4	60	40	100
BTEX1-303	Fabric Manufacturing – I	3	1	0	4	60	40	100
BTEX1-304	Yarn Manufacturing – I	3	1	0	4	60	40	100
BSOS0-F91	Soft Skills-I	0	0	2	1	40	60	100
BTEX1-305	Lab –I Textile Fiber –I	0	0	2	1	40	60	100
BTEX1-306	Lab –II Fabric Manufacturing – I	0	0	2	1	40	60	100
BTEX1-307	Lab –III Yarn Manufacturing – I	0	0	2	1	40	60	100
BTEX1-300	Workshop Training	0	0	0	2	40	60	100
Total	**Theory = 4 Lab = 03**	**12**	**3**	**08**	**21**	**400**	**400**	**900**

SEMESTER - 4TH

Total Contact Hours = 24 **Total Marks =700** **Total Credits = 20**

Subject Code	Subject	Periods			Credits	Ext.	Int.	Total
		L	T	P				
BTEX1-408	Textile Fiber –II	3	1	0	4	60	40	100
BTEX1-409	Yarn Manufacturing – II	3	1	0	4	60	40	100
BTEX1-410	Fabric Manufacturing –II	3	1	0	4	60	40	100
BTEX1-411	Textile Chemical Processing –I	3	1	0	4	60	40	100
BSOS0-F92	Soft Skills-II	0	0	2	1	40	60	100
BTEX1-412	Lab –IV Yarn Manufacturing-II	0	0	2	1	40	60	100
BTEX1-413	Lab – V Fabric Manufacturing-II	0	0	2	1	40	60	100
BTEX1-414	Lab –VI Textile Chemical Processing – I	0	0	2	1	40	60	100
Total	**Theory 04 Lab 03**	**12**	**04**	**08**	**20**	**400**	**400**	**800**

SEMESTER-5th

Total Contact Hours = 27 **Total Marks =1000** **Total Credits = 26**

Subject Code	Subject	Periods			Credits	Ext.	Int.	Total
		L	T	P				
BTEX1-515	Properties of Fiber	3	1	0	4	60	40	100
BTEX1-516	Quality management in Textile Industry	3	1	0	4	60	40	100
BTEX1-517	Fabric Structure Analysis	3	0	0	3	60	40	100
BTEX1-518	Textile Testing-I	3	1	0	4	60	40	100
BTEX1-519	Textile Chemical Processing –II	3	1	0	4	60	40	100
BSOS0-F93	Soft Skills-III	0	0	2	1	40	60	100
BTEX1-520	Lab –VII Textile Testing-I	0	0	2	1	40	60	100
BTEX1-521	Lab – VIII Textile Chemical Processing –II	0	0	2	1	40	60	100
BTEX1-522	Lab –IX Fabric Structure Analysis	0	0	2	1	40	60	100
BTEX1-523	Training-II				3	40	60	100
Total	**Theory 05 Lab 03**	**15**	**4**	**8**	**26**	**500**	**500**	**1000**

SEMESTER-6th

Total Contact Hours = 26 **Total Marks =800** **Total Credits = 23**

Subject Code	Subject	Periods			Credits	Ext	Int	Total
		L	T	P				
BTEX1-624	Theory of Textile Structure	3	1	0	4	60	40	100
BTEX1-625	Process Control in Textiles	3	1	0	4	60	40	100
BTEX1-626	Knitting Technology	3	1	0	4	60	40	100
BTEX1-627	Textile Testing-II	3	1	0	4	60	40	100
BSOS0-F94	Soft Skills-IV	0	0	2	1	40	60	100
BTEX1-628	Lab –X Knitting Technology	0	0	2	1	40	60	100
BTEX1-629	Lab –XI Textile Testing-II	0	0	2	1	40	60	100
Departmental Elective – I (Select any one)		3	1	0	4	60	40	100
BTEX1-656	Nonconventional Yarn Manufacture							
BTEX1-657	Advanced Fabric Structure							
BTEX1-658	Process Control in Chemical Processing							
Total	**Theory 05 Lab 02**	**15**	**05**	**06**	**23**	**420**	**380**	**800**

SEMESTER 7TH

Total Contact Hours = 23 **Total Marks =600** **Total Credits = 22**

Subject Code	Subject	Periods			Credits	Ext	Int.	Total
		L	T	P				
BTEX1-730	Kinematics of Textile Machines	3	1	0	4	60	40	100
Departmental Elective – II (Select any one)		3	1	0	4	60	40	100
BTEX1-759	Nonwoven Technology							
BTEX1-760	Texturing Technology							
Departmental Elective – III (Select any one)		3	1	0	4	60	40	100
BTEX1-761	Garment Manufacturing Technology							
BTEX1-762	Marketing & Financial Management in Textiles							
Departmental Elective – IV (Select any one)		3	1	0	4	60	40	100
BTEX1-763	Post Spinning Operation							
BTEX1-764	Waste Management and Pollution Control in Textile Industry							
Open Elective	--------------------------------	3	0	0	3	60	40	100
BTEX1-731	Training-III	0	0	0	3	40	60	100
Total	**Theory 04 Lab 0**	**15**	**04**	**00**	**22**	**340**	**260**	**600**

SEMSETER- 8TH

Total Contact Hours = 22 **Total Marks =500** **Total Credits = 18**

Subject Code	Subject	Periods			Credits	Ext.	Int.	Total
		L	T	P				
BTEX1-832	Mechanics of Textile Process	3	1	0	4	60	40	100
BTEX1-833	Mill Planning & Management	3	1	0	4	60	40	100
Departmental Elective – V (Select any one)		3	1	0	4	60	40	100
BTEX1-865	Technical Textiles							
BTEX1-866	High Performance & Specialty Fibers							
Departmental Elective – VI (Select any one)		3	1	0	4	60	40	100
BTEX1-867	Multi Fibre Process							
BTEX1-868	Nonconventional Fabric Manufacture							
BTEX1-834	Project	0	0	6	2	40	60	100
Total	**Theory 04 Lab 0 P01**	**12**	**4**	**6**	**18**	**280**	**220**	**500**

Total Credits = 25 + 25 + 21 + 20 + 26 + 23 + 22 + 18 = 180

FUNDAMENTALS OF TEXTILE MACHINE AND PROCESSES

Subject Code: BTEX1-301	**LT P C** **3 1 0 4**	**Duration: 40 Hours**

UNIT– I (15 Hours)

Basic characteristics of textile materials; Classification of fibres. Basic requirements of fibre forming polymers. Elementary idea of polymerization. Concept of dimensional characteristics of textiles; (eg. Fiber and Yarn Numbering systems, fabric thickness etc.) Applications of textiles in diversified fields; Variations in textile structure and properties based on applications.

UNIT – II (12 Hours)

Role of different structure and material constituents for fulfillment of target requirements; Different machine sequences for processing textile materials differing in structure Introduction to the language of textile and process flow of fibers up to finished product.

UNIT – III (8 Hours)

Elementary idea about the objectives and working of each machine used in yarn manufacturing. Woven knitted and nonwoven fabric production. Basic idea of nonconventional spinning & weaving machineries.

UNIT – IV (5 Hours)

Elementary idea of desizing, scouring, bleaching, dyeing, printing & finishing processes. Different end uses of finished products.

Recommended Books:

1. V.A. Senhai, 'Textile Fibre', vol-1, Sevak Publishers, Bombay, **1995.**
2. W. Klein, 'Manual of Textile Technology' Textile Institute, Manchester, **1995.**
3. T.K. Pattabhiram, 'Essential Elements of Textile Calculations' 2nd Edn., Textile Trade Press, Ahmedabad.
4. E.P.G. Gohl & Vilensky L.D., 'Textile Science', 1st Indian Edn., CBS Publishers, **1987.**
5. Rose Sinclair, 'Textiles and Fashion: Materials, Design and Technology', Woodhead Publishing Series in Textile, No. 126.
6. W.E. Morton and J.W.S. Hearle, 'Physical Properties of Textile Fibres', Woodhead Publishing Series in Textiles No. 68, 2008, UK.

TEXTILE FIBRE –I

Subject Code : BTEX1-302	**LT P C** **3 1 0 4**	**Duration : 40 Hours**

UNIT -I (5 Hours)

Introduction: Fibre, Textile fibre, Staple fibre, Filament fibre, Natural fibres, Manmade fibres, regenerated and Synthetic Fibres, Classification of textile fibers.

UNIT- II (10 Hours)

Properties of fibres and polymers: Essential and desirable properties of textile fibers, Essential properties of fibre forming polymers. Correlation of structures with properties of fibres, Crystallinity and Orientation in fibres.

UNIT-III (10 Hours)

Production properties and uses of Major natural Fibres: Production, Physical & Chemical properties and uses of Major natural Fibres (e.g. cotton, flax, jute, wool, silk).

UNIT-IV (15 Hours)

Man Made Fibres : Introduction to manmade fibres. Basic production systems for the manmade fibre i.e. melt, wet and dry spinning systems. Production, Properties and uses of regenerated fibres (e.g. viscose, Cuprammonium, polynomic, HWM & acetate rayons).

Recommended Books:

1. M. Lewin, Hand Book of Fibre Chemistry, 3rd Edn, CRC Press Tylor & Francis Group, **2007**.
2. B.P. Corbman, Textile Fibre to Fabric, 6th Edn, McGraw Hill Singapore, **1983**.
3. R.R., Wardman, R.H., The Chemistry of Textile Fibres, Royal Society of Chemistry (RSC) Publishing, Cambridge, U.K, **2011**.
4. R.M. Kozlowsky, 'Hand Book of Natural Fibres', Volume-I, Wood Head Publishing, Cambridge, U.K, **2012.**
5. E.P.G Gohl,, L.D. Vilensky, 'Textile Science', CBS Publishers, New Delhi, India, **1987**.
6. V.A Shenai., 'Technology of Textile Processing: Textile Fibres', Volume-I, Sewak Publications, Mumbai, India, **1995**.

FABRIC MANUFACTURE-I

Subject Code: BTEX1-303 **LT P C** **Duration: 40 Hours**
3 1 0 4

UNIT-I (12 Hours)

WINDING: Objectives, basic features of slub catchers and yarn clearers like Mechanical and electronics types. Yarn tensioners: Additive, Multiplicative & Combined. Anti-patterning: Reasons and Remedies. Classification and basic features of auto winders, Yarn doubling systems, Splicing and knotting Yarn fault classifying systems.

PIRN WINDING: Objective, different types of pirns, yarn traversing system, automation, standard winding parameters.

UNIT-II (10 Hours)

WARPING: Comparison of various types of warping such as: Beam warping & Sectional warping. Basic features, Creels, Reeds, Leasing systems and drawing systems

SIZING: Objectives & classification of sizing methods, features of sizing machine, machine elements, sizing ingredients, size preparation. Principles of different modern sizing techniques and their uses.

UNIT-III (4 Hours)

WEAVING: Manual, automation, General loom classifications, and Overall concept of looms. Concepts of primary, secondary & auxiliary motions of looms

UNIT- IV (14 Hours)

BASIC MOTIONS: Different types with advantages and disadvantages, Reed and reed counting systems, Tappet shedding: Mechanisms & principles. Positive & negative shedding, Heald reversing motions Types such as: under picking, over picking and parallel picking. Calculation of Picking force & shuttle velocity, Different picking accessories and its function, Pick timing such as late picking & early Picking. Reasons of false picking & shuttle fly. Movement of sley, Beat-up & sley eccentricity, Calculation related to sley eccentricity & its effects.

CALCULATIONS ON: Production and efficiency related to winding, warping and sizing. Machine Balancing in winding, warping, sizing and weaving.

Recommended Books

1. J.E Booth, 'Textile Mathematics', CBS Publishers N. Delhi, **1995.**
2. N.N. Bannerjee, 'Weaving Mechanism', Textile Book House, Berhampore, WB., **1993**.
3. M.K. Talukdar, 'Winding', Spinnet View, **1992**.
4. A. Sengupta, 'Weaving Calculations', DBT & SONS Pvt. Ltd., Mumbai., **1996**.
5. R. Marks & Robinson A.T.C. 'Principles of Weaving', Textile Institute, Manchester, **1976**.
6. P.R. Lord & Mohammed M.H, Conversion of Yarn to Fabric', 2nd Edn., Merrow Publications Manchester, **1982**.

YARN MANUFACTURING - I

Subject Code: BTEX1-304 **LT P C** **Duration: 40 Hours**
3 1 0 4

UNIT-I (4 Hours)

Introduction to short and long staple spinning

Ginning: Objectives of ginning, differential ginning, Roller, Saw and McCarthy ginning machines.

UNIT-II (12 Hours)

Blow Room: Objectives of mixing and blending, Different methods of mixing and blending, Study of modern blending machines, Auto mixer. Principle of opening and cleaning objects of Blow room line. Various type of opener and cleaner their construction and working, its modern development. Study of Lap forming mechanism, Calendar roller pressure, Length measuring mechanism, feed regulating system. Single line processing, Selection of machinery for different types of cotton fibre, Different types of Lap defects and their remedies, Degree of opening, Norms, Recent development in Blow room, Calculation pertaining to blow room. Selection of Blow Room line for different types of cotton fibre.

UNIT-III (12 Hours)

Carding: Objectives of carding. Introduction to roller and clearer card. Principle of carding. Detailed study of revolving flat card. Construction, feature and working details of licker-in cylinder, doffer and flats. Card clothing; metallic & flexible, Carding angle, card setting, Neps in card, Fibre hooks, Fibre transfer. Features of high production card. Defects in card web & their remedies. Auto leveller. Calculation pertaining to production, draft etc. of carding m/c. Recent development in Card.

UNIT-IV (12 Hours)

Darwframe: Objectives of drawing, principles of roller drafting. Detailed study of draw frame machine. Roller & Rollers settings, Roller weighting, Roller clearer, Mechanics of roller slip, roller eccentricity, roller vibration. Conventional drafting system, Shirley draft distribution. Drafting wave, Different drafting system, Features of Modern draw frame, auto leveller in draw frame. Calculation pertaining to draft and production of draw frame machine.

Recommended Books:

1. W. Klein, 'Opening and Carding', Textile Institute Manchester, **1987**.
2. W. Klein, 'Short Staple Spinning Series', Textile Institute Manchester, **1987**.
3. K.R. and R. Chattopadhyay, 'Blow Room and Card NCUTE, IIT Delhi, **1998**.
4. Venkatsubramanian, 'Spun Yarn Technology', Vol.-I, & II, Mub. Sevak Pub.
5. T.K. Pattabhiram, 'Cotton Spinning, Somaiya Publication Pvt. Limited, New Delhi, 4th Edn., **1997**.
6. Gilbert R. Merill, 'Cotton Blow Room and Carding', Gilbert R Publication, Lowell, No.1955.
7. J.E. Booth, 'Textile Mathematics', Vol –I, Textile Institute Manchester, **1975**.
8. J.E. Booth, 'Textile Mathematics', Vol –II, Textile Institute Manchester, **1975**.
9. Gilbert R. Merill, 'Opening and Carding', Gilbert R. Publication, Lowell, Mass, **1960**.
10. Taggart William, 'Cotton Spinning', Universal Book Corporation, Mumbai.

LAB I : TEXTILE FIBRE

Subject Code: BTEX1-305	**LT P C** **0 0 2 1**	**Duration: 20 Hours**

At least 10 experiments are to be performed by each student

Physical and Chemical identification of following Textile fiber (s)

1. Identification of cotton
2. Identification of wool
3. Identification of silk
4. Identification of Bast fibres
5. Identification of polyester
6. Identification of nylon
7. Identification of Acrylic
8. Identification of Polypropylene
9. Identification of fibres in blend and % fibre content in blend
10. Analysis of P/C blended fabric
11. Analysis of P/V blended fabric
12. Analysis of P/W blended fabric
13. Estimation of fibre/filament fineness using projection microscope.
14. Determination of moisture regain and content in cotton fibres.
15. Determination of fibre maturity percentage in cotton fibres.

LAB II: FABRIC MANUFACTURE-1

Subject Code: BTEX1-306	**L T P C** **0 0 2 1**	**Duration: 20 Hours**

At least 10 experiments are to be performed by each student

1. Study of the motion transmission system in winding machine.
2. Study of the effect of slub catcher, yarn tensioner & yarn guide on package formation.
3. Study of Package stop motion in cone winding machine.

4. Calculation of winding speed on grooved drum winding system and study of anti-patterning system incorporated to it.
5. Study of precision winding machine and mechanism of package building.
6. Study of the motion transmission system in Pirn winding machine.
7. Calculation of winding speed and traversing speed of Pirn winding machine.
8. Study of the sectional working machine & plan the width of a section according to the given striped fabric keeping in view the pattern.
9. To study the passage of yarn on a sizing machine and the features of various parts/mechanism of the sizing machine.
10. 10. To select the proper reed and heald for a weaver's beam keeping in mind the beam, loom size and fabric construction.
11. Study of shedding mechanism of shuttle loom and cam positioning with respect to loom cycle.
12. Study of picking mechanism, Picker movement in relation with crank shaft rotation & calculation of average velocity of shuttle.
13. Study of sley movement, construction and calculation of sley eccentricity.

LAB III: YARN MANUFACTURE-1

Subject Code: BTEX1-307 **LT P C** **Duration: 20 Hours**
0 0 2 1

At least 10 experiments are to be performed by each student

1. Study of general outline of opener & clearer machine employed in B/R line process.
2. Study of following in Shirley Trash Analyzer machine.
    A) Chief organs.
    B) Gearing arrangements.
    C) Speed of different beater.
    D) Teeth inclination & Teeth per inch.
3. Determination of trash content and analysis of waste by using trash analyzer machine.
4. Study of carding machine with technical details.
5. Study of gearing mechanism calculation of the speed of different organs of carding machine.
6. Calculation of draft between different zone & production of carding machine.
7. Study of card settings for different fibre lengths & types.
8. Maintenance and overhauling of carding machine.
9. Study of distribution of fibrous waste in a carding machine.
10. Study of the `Nep -COUNT' in a card.
11. Study of drafting arrangement & top roller weighting system of Drawframe machine.
12. Calculation of the total draft and its distribution in draw frame machine
13. Effects of break draft and roller settings on sliver uniformity.
14. Measurement of nip-load pressure, roller eccentricity & shore hardness of top roller drafting rollers.
15. Maintenance and overhauling of draw frame machine.

TEXTILE FIBRE-II

Subject Code: BTEX1-408 **LT P C** **Duration: 40 Hours**
3 1 0 4

Unit-I (5 Hours)

Introduction: Introduction to man-made fibres, Idea about fine structure of man-made fibres. **Crystallinity, orientation:** Detailed study of crystallinity, orientation and its effects on fibre properties.

Unit-II (15 Hours)

Melt Spinning: Melt Spinning with special reference to Polyester & Nylon. Melting of polymer chips, extrusion, spinning, drawing, heat setting & cutting of melt spun filaments/fibre.

Wet and dry spinning: Wet and dry spinning with special reference to acrylic. Relative merits & demerits of the wet & dry spinning systems. Preparation of polymer solution, extrusion, spinning, filament formation drawing, heat setting, cutting of wet & dry spun filaments/fibre.

Unit-III (10 Hours)

Heat Setting: Introduction about heat setting. Important parameters of heat setting & their effect on fibre properties.

Drawing and Stretching: Introduction about drawing. Drawing condition, phenomenon of necking, Machines for stretching continuous, filament yarns, Drawing, heat setting, crimping of staple fibres.

Unit-VI (10 Hours)

Production Properties and uses of Synthetic Fibres: Detail study of the production, physical, chemical structures & Properties of polyester, nylon 6 & 66, **Polypropylene**, acrylic, elementary idea about high speed spinning.

High Performance Fibres: Introduction to high performance fibres, Elementary idea about aramid, carbon & glass fibres.

Recommended Books:

1. R.R. Matter, R.H. Wardman, 'The Chemistry of Textile Fibres', Royal Society of Chemistry (RSC) Publishing, Cambridge, U.K, **2011**.
2. M. Lewin, 'Hand Book of Fibre Chemistry', 3rd Edn, CRC Press Tylor & Francis Group, **2007**.
3. V.K Kothari., 'Progress in Science and Technology, Textile Fibres- Development and Innovation', Volume-2, IAFL Publication, New Delhi, India, **2000**.
4. B.P. Corbman, 'Textile Fibre to Fabric', 6th Edn, McGraw Hill Singapore, **1983**.
5. B.L. Deopura, B. Gupta, Manmade Fibres, NCUTE-Pilot Programme, Dept. of Textile Technology, IIT, Delhi, **1999**.
6. E.P.G. Gohl, L.D. Vilensky, 'Textile Science', CBS Publishers, New Delhi, India, **1987**.
7. S.P. Mishra, 'Science and Technology of Manmade fibres', Suraj Publication, **2007**.
8. V.A. Shenai, Technology of Textile Processing: Textile Fibres, Volume-I, Sewak Publications, Mumbai, India, 1**991**.
9. A.A. Vaidya, 'Production of Synthetic fibres', Prentice Hall of India Pvt. Ltd. Publisher, **1988**.

YARN MANUFACTURE – II

Subject Code: BTEX1-409 **LT P C** **3 1 0 4** **Duration: 40 Hours**

UNIT-1 (3 Hours)

Brief idea about short staple spinning technology.

UNIT-II (11 Hours)

Combing process: Objectives, combing for shorter and medium varieties of cotton, cottons suitable for combing, preparation of stock for combing, combing cycle, role of machine components and settings, noil extraction at backward feed and forward feed comber, norms, assessment and production calculations. Recent developments, Process related to roving formation: Objectives, functions of different machine components and high drafting system, roving twist in speed frame, winding principles and equations related to bobbin leading and flyer leading, building motion, production calculations, norms, and performance assessment. Developments in speed frame.

UNIT-III (13 Hours)

Ring spinning Process: Function and mode of operation of ring frame, role of drafting system, yarn guiding devices, forces acting between ring and traveler, yarn tension variation, angle of yarn pull, tasks of traveler, limiting speed, classification, form of traveler, traveler mass and material, different ring-traveler combinations, fiber lubrication, running on new-ring, winding process, cop building, cylinder and conical tip, spinning geometry, causes of end breaks, production calculations, norms, performance assessment. Latest developments including compact spinning

UNIT-IV (13 Hours)

Non-conventional spinning processes: Brief idea about principle of open end spinning, rotor spinning, chief organs and their functions, yarn properties in comparison with ring-spun yarn, principle of friction spinning, function of chief organs, yarn properties, basic principle to air jet spun yarn, functions of chief organs, yarn properties.

Recommended Books:

1. W. Klein, 'Manual of Textile Technology', vol.1 to 5', The Textile Institute Manchester, **1995**.
2. A.R. Khare, 'Elements of Combing', Sai book Center, Mumbai, **1999**.
3. A.R. Khare, 'Elements of Ring Frame and Doubling', Sai book Centre, Mumbai, **1999**.
4. K.R. Salhotra, 'Spinning of Man Made and Its Blends in Cotton System', The Textile Association of India, Mumbai, **1989**.
5. R. Chattopadhyay and R. Rengasamay, 'Spinning: Drawing, Combing and Roving', NCUTE, IIT, Delhi, **1999**.
6. Merill, R Gilbert, Roving, Gilbert R Publication, Lowell, Mass, **1956**.
7. W. Klein, 'Practical Guide to Ring Spinning', Vol. -4, Textile Institute, Manchester, **1987**.
8. W. Klein, 'Short Staple Spinning Series', Textile Institute, Manchester, **1987**.
9. P.R. Lord, 'Roller Drafting', Textile Progress 23 vol. 4, Textile Institute, Manchester, **1993**.
10. Taggart William, 'Cotton Spinning', Universal Book Corporation, Mumbai.
11. K.R. Salhotra, R. Alagiruswamy, R. Chattopadhyay, 'Ring Spinning, Doubling and Twisting', NCUTE, IIT Delhi, **2000**.

12. K.R. Salhotra and B. Dutta, ‘Seminar on Rotor Spinning’, IIT Delhi, **1981**.
13. J.E. Booth, ‘Textile Mathematics’, Vol. –II, Textile Institute Manchester, **1975**.
14. Taggart William, ‘Cotton Spinning’, Universal Book Corporation, Mumbai.

FABRIC MANUFACTURE - II

Subject Code: BTEX1-410 **LT PC** **Duration: 40 Hours**
3 1 0 4

UNIT-I (6 Hours)

LET OFF: Different types of let-off systems, long term, short term and medium term variations. Relation between beam diameter and tension of warp. Principles of modern positive Let-off systems as such as Sulzer, Hunt, etc.

TAKE-UP: Types of take-up, examples of each.: Periodicity in Take - up, Modern continuous take up like Sulzer, Saurer etc.

UNIT-II (4 Hours)

WARP STOP:-Types of warp stop motions with examples such as Mechanical & Electrical stop motion.

WARP PROTECTOR: Study of Loose reed and fast reed warp protector motion.

WEFT STOP: Functions of Weft feelers and its different types.

UNIT-III (10 Hours)

DOBBY:-Object of dobby, scope of dobby, different types of dobby and their mechanisms such as Positive and Negative dobby. Pegging systems as per design of fabric, Functions of Paper dobby & Climax dobby.

JACQUARD:- Scope of jacquard, different types of jacquard such as single lift single cylinder, Double lift single cylinder, double lift double cylinder, Cross border jacquard, Jacquard card punching systems as per fabric design. Temple motions and its importance, Different types of temples used in loom.

UNIT-IV (20 Hours)

Study of Automatic Package Changing mechanism (Pirn changing and shuttle changing). Functions of Multiple Box motion. (2x1 and 4x1 drop box) Different types of non-conventional weaving machines.

Unconventional Loom: History behind their development Sulzer projectile weaving machines (Shedding, beat-up, torsion bar picking, let-off and Take-up mechanism). Projectile checking and return. Elitex and Sulzer airjet weaving machine. Picking System of water jet weaving machine. Projectile loom. Different types of Rapier weaving machines. Weft feeding system to the shuttle-less weaving machines. Basic principles of Multiphase weaving & Circular weaving machine.

Recommended Books:

1. R. Marks and A.T.C. Robinson, ‘Principles of Weaving’, Textile Institute, **1976**.
2. Prabir Kumar Banerjee, ‘Principles of Fabric Formation’, CRC Press, **2015.**
3. P.R. Lord & M.H. Mohamod, ‘Weaving: Conversion of Yam to Fabric’, Merrow Publishing Co. Ltd., **1992**.
4. V. Valeriy, Choogin, ‘Mechanisms of Flat Weaving Technology, Woodhead Publishing, **2013.**
5. Sabit, Adanur, ‘Handbook of Weaving’, Technomic Publications, **2001**.

TEXTILE CHEMICAL PROCESSING – I

Subject Code: BTEX1-411 **L T P C** **Duration: 40 Hours**
3 1 0 4

UNIT-I (10 Hours)

Introduction: Process line for pretreatment, colouration and finishing of textiles

Singeing: Object of the process, types of singeing, details of various singeing methods, drawbacks and advantages. Process and quality control aspects involved.

Desizing: Object, types, method details and mechanism of removal of starch in various methods. Efficiency of desizing.

Scouring: Objectives, mechanism of removal of impurities, recipe and controlling parameters involved. Scouring of coloured textiles. Scouring of natural, manmade and blended textiles. Evaluation of scouring efficiency.

UNIT-II (10 Hours)

Bleaching: Objectives of bleaching. Hypochlorite, peroxide, chlorite and per-acetic acid bleaching methods and their effectiveness on various textiles. Controlling parameters and mechanism involved in each method. Efficiency of bleaching.

Mercerization: Objectives, mechanism related to various physical and chemical changes in cotton during mercerization. Process parameters and operation details. Causticization. Wet and hot mercerization. Ammonia treatment of cotton. Performance of various mercerization /alkali treatment processes. Assessment of efficiency of mercerization: Barium activity number, its determination and interpretation.

Pretreatment machineries: Singeing m/c, J-box, kier, mercerizing machine,

UNIT-III (10 Hours)

Heat setting: Objectives and mechanism of setting. Different methods of heat setting and their effectiveness on various man made textiles and blends. Heat setting conditions and controls. Heat setting of polyester, nylon, acetate and their blends. Evaluation of degree of heat setting.

Mechanical Finishes: Physical and chemical softening processes, selection of chemical and evaluation of softening. Calendering - its types, construction and function of various calendering m/cs. Sanforizing - method, mechanism and machineries involved. Evaluation of sanforizing.

UNIT-IV (10 Hours)

Carbonization: Objectives, selection of chemical, process details, trouble shoots, precautionary measures and efficiency of carbonization.

Functional finishes: Problem of creasing, anti-crease finish on cotton. Choice of chemical, catalyst and process parameters. Drawback and advantages associated with use of various anti-crease chemicals. Measures to reduce release of formaldehyde. Water repellency and water repellent finishes on cotton. Evaluation of water repellency.

Recommended Books:

1. A.K. Roy Choudhary, 'Textile Preparation & Dyeing', Science Publishers, USA, **2006**.
2. R.H. Peters 'Textile Chemistry', Vol - II, Elsevier Publishing Company, London, **1967**.
3. R.M. Mittal and S.S. Trivedi, 'Chemical Processing of Polyester / Cellulosic Blends', Ahmedabad Textile Industries Research Association, Ahmedabad, India, **1983**.
4. S.R. Karmakar, 'Chemical Technology in the Pretreatment Processes of Textiles', Textile Science & Technology Series, Vol-12, 1st Edn, Elsevier, **1999**.

5. A.J. Hall, 'Textile Finishing', Haywood Books, London, **1996**.
6. V.A. Shenai, 'Technology of Bleaching & Mercerization'.
7. A.A. Vaidya, 'Textiles Auxiliaries & Finishing Chemicals'.
8. V.A. Shenai and N.M. Saraf, 'Technology of Textile Finishing', Sevak Publications, Mumbai, **1990**.

LAB IV: YARN MANUFACTURE-II

Subject Code: BTEX1-412	LT P C 0 0 2 1	Duration: 20 Hours

At least 10 experiments are to be performed by each student.

1. To study the timing diagram of a comber.
2. To study the function of top comb and its depth of penetration with reference to noil extraction and fractionating efficiency.
3. To study the nature of movement of nipper assembly.
4. To study the mechanism of detaching roller drive and the nature of its motion.
5. To study the effect of type of feed and detachment setting on noil percentage and fractionating efficiency.
6. To estimate head to head difference in noil level (mill based study).
7. To study the effect of feed per nip on percentage in Nep level during combing.
8. To study the Drafting, Twisting and Winding Zone of speed frame.
9. To study the Gearing & Driving mechanism of speed frame.
10. To study the Differential Motion of speed frame and calculation of Bobbin speed.
11. Calculation of break draft constant, draft constant and twist constant and production of speed frame.
12. 12. To study the influence of machine and process parameters on roving unevenness.
13. To study the drafting, twisting and winding zone in ring frame.
14. To study the Gearing, Driving and Building motion in Ring frame.
15. Calculation of Draft Constants, Twist Constant, Coils per inch and production of Ring frame.
16. To ascertain the effect of break draft and total draft on yarn unevenness and strength.
17. Estimation of spinning tension as a function of traveler weight, yarn count and balloon height.
18. To perform various settings and maintenance operation on Ring frame; Such as:
19. Ring rail leveling
20. Spindle gauging
21. Spindle eccesntricity
22. Lappet eccentricity
23. To study the effect of shore hardness on yarn quality.
24. To study the influence of spindle speed & traveler weight on hairiness.
25. Study the chief organs mechanism and calculations of open end and friction spinning machines.

LAB V: FABRIC MANUFACTURE-II

Subject Code: BTEX1-413 **LT P C** **Duration: 20 Hours**
0 0 2 1

At least 10 experiments are to be performed by each student
1. Study of take up motion and calculation of loom take up constant.
2. Study of positive let-off system.
3. Study of Warp protection motion (both loose reed and fast reed).
4. Study of warp stop motion.
5. Study of Beating up system in Terry towel loom.
6. Study of Jacquard machine and designing of cards for different weave designs.
7. Study of temple motions.
8. Study of pirn changing mechanism.
9. Study of side/centre weft fork mechanism.
10. Study of (4x1) multiple box motion.
11. Study of Let-off and take-up of shut-less weaving machine.
12. Study of weft insertion mechanism of Air-jet and rapier weaving machine.
13. Study of selvedge formation technique of Air-jet weaving machine.
14. Identification of fabric faults by fabric inspection machine.

LAB VI: TEXTILE CHEMICAL PROCESSING – I

Subject-BTTX 1-414 **L T P C** **Duration: 20 Hours**
0 0 2 1

At least 10 experiments are to be performed by each student
1. Scouring of cotton goods
2. Scouring of polyester goods
3. Scouring of P/C blended goods
4. Scouring of wool fibre
5. Degumming of silk
6. Bleaching of cotton with H_2O_2
7. Bleaching of cotton with $NaClO_2$
8. Bleaching of cotton with NaOCl
9. Bleaching of Polyester
10. Bleaching of P/C blend
11. Bleaching of jute yarns / fabric
12. To finish cotton fabric with
- Water repelling agent
- Urea – formaldehyde

PROPERTIES OF FIBRES

Subject Code: BTEX 1-515 **LT P C** **Duration: 40 Hours**
3 1 0 4

UNIT- I (12 Hours)

Traditional View of fibre structure and its later development: Study of the methods of investigation of fibre structure, e.g,. X-ray diffraction, electron microscopy and absorption of infra -red radiation. Fibre density and its measurement.

Moisture relations in Textile Fibre: Measurement of moisture absorption, measurement of regain, relationship between Moisture Regain and Moisture Content, Swelling of fibres-definitions and measurement. Heat of sorption- definitions, measurement and its effect on properties of textile material. Quantitative theory of moisture absorption. **Hysteresis** of moisture absorption.

UNIT–II (10 Hours)

Tensile properties of fibre: - Factors determining the result of tensile tests. Quantities & units of different parameters. Experimental methods. Elementary study of Fibre fracture.

Effect of Variability: Effect of specimen length on strength, weak link effect.

Elastic recovery: Definition, experimental methods, change of properties as a result of straining.

Study of time dependence: creep behavior, relaxation of stresses with time & its effect on tensile testing.

UNIT – III (8 Hours)

Introduction to dynamic testing: Basic concept & definition of elastic, viscoelastic and plastic deformations. Characterization of viscoelastic behavior, Concepts of Voight & Maxwell model. Test method for dynamic testing. Bending & torsional rigidity of fibre: Elementary concepts, theories and measurements.

UNIT– IV (10 Hours)

Fibre friction and its measurement: nature of friction & equations. Fibre to fibre and fibre to metal friction. Basic concept of Thermal properties & heat setting. **Optical properties of fibre:** Definition of refractive index, concept of fibre birefringence and orientation, Dichroism.

Introduction to dielectric property & static charge generation in textile material.

Recommended Books:

1. W.E. Morton & J.W.S. Hearle, 'Physical Properties of Fibres'., 4th Edn., Woodhead Publishing Limited, Cambridge, UK, **2008**.
2. V.K. Kothari, 'Progress in Textile Science & Technology', Vol - II, IAFL Publishers, New Delhi, **2000**.

QUALITY MANAGEMENT IN TEXTILE INDUSTRY

Subject Code: BTEX 1-516 **LT P C** **Duration: 40 Hours**
3 1 0 4

UNIT-I (10 Hours)

Quality Management: Definition of quality and its importance, different approaches to quality, Description of Deming's fourteen points and Ishikawa's seven tools of quality, utility of statistical method for quality control and improvement, concept of Total Quality Management (TQM), ISO 9000 Standards, Quality Function Deployment (QFD) and Quality Costs.

UNIT-II (12 Hours)

Basic Approaches to Statistical Quality Control: Population and sample, descriptive and inductive statistics, discrete and continuous variables, subjective tests, collection and classification of data, frequency distributions, measures of central tendency, measures of dispersion, random variables and probability distribution, differences and applications of normal, binomial, Poisson's and other form of distribution.

Statistical Analysis for Continuous Function: Population and sampling distribution of mean, statistical estimation theory, points estimates, concept of single tail and double tail test, Student's t distribution, confidence limit, statistical decision theory, tests of hypotheses and significances, type I and type II errors, difference between two sample means. Test for single variance, Chi-square test, the F distribution, test for the difference between two variances, confidence limits for variance and ratio of two variances, choice of sample size.

UNIT-III (6 Hours)

Statistical Analysis for Discrete Function: Application of binomial and Poisson's distribution, normal approximation, test for a single proportion and difference between two proportions, application of χ 2 distribution, contingency table.

Subjective Tests: Rank correlation, tied rank, coefficient of concordance.

UNIT-IV (12 Hours)

Acceptance Sampling: Basic idea about acceptance sampling, OC curve, producer's risk and customer's risk.

Control Charts: Advantages using quality control charts, random and assignable causes, action and warning limits, X**,** R, p, n p and c chart, Process Capability Ratio (CP and CPK), concept of 6 sigma process control, brief idea about CUSUM and EWMA chart.

ANOVA and Regression: Some basic concept of Analysis of Variance, method of least squares, Curve fitting, linear regression methodology, Karl Pearson correlation and standard error.

Recommended Books:

1. G.A.V. Leaf, 'Practical Statistics for the Textile Industry', Part I & II, The Textile Institute, UK, **1987**.
2. D.C. Montgomery, 'Introduction to Statistical Quality Control', John Wiley & Sons Publications, **2002**.
3. B.S. Dhillon, 'Applied Reliability and Quality: Fundamentals', Methods and Procedures, Springer, London, **2007**.

FABRIC STRUCTURE & ANALYSIS

Subject Code: BTEX1-517	**LT P C** **3 1 0 4**	**Duration: 40 Hours**

UNIT-I (10 Hours)

Formation of fabric. Fabric cover and crimp. Detection of directions of warp and weft. Weaving plan. Methods of its preparation.

UNIT-II (10 Hours)

Detailed study of various weaves for their reproduction: Plain weave & its derivatives, Twill weave & its derivatives. Satin/sateen weave & its derivatives. Diamond and diaper, Honeycomb, Huck-a-back, Mock leno.

UNIT-III (10 Hours)

Welt/pique, Bedford cord, crepe weaves. Stripe & check effects. Its types. Different methods to produce these weaves. Color and weave effect.

UNIT-IV (10 Hours)

Terry weaves Backed fabric, Doubled fabric. Technical specification of important weaves. Calculation relating to raw material required to produce different weaves.

Recommended Books

1. Watsons, 'Textile Design & Color', 7th Edn., Butterworth & Co. Ltd., London, **1988**.
2. Watsons, 'Advanced Textile Design', 7th Edn., Butterworth & Co. Ltd., London, **1989**.
3. Nisbet, 'Grammar of Textile Design', **1994**.

TEXTILE TESTING –I

Subject Code: BTEX 1-518	**LT P C** **3 1 0 4**	**Duration: 40 Hours**

UNIT-I (5 Hours)

Introduction: Aim and scope of testing, Sample and Population, Sampling techniques for fibre, yarn and fabrics, Sample Size and Sampling errors.

UNIT-II (8 Hours)

Moisture in Textiles: Absolute humidity, Relative Humidity, Moisture content, Moisture regain, Relation between Moisture Regain and Moisture Content, Factors affecting regain of textile materials, effect of moisture on fibre properties, standard atmospheric conditions, measurement of atmospheric conditions, Moisture measuring Instruments.

UNIT-III (10 Hours)

Testing of Fibres: Cotton fibre testing such as length, fineness, maturity, neps, strength, elongation, trash-content, grading of different cotton, fibre contamination measurement, application of HVI and AFIS. Testing of wool and manmade staple fibers, measurement of fiber friction and crimp,

UNIT-IV (17 Hours)

Testing of Yarn: Yarn numbering and conversion system, Measurement of yarn twist, relation between yarn count, twist and yarn diameter, tensile properties, various type of measuring instruments and their working principles, factors affecting tensile properties, elastic recovery, effect of impact loading and fatigue behavior, yarn friction. Evenness testing of yarns, nature and causes of irregularities, principles and methods of evenness testing, evaluations and interpretation of evenness results, concept of index of irregularity, variance length curves and spectrogram analysis, yarn faults, classification, utility and principle of different types of measuring instruments. Yarn hairiness, principle of measurement, measuring instruments. Test for filament and textured yarn.

Recommended Books:

1. B.P. Saville, 'Physical Testing of Textiles', Woodhead Publishing Ltd. Cambridge, **2002.**
2. V.K. Kothari, "Textile Fibers: Developments and Innovations', IAFL Publications, New Delhi, **2000**.
3. J.E. Booth, 'Principles of Textile Testing', CBS Publishers and Distributors, New Delhi, **1999**.
4. P. Angappan and R. Gopalakrishnan, 'Textile Testing', SSM Institute of Textile Technology, Komarapalayam, **2002.**
5. A. Basu, 'Textile Testing', SITRA Coimbatore, **2002**.
6. V.K. Kothari, 'Progress in Textile: Science & Technology', Vol. 1, Testing & Quality control, IAFL Publications, New Delhi, **1999**.

TEXTILE CHEMICAL PROCESSING-II

Subject Code: BTEX 1-519 **LT P C** **Duration: 40 Hours**
3 1 0 4

UNIT-I (10 Hours)

Concept of Colour: Visible spectrum, wavelength and blindness of colour.
Metamerism/isomerism.

Theories of Colour: Additive and subtractive theories. Primary, secondary, tertiary, complementary and contrasting colours. Tristimulus values of colour. Computer colour matching, kubelka-munk equation, reflectance factor, colour-co-ordinates, CIELAB values. Dye uptake on textiles.

UNIT-II (10 Hours)

Theory of Dyeing: Dye-fibre interaction, free volume theory.

Dyeing of textiles: Dyeing technology of natural and manmade textiles with direct, reactive, vat, insoluble azoic, sulphur, solubilized vat, acid, metal-complex, basic and disperse dyes.

UNIT-III (10 Hours)

Colouration with Pigments. Auxiliaries used in dyeing.

Dyeing of blends: Classification of blends, shades and methods for dyeing of blends. Suitability of each method for dyeing of specific blend.

Dyeing Machineries: loose fibre, yarn and package dyeing machines. Jigger, winch, jet and HTHP beam dyeing m/cs. Padding mangles.

Identification of Dyes: Identification of dye on dyed natural and manmade textiles.

UNIT-IV (10 Hours)

Printing Methods: Hand block, roller and screen printing processes. Construction and working of roller printing machine, photoelectric method of screen preparation. Drawback and advantage of each method.

Print Paste: Constituent and characteristics of print paste, classification and mechanism of working of thickeners.
Printing after treatments: Importance of steaming, curing, ageing of prints. Mechanism of each process.
Printing Styles: Direct, discharge and resist styles of printing on natural, man-made and blended textiles.
Transfer Printing: Types, mechanism of transfer in each type and machineries. Transfer printing of natural, man-made and blended textiles.

Recommended Books:

1. L.W.C. Miles, 'Textile Printing', Dyers Company Publication Trust, Bradford, England,**1981**.
2. V.A. Shenai, 'Technology of Printing', Sevak Publications, Mumbai, **1990**.
3. D.M. Nunn, 'The Dyeing of Synthetic Polymer and Acetate Fibres', Dyers Company Publication Trust, London, **1979**.
4. J. Shore, 'Cellulosic Dyeing', Society of Dyers & Colourists, Bradford, UK, **1979**.
5. A.K. Roy Choudhary, 'Textile Preparation & Dyeing', Science Publishers, USA, **2006**.
6. 'Cotton Piece Dyeing', ATIRA.
7. 'Dyeing of Polyester & Cellulose Blends', ATIRA.
8. V.A. Shenai, 'Technology of Dyeing, Sevak Publications, Mumbai.
9. Jose Cegarra, 'The Dyeing of Textile Materials'.
10. E.R. Trotman, 'Dyeing and Chemical Technology of Textile Fibre'.
11. J.N. Chakraborty, 'Fundamentals and Practices in Colouration of Textiles', Woodhead Publishing India Pvt. Ltd.

Lab VII: (TEXTILE TESTING)

Subject Code: BTEX 1-520 **L T P C** **Duration: 20 Hours**
0 0 2 1

At least 10 experiments are to be performed by each student

1. To prepare a Bear Sorter diagram and determine the following:
    - Mean Length
    - Effective length
    - Short fibres Percentage
    - Dispersion Percentage
2. Determine 2.5 % S.L., 50 % S.L., and uniformity ratio of a given cotton using fibro graph. Construct a fibro gram by re-setting the counters for various S.L. between 5 % to 90 %. Compare the fibro gram of manmade fibre with cotton.
3. Determine the micronaire value of a given cotton sample by Air-Flow method. Convert the result into SI units and give a suitable rating to the fibre sample.
4. Determine maturity coefficient and maturity ratio of a given sample by caustic soda method. Give appropriate rating to the fibre sample.
5. Determine Pressley Index of a cotton sample by Pressley Tester at zero and 3mm gauge length and convert result into tenacity. Compare and comment on the results at different gauge lengths.

6. Determine the bundle strength and elongation of a given manmade fibre using Stelometer. Study the effect of rate of loading on tensile properties of the fibre.
7. Study the imperfections at different sensitivity level for different yarn samples.
8. Prepare yarns Appearance Boards and compare with ASTM standards.
9. Study the hairiness of a given yarns using Hairiness Tester. Compare the results of Evenness Tester and Hairiness Tester with ASTM grade.
10. Determine bending rigidity by (HEART) loop method.
11. Determine the Lea C.S.P by Lea CSP Tester and Auto-sorter and compare the results.
12. Fibre Testing by HVI
13. Determine moisture content/regain of a fibre sample by hot air oven method.
14. Determine crimp (crimp %) of a given manmade fibre sample.
15. Determine fibre fineness of a manmade fibres/filaments by:
    - whole fibre method
    - vibroscope
16. Tensile properties of a staple fibre by:
    - vibromat
    - Instron/zwick UTM

Determine stress relaxation and creep recovery of fibre.

LAB VIII: TEXTILE CHEMICAL PROCESSING-II

Subject Code: BTEX1-521 **LT P C** **Duration: 20 Hours**
0 0 2 1

At least 10 experiments are to be performed by each student

1. To dye cotton with Azoic dyes
2. To dye cotton with Vat dyes
3. To dye cotton with Indigoid dyes
4. To dye wool fibre with

a. Reactive dyes
b. Acid dye
c. Metal complex dyes

5. To dye silk with acid dyes / acid mordant dyes
6. To dye polyester with disperse dyes
7. To dye nylon with acid dyes / metal complex dye
8. To dye acrylic with basic dyes
9. To print cotton fabric with hand block method in direct style
10. To print cotton fabric with hand block in discharge style
11. To print cotton fabric with hand block in resist style
12. Study of fastness properties of different dyed samples
13. Identification of dyes on dyed textiles
14. To dye the fabric with direct dye and it’s after treatment
15. To dye the fabric with reactive dyes
16. To dye fabric with Sulphur dyes

Lab IX: FABRIC STRUCTURE & ANALYSIS

Subject- BTEX1-522 **LT P C** **Duration: 20 Hours**
0 0 2 1

At least 10 experiments are to be performed by each student

1. Analysis of different fabric samples to know their particulars as stated:
2. For Yarns:- Ends & Picks/inch, Warp & Weft Count & Crimp, Warp & Weft Crimp, Ply & Twist.
3. For Fabrics:- Tape length, Reed width, Denting order, Weight of warp & Weft & fabrics, Weight per square yard, Warp & weft cover, Colour plan, and use.

Study of the following fabrics samples:

1. Plain & derivatives
2. Twill & derivatives
3. Diamonds & Drapers
4. Honey comb
5. Huck-a-back
6. Mockleno
7. Welts & Piques
8. Stripe & Cheques
9. Satin / Sateen
10. Crepe
11. Terry pile
12. Colour & Weave effect.
13. Double Cloth

THEORY OF TEXTILE STRUCTURE

Subject Code: BTEX 1-624 **LT P C** **Duration: 40 Hours**
3 1 0 4

UNIT-I (5 Hours)

Yarn Geometry: Basic geometry of twisted yarns. The idealized helical yarn structure and deviation. Real Yarn: Twist contraction and retraction, packing of fibres in yarn, Forms of Twisting.

UNIT-II (8 Hours)

Fibre Migration: Ideal migration, Parameters affecting migration, characterization of migration behavior, mechanism of migration in single and plied structure. Criteria for interchange of fibre position. Conditions for migration to occur, combination of the mechanics of migration.

UNIT-III (12 Hours)

Structural Mechanics: Extension of yarn under small load. Analysis of tensile forces of yarn under stress. Prediction of breakage, Nature of rupture for continuous filament yarn. Extension and breakage of spun yarn: Traditional view and approach by Hearle and E1-Sheikh. Blended Yarn: Blended yarn structure, Humburgers Theory. Structure property relationship of ring, rotor, air-jet, friction spun yarn.

UNIT-IV (15 Hours)

Fabric Geometry: Engineering approach to the analysis of fabric, Pierce geometrical model relationship between h, p, c, Crimp interchange, Jammed Structure, concept of similar cloth. Minimum possible cover factor. Race track geometry, close limit of weaving, concept of similar fabric. Pierce elastic thread model, Geometry of plain knitted fabric. Fabric Properties: An elementary idea about tensile, bending, shear and drape behavior of fabric. An elementary idea about fabric objective measurement.

Recommended Books:-

1. J.W.S. Hearle, P. Grosberg and S. Backer, 'Structural Mechanics of Fibres Yarns and Fabrics', Wiley Inter-Science, New York, **1969**.
2. B.C. Goswami, J.G. Martindale and F. Scardino, "Textured Yarn Technology, Structure and Applications', Wiley Interscience Publisher, New York, **1995**.
3. F.T. Peirce and J.R. Womersley, 'Cloth Geometry', Reprint, The Textile Institute, Manchester, **1978**.

PROCESS CONTROL IN TEXTILES

Subject Code: BTEX1-624	**LT P C** **3 1 0 4**	**Duration: 40 Hours**

UNIT-I (5 Hours)

Control of mixing quality and Cost; Formulation of LPP; Bale Management. Control of yarn realization; Control of waste and cleaning in a spinning line; improving the machines performance and optimization.

UNIT-II (12 Hours)

Control of yarn quality; Yarn faults and package defects; Controls for quality, Machine stoppage and productivity in winding, warping, warping, sizing, drawing, pirn winding and weaving;

UNIT-III (12 Hours)

Calculations pertaining to production, efficiency and machine allocation in winding, warping, sizing and looms; Standard norms for settings, speeds and production rates. Fabric defects and their control.

UNIT-IV (11 Hours)

Grey fabric inspection, Standard for damages of cotton fabrics, norms for cause wise defects in grey fabrics Control & norms of hard waste in various processes; Care, selection and consumption norms of accessories.

Machinery audit: Measurement and analysis of productivity: Means to improve productivity

Recommended Books

1. ATIRA, 'Process Control in Spinning'.
2. K.R. Salhotra, 'Spinning of Man-Made & their Blends in Cotton System'.
3. R. Chatopadhaya, 'Process Control in Spinning', I.I.T. Delhi.
4. SITRA, 'Quality Control in Spinning', Coimbatore, **1994**.
5. ATIRA, 'Process Control in Weaving'.

KNITTING TECHNOLOGY

Subject Code: BTEX1-626	**LT P C** **3 1 0 4**	**Duration-40 Hours**

UNIT– I (5 Hours)

BASIC concept of Knitting: Basic warp and weft knitting. Difference between warp and weft knitting. Classification of knitting machine and their application. Comparison of knitted and woven fabrics.

UNIT– II (15 Hours)

WEFT KNITTING:

Study Of Knitting Elements: Types and specifications of needles. Functions of sinkers. Basic knitting action of Beard, Latch and Compound needles

Study of Different Types of Stitches: knit, tuck and float and their effects on fabric properties and structures.

Knitting Cam Systems for Plain, Rib, Interlock and Purl structures. Machine and mechanism for producing basic structures viz. - Plain, Rib, Interlock and Purl and their derivatives.

Properties & Uses of different types of weft knitted fabrics. **Introduction to Patterning** in Circular knitting machine: General concept, Four cam track system, Pattern wheel and Pattern drum and design area calculations. Electronic needle selection. Computer controlled knitting machines.

Hand Operated Flat V-bed Knitting Machine and its cam system.

UNIT– III (10 Hours)

WARP KNITTING:

Study of Knitting Elements in Tricot and Raschel knitting machine and loop formation processes. **Pattern mechanism**, development of designs and properties of different warp knitted fabrics. Uses of warp knitted fabrics. Study of Let-off and take-up mechanisms.

UNIT– IV (10 Hours)

Concept of Loop Length and their effect on fabric structure & properties. Control of loop length and Positive Feed devices.

Basic study of knitting tensioning devices and stop **motions**.

Calculations: Production calculations of knitting machines and fabric weight in g/m2. Calculations of wales and courses per inch from k-factors. Tightness Factor and related calculations.

Recommended Books

1. D.J. Spencer, ‘Knitting Technology’, 3rd Edn., Woodhead Publishing Limited, England, **2001**.
2. S.C. Ray, ‘Fundamentals and Advances in Knitting Technology’, Woodhead Publishing India Limited, New Delhi, **2013**.
3. C. Mazza and P. Zonda, ‘Knitting: Reference Book of Textile Technologies’, 2nd Edn,, ACIMIT, Italy, **2001**.
4. J.E. Booth, ‘Textile Mathematics’, Volumes – 3, Textile Institute, Manchester, **1975.**

TEXTILE TESTING-II

Subject Code: BTEX1-627 **LT P C** **Duration-40 Hours**
3 1 0 4

UNIT-I (5 Hours)

Testing of yarn: Innovations in yarn testing instruments (dynamic, continuous and on-line testing of yarn quality).

UNIT-II (18 Hours)

Testing of Fabric: Measurement of fabric dimensions and other physical properties such as thickness, weight, crimp, shrinkage, air-permeability, thermal properties, wettability, water proof ness, and flame resistance, Fabric low stress mechanical properties such as smoothness, stiffness, softness and shear, drape behavior. Test related to fabric appearance such as pilling, crease recovery. Fabric handle and factors influencing it, fabric comfort. Serviceability testing parameters such as abrasion resistance, fabric strength, tear strength, bursting strength test, honey dew, stickiness measurement, assessment of barre and other form of fabric defects.

UNIT-III (7 Hours)

Testing of Garments: Tests related to garment appearance and performance such as measurement of seam pucker, seams slippage and seam strength etc.

UNIT-IV (10 Hours)

Statistical Techniques: Concept of reproducibility and repeatability, methods pertaining to fibre, yarn and fabric testing, concept of quality, quality assurance, textile product leveling, international quality parameters and standards like Uster standards and ASTM.

Recommended Books:

1. B.P. Saville, 'Physical Testing of Textiles', Woodhead Publishing Ltd., Cambridge, **2002**.
2. J.E. Booth, 'Principles of Textile Testing', CBS Publishers and Distributors, New Delhi, **1999**.
3. P. Angappan and R. Gopalakrishnan, 'Textile Testing', SSM Institute of Textile Technology, Komarapalayam, **2002**.
4. A. Basu, 'Textile Testing', SITRA, Coimbatore, **2002**.
5. V.K. Kothari, 'Textile Fibers: Developments and Innovations', IAFL Publications, New Delhi, **2000**.
6. V.K. Kothari, 'Progress in Textile: Science & Technology', Vol. 1, Testing & Quality Control, IAFL Publications, New Delhi, **1999**.

LAB X: KNITTING TECHNOLOGY

Subject Code: BTEX 1-628 **LT P C** **Duration-20 Hours**
0 0 2 1

At least 10 experiments are to be performed by each student

1. List of Experiments.
2. To study the path of yarn through plain knitting machine.
3. To study the different knitting elements including the cam system.
4. To study the driving mechanism of Circular Knitting Machine.
5. To study the cloth take-down mechanism of Circular Knitting Machine.

6. To study the rib knitting m/c including arrangement of dial and cylinder needles, cam system and driving mechanism.
7. To study the Interlock knitting m/c including arrangement of dial and cylinder needles, cam system & driving mechanism.
8. To study cam system of V - bed Flat Knitting Machine.
9. To study passage of yarn of Hand Operated V - bed Flat Knitting Machine.
10. Preparation of Fabric samples (rib, circular, half cardigan and full cardigan in V-bed rib knitting machine.
11. To study the effect on loop length with the change in cam setting in Single Feeder Circular Knitting Machine.
12. To study the Positive Feed Device (IRO) on a Circular Knitting Machine.
13. To analyze plain, rib and Interlock knitted fabrics and their derivatives (course per inch, wales per inch, loop length, GSM & needle diagram).

LAB XI: TEXTILE TESTING-II

Subject Code: BTEX 1-629	**LT P C** **0 0 2 1**	**Duration-20 Hours**

At least 10 experiments are to be performed by each student

1. Classmate fault analysis (yarn fault classifying system)
2. Determine coefficient of friction of a spun yarn and see the effect of waxing on coefficient of friction.
3. Characterize a woven fabric with respect to its dimensional properties.
1. thread density
2. yarn number
3. yarn crimp
4. weave
5. cover factor
6. Areal density
7. skewness
8. Thickness
2. Determine the tensile strength and elongation of a woven fabric and compare the Load-elongation curve with Non-woven and knitted fabric.
3. Determine the tear resistance of a fabric using Elmendorf Tear Tester.
4. Determine the bursting strength of a fabric on a hydraulic bursting tester.
5. Determine the abrasion resistance of a fabric.
6. Determine the pilling propensity of a fabric.
7. Determine the crease recovery of fabric and observe effect of loading time & recovery time on crease recovery.
8. Determine the Drape coefficient of a fabric sample.
9. Determine the compression property of a fabric (thickness).
10. Determine the Air permeability, water permeability and water repellency of a fabric.
11. Determine the stiffness of a fabric, knitability of hosiery yarn.

KINEMATICS OF TEXTILE MACHINES

Subject Code : BTEX 1-730 **LT P C** **Duration-40 Hours**
3 1 0 4

UNIT – I (10 Hours)

Machine elements and drives Introduction to drives, selection of drives, primary machine elements, special purpose drives and devices

Belt drives

Types of drives, selection of drives; Flat belt- leather and reinforced belts, analysis of belt tensions, positions of slack and tight sides, condition for maximum power transmission, selection of belt and pulley diameter, V belt- construction, force analysis; Round belt-friction spinning machine; Clutching action in card; Variable speed drives in textile machines- cone and stepped pulleys, conical discs; Adjustment of belt tensions- movable motor in main drives of textile machines, tension pulleys in card and friction spinning machine; Comparison of flat and V belts; Applications of belt drives in textile machines.

UNIT – II (15 HOURS)

Gears

Design aspects of gears nomenclature, basic relationship; conjugate action; Involute properties- involute profile of teeth; Construction of tooth with involute profile; Contact ratio-arc of action; Pressure angle; Interference- elimination of interference, periodic faults in fibre assemblies- defective gears; back lash; Internal gears & rack and pinion in textile machines; lubrication of gears, Helical gears- notation of hand, Parallel helical gears- geometry, force analysis; thrust loads; Crossed helical gears- card & roving machines; Worm gears- features, terminology, single and double envelop worms; Applications of helical, bevel & worm gears in textile machines.

Gear Trains

Gear trains- simple, compound, reverted; Epicyclic tabulation and formula methods; two degrees of freedom; Epicyclic gear trains in roving machine- bobbin diameter and speeds of bobbin, roving stretch, relation between bobbin speed and bottom cone pulley speed.

UNIT – III (15 HOURS)

Cone Pulleys

Cone pulleys in roving machine- design aspects, steps to design, hyperbolic and straight cone pulleys, shifting of belt, belt slippage and corrections for belt position, belt shifting mechanism for straight cone pulleys, finer adjustment of belt shifting; Cone pulleys for piano-feed regulation.

Brakes

Mechanical brakes- block brake with short shoe, analysis of forces acting on drum, Block brake in lap former; Pivoted block brake with long shoe, spindle brake; brake on warp beam, Internal expanding brake; Band brakes, brake for warp let-off, differential band brake; disk brakes,

UNIT-IV (5 HOURS)

Bearings

Sliding contact bearings-types, Lubrication in bush bearings- thick & thin film lubrication, Coefficient of friction in boundary & hydrodynamic regions, hydrostatic & hydrodynamic bearings; Types of ball and roller bearings, Applications of rolling contact bearings in textile machines.

Cam Devices

Classification of cam mechanisms; Design and profile of tappet devices in shedding mechanism in power loom.

Recommended Books:

1. N. Gokarnashan, 'Mechanics and Calculation of Textile Machinery', Woodhead Publishing India, Delhi, **2015.**
2. G. Nagarajan, 'Textile Mechanisms in Spinning and Weaving machines', Woodhead Publishing India, Delhi, **2015.**
3. S.S. Ratan, 'Theory of Machines'.
4. J.E. Booth, 'Textile Mathematics', Volumes – 2 & 3, Textile Institute, M.

MECHANICS OF TEXTILE PROCESSES

Subject Code: BTEX 1-832 **LT P C** **Duration-40 Hours**
3 1 0 4

UNIT-I (4 Hours)

Forces acting on fibre during opening and cleaning processes. Analysis of piano feed regulating motion. Design of Cone drums for Scutcher. Evaluation of Blow Room performance.

UNIT-II (20 Hours)

Mechanics of fibre entanglement and hook formation during carding. Degree of combing in carding process. Theories of carding. Forces acting in carding zone. Analysis of flat actions; opening, cleaning, accumulation of flat strip on stationary flat. Carding Index. Transfer mechanism of fibres, Doffing arc, Analysis of its significance. Analysis of stripping process. Cylinder load and transfer efficiency. Configuration and estimation of degree of disorder. Effect of different parameters on hook formation,

UNIT-III (6 Hours)

Fibre straightening & hook removal in roller drafting. Mechanism of package building and twisting in speed frame. Design of Cone drums for roving frame. Differential gearing in Roving frame. Balloon theory in spinning. Analysis of forces in yarn & traveller. Analysis of yarn tension during unwinding.

UNIT-IV (10 Hours)

Kinematics of sley and heald motion. Shed depth diagram. Shedding cam design. Mathematical treatment of picking. Friction and impactal checking with swell. Theoretical understanding of causes of pick variation by beat-up force, Bumping condition.

Recommended Books:

1. C.A. Lawrence, 'Fundamentals of Spun Yarn Technology', CRC Press, **2003**.
2. W. Klein, 'The technology of Short-Staple Spinning', Textile Institute, **1986.**
3. J.E. Booth, 'Textile Mathematics', Textile Institute, **1975**.
4. M.H. Mohamed, 'Weaving: Conversion of Yam to Fabric', Merrow Publishing Co. Ltd., **1992**.
5. R. Marks and A.T.C Robinson, 'Principles of Weaving', Textile Institute, **1976**.

MILL PLANNING AND MANAGEMENT

Subject: BTEX1-833	LT P C 3 1 0 4	Duration-40 Hours

UNIT -I (8 Hours)

Introduction: Introduction to mill planning and management, Functions of management, Forms of business organizations, Mill organization.

UNIT- II (10 Hours)

Mill Location: Mill location and site selection, Concept, Various factors affecting plant location.

Factory Buildings: Benefit of good buildings, Shape of factory buildings, Different types of factory building for Textile Mills and their advantages and disadvantages.

Plant Layout: Objectives of good plant layout, Types of plant layout, Plant layout Procedure, Calculation for different machines required and lay-out plan for Spinning, Weaving, and chemical processing.

UNIT-III (12 Hours)

Air Conditioning and Humidification: Air conditioning and humidification in Textile Mills, different measurements of underground duct for air-conditioning, calculations of total heat, air circulation required etc. Different terms and definitions like Dry Bulb Temp, Wet bulb temp. humidity ratio etc. Basic concept about Psychometric chart, different humidification systems used in Textile Mills.

Material Handling: Functions and Principles of material handling, Selection of material handling equipment, types, advantages, different terms related to it, ways to reduce material handling expenditure.

Lighting: Lights, different basic terms related to lighting calculations, different lamp shades and its uses. Concept of room index, concept of height and distance ratio related to lighting, calculations on lamp numbers and positioning depending on required illumination level etc.

UNIT- IV (10 Hours)

Working environment: Different measures of good working environment. Brief Idea about Environmental Pollution from textile industry and Its Control.

Noise and its Control: Different types of Noise, primary idea about dB and different standards of it for different departments, Different remedial measures to minimize noise of different department.

Cost: Different costs, Elements of cost, Costing the products, Method of selection of cotton to minimize mixing cost, yarn selling price, conversion cost, cost reduction techniques, impact of end breaks in ring spinning on productivity and cost.

Recommended Books:

1. O.P. Khanna, Industrial Engineering and Management, Dhanpat Roy Publications, New Delhi, India, **2009**.
2. P.R. Lord, Hand Book of Yarn Production, Wood Head Publishing, Cambridge, England, **2003**.
3. K. Aswathapa, K.S. Bhat, ‘Production and Operation Management’, Himalayan Publishing House, Banglore, India, **2002**.
4. D.M. Parate,, ‘Noise in Loom-Shed: Analysis and Remedies’, Man Made Textile in India, **1996**, No.187-189.

5. S.K. Chinta, A.I. Washif, C.D. Kane and J.R. Desai, ‘Noise Pollution’, Colourage, **1996**.

PROJECT (PHASE-II)

Subject Code: BTEX1-834	**LT P C** **3 1 0 4**	**Duration-40 Hours**

UNIT-I

A comprehensive problem involving the various technologies of textile engineering should be framed. The students are required to complete their project work and submit a comprehensive report.

NON CONVENTIONAL YARN MANUFACTURE

Subject Code: BTEX 1-656	**LT P C** **3 1 0 4**	**Duration-40 Hours**

UNIT-I (10 Hours)

Introduction: Summary of new spinning processes. Possibilities & limitations use of various spinning processes. Fibre Characteristics required for different, leading spinning Technologies.
Rotor Spinning: Tasks of the rotor spinning machine, Principle of operation, Raw material requirements & preparation, Yarn formation, Specifications of different organs and effect of each on the process and product quality. New developments.

UNIT-II (5 Hours)

Air-jet Spinning: Principle and raw material preparation. Process and machine parameters affecting product quality. Principle of vortex yarn manufacture. Difference between air jet spun and vortex spun yarn structure.

UNIT-III (10Hours)

Friction Spinning: Principle and raw material preparation, process and machine parameters affecting product quality. Difference between DREF-II and DREF-III yarn structures and properties.
Compact Spinning: Principle and raw material preparation. Comparative assessment of the structure and performance with respect to ring yarn.

UNIT-IV (10 Hours)

Other Spinning system: Self twist, twist less, wrap spinning, Air-Vortex spinning, Electrostatic spinning, Core spinning, Siro spinning, Bobtex yarn manufacture, solo spun yarn manufacture. New Developments. Structure and properties of different types of yarns.

Recommended Books:

1. R. Salhotra K. and S.M. Ishtiaque, ‘Rotor Spinning: Its Advantages, limitations and Prospects in India’, 1st Edn., National Information Centre for Textile and Allied Subjects, **1995**.
2. W. Klein, ‘Manual of Textile Technology: New Spinning Systems’, 1st Edn’, The Textile Institute, Manchester, U.K., **1993**.
3. C.A. Lawrence, ‘Fundamentals of Spun Yarn Technology’, 1st Edn., CRC Press LLC, Florida, USA, **2003**.
4. R. Chattopadhyay and S.M. Ishtiaque, ‘Advances in Yarn Manufacturing Process’, Department of Textile Technology’, IIT Delhi, **1991**.

ADVANCED FABRIC STRUCTURE

Subject Code: BTEX 1-657 **LT P C** **Duration-40 Hours**
3 1 0 4

UNIT-I (10 Hours)

Backed Fabric: Type of backed fabric, weaving plans, conditions of dropping and lifting stitching ends/picks, wadded backed fabrics. Gauze & Leno Weaves: Feature of these weaves, method of preparation, weaving plans, types. Extra attachments required and control of these attachments. Methods to control tension over crossing ends.

UNIT-II (10 Hours)

Double Fabric: Objectives of preparation, types, specialties of these types and their weaving plans (self-stitched, center stitched, interchangeable thread/fabric etc.), Principle of Dropping & Sifting of stitching ends/picks. Extra warp and Extra weft figuring: Method Of preparation, comparison of two of two methods. Control over compactness of weaves.

UNIT-III (10 Hours)

Warp & Weft Pile Fabrics: - Terry pile structure, method of production, extra attachments required. All-over pile structures, figuring with pile threads. Card cutting, warp pile fabrics produced on face to face principles, All- over and corded velveteen, weft plushes, figured weft pile fabrics. Tapestry structures: - Warp and weft faced tapestry, structures in single and combination.

UNIT-IV (10 Hours)

Damask and Compound Brocades: - Damask and its preparation. Figured warp rib and multi-weft brocades.

Spool and Gripper Axminster carpets: - Spool axminster system: Spool setting its presentation, loom operation, Tuft insertion. Gripper axaminster system: Selection of pile colours, Tuft insertion and general features. Spool-Gripper system.

Recommended Books:

1. Watson, ‘Advance Watsons Textile Design & Colour’, Butterworth Co. & Publishers Ltd, **1989**.
2. Nisbeth, ‘Grammar of Textile’, **1994**.
3. R. Marks and A.T.C. Robinson, ‘Principles of Weaving’, Textile Institute, **1976**.

PROCESS CONTROL IN TEXTILE CHEMICAL PROCESSING

Subject: BTEX1-658 **LT P C** **Duration-40 Hours**
3 1 0 4

UNIT-I (10 Hours)

Review of different steps of chemical Processing of Textiles. Process parameters involved: - Optimized Process Parameters of each process imparted to textiles in pre-treatment viz. Singeing, desizing, scouring, bleaching, mercerization.

UNIT-II (10 Hours)

Optimized dyeing parameters for dyeing for printing of different fibres through various styles. Optimized finishing parameters to impart various finishes on different fibres. Process parameters/process modification/any other changes.

UNIT-III (10 Hours)

Change in quality due to selection of impure starting chemicals/faulty fabric/machine handing. Analysis of various chemical processing steps in terms process and quality control. Methods to asses quality of processed product after every stage of processing and that of final product.

UNIT-IV (10 Hours)

Standardization of instruments/machineries, analysis of colour to check impurity percentage, evaluation of chemicals to check their efficiencies.

Recommended Books

1. 'ATIRA's Process & Quality Control in Chemical Processing'.

NON-WOVEN TECHNOLOGY

Subject Code : BTEX 1-759 **LT P C** **Duration-40 Hours**
3 1 0 4

UNIT-I (5 Hours)

Introduction to nonwovens, Classification of non-woven fabrics. Raw material - fibre - natural, synthetic, Various industrially produced fibres.

UNIT-II (10 Hours)

Web formation: Dry-laid nonwovens from staple fibres, Wet laid nonwovens, Melt blown technology,

UNIT-III (10 Hours)

Spun bond technology. Needle punched nonwovens, Developments in needle punching machine, Spun lace (hydro entanglement technology), Thermal bonding of nonwoven fabrics.

UNIT-IV (10 Hours)

Chemical bonding of nonwoven fabric: Various types of binder, their properties and formulations, various bonding techniques. Stitch bonding, End uses of non-woven fabric

Recommended Books:

1. Albrecht, Wilhelm, 'Nonwoven Fabrics: Raw Materials, Manufacture, Applications, Characteristics, Testing Processes', Wiley VCH, **2006**.
2. S. Russel, 'Handbook of Nonwovens', Woodhead Publishing, **2006**.

TEXTURING TECHNOLOGY

Subject Code: BTEX 1-760 **LT P C** **Duration-40 Hours**
3 1 0 4

UNIT-I (5 Hours)

Importance of texturing, classification of textured yarns. Methods of texturizing.

UNIT-II (10 Hours)

False twist texturing machines. Properties of False twist textured yarns. Stiffer box crimping. Methods and machines for stuffer box texturizing system. Edge crimping: Methods and machines for edge crimping. Gear crimping.

UNIT-III (5 Hours)

Knit-de-Knit texturizing system. Principle of draw texturizing: draw texturizing machine, machine settings.

UNIT-IV (10 Hours)

Principle and process of Air-jet texturizing. Effects of machine variables on Air-jet textured yarn. Properties of Air-jet textured yarn. Modern developments in Air-jet texturizing. Testing of textured yarns: Strength and elongation test. Degree of texturizing and stability test for textured yarns.

Recommended Books:

1. A.A. Vaidya, 'Production of Synthetic Fibres', 1st Edn., Prentice Hall of India, New Delhi, **1988**.
2. J.W.S. Hearle, L. Hollick and D.K. Wilson, 'Yarn Texturing Technology', Woodhead Publishing Ltd., UK, **2002**.
3. B.C. Goswami, J.G. Martindle and F.L. Scardino, 'Textile Yarns Technology, Structure and Applications', Wiley-Interscience Publication, New York, **1976**.
4. H.F. Mark, S.M. Atlas, E. Cernia, 'Man Made Fibre Science and Technology', 1st Edn., Vol. 1, 2, 3, Science Publishers, New York, **1967.**

GARMENT MANUFACTURING TECHNOLOGY

Subject Code: BTEX 1761 **LT P C** **Duration-40 Hours**
3 1 0 4

UNIT– I (10 Hours)

Brief outlook of garment manufacturing industry and its classification. Concept of garment design and proportion. Functions of Designing Department.

UNIT – II (15 Hours)

Anthropometrics; garment sizing. Pattern making and grading. Principles of marker making; spreading and cutting. Cutting methods. Quality control in cutting room. Stitch classification, seam types and applications. Sewing faults, their causes and remedies. Choice of sewing needles and threads. Different types of sewing machines and their principles. Work aids- folders, presser feet, feeding systems. Outline of fusing and pressing machines.

UNIT- III (10 Hours)

Outline of various Apparel Production Systems and Material Handling. Quality control systems in garment manufacturing. Low stress mechanical properties of fabrics and their effect on garment production sequences. Preliminary ideas on Garment dyeing and finishing**.**

UNIT– IV (5 Hours)

Physiological and psychological aspects of fabric comfort. Heat and moisture relations in clothing.

Recommended books:-

1. R. Nayak & R. Padhye, 'Woodhead Publishing Limited, Cambridge, UK, **2015**.

2. G. Cooklin, ‘Introduction to Garment Manufacture’, Blackwell Sciences, UK, **2001**.
3. Colovic Gordana, ‘Management of Technology Systems in Garment Industry’, Woodhead Publishing, India Ltd., New Delhi, **2011**.
4. T. Brackenbury, ‘Knitted Clothing Technology’, Blackwell Sciences, UK.
5. R.M. Liang & J. Webster, ‘Stitches and Seams’, Textile Institute, Manchester, UK, **1994**.
6. S. Das, ‘Quality Characterization in Apparel’, Woodhead Publishing India Ltd., New Delhi, **2009**.
7. A. Das & R. Alagirusamy, ‘Science in Clothing Comfort’, Woodhead Publishing India Ltd., New Delhi, **2010**.

MARKETING & FINANCIAL MANAGEMENT IN TEXTILES

Subject Code: BTEX1-762 **LT P C** **Duration-40 Hours**
3 1 0 4

UNIT-I (10 Hours)

MARKETING MANAGEMENT: Marketing- its definition & core concepts. Marketing Management, Production concept. Product concept. Selling concept, Marketing and societal Marketing concept. Marketing Information system. Marketing Research Process and various research designs. Consumers

UNIT-II (10 Hours)

Behavior, factoring affecting CB, Buyer decision Process and Type of Buying Behavior. Marketing Mix: Product-Levels of Product, Product hierarchy, stages in New Product development. Product life cycle & its stages. Product Mix, Product time. Branding - Packaging and labeling. Price - Pricing strategies & setting the price. Place - Channels of distribution, functions & its flow. Promotion -

UNIT-III (10 Hours)

Mix: Advertising, sales Promotion. Personnel selling & Public relations, Factors in setting the Promotion mix. With supporting examples from Textile Industry.

Financial Management: Management Accounting - Accounting concepts and financial statements. Various finance functions & financial objectives of firms. Sources of finance cost classification and cost of capital. Working capital

UNIT-IV (10 Hours)

Management - Concept of cross & net W C, classification of working capital. Factors determining the requirement of working capital. Capital Structure - Factors affecting capital structure. Capital Budgeting - its importance & methods of capital Budgeting.

Recommended Books:

1. Philip Kotler, ‘Marketing Management’.
2. I.M. Pandey, Financial Management’.

POST SPINNING OPERATIONS

Subject Code: BTEX 1-763 **LT P C** **Duration-40 Hours**
3 1 0 4

UNIT- I (5 Hours)

Objectives: Objectives of post spinning operations.

UNIT- II (12 Hours)

Drawing & Stretching: Stretching or drawing, drawing conditions, phenomenon of necking. Influences of drawing conditions on the structure and properties of fibres. Machines for stretching continuous filament yarn. Draw warping. Stretching of polyester & acrylic tow. Draw warping. Drawing of tow for production of staple fibre.

UNIT- III (13 Hours)

Heat setting Preliminary heat setting, crimping, drying and final heat setting, cutting & packing of staple fibres. Heat setting, objectives of heat setting. Influence the heat setting process parameters such as time, temperature and tension. Heat setting conditions for polyester polyamide, acrylic and polypropylene.

UNIT- IV (10 Hours)

Texturing: Introduction to texturing. Different methods for texturing, factors influencing properties of false twist, draw textured and air jet textured yarns.

Recommended Books:

1. A.A. Vaidya, 'Production of Synthetic fibres', Prentice hall India Pvt. Ltd., **1988**.
2. 'Texturin', MANTRA.
3. Marks, Atlas, Cernia, 'Man-Made Fibre Sc.& Tech.', Vol.-I, II, III, Interscience Publishers, **1976-68**.
4. Mukherjee, 'Recent Advances in Fibre Science'.

WASTE MANAGEMENT & POLLUTION CONTROL IN TEXTILE INDUSTRIES

Subject Code: BTEX 1-764 **LT P C** **Duration-40 Hours**
3 1 0 4

UNIT-I (10 Hours)

Impact of Man on Environment: The Biosphere, the hydrologic cycle, the nutrient cycle, consequences of population growth, energy problem, pollution of air, water, soil & noise.

UNIT-II (10 Hours)

Air Pollution: Definition, concentration, classification & properties of air pollutants. Emission sources, Effect of air pollution on health, vegetation & material damages. Laws and standards. Basic concept of air pollution control methods & equipment. Role of Textile Industry in creating air pollution. Textile fabric as an air pollution control medium.

UNIT-III (14 Hours)

Water Pollution: Definition & concentrations, classification & properties of water pollutants. Sources of water pollution. Effect of water pollution on health, vegetation & material damages. Laws & Standards. Role of textile industry in creating water pollution, e.g., effluents from sizing, desizing, scouring, bleaching, dyeing & finishing. Character of the effluents from different processes. Methods to control pollution from textile industry effluents. Techniques of effluent treatment.

UNIT-IV (6 Hours)

Noise Pollution: Role of textile industry in creating noise pollution. Measures to reduce noise pollution in textile industry.

Recommended Books:

1. S. Asolekar, 'Environmental problems in Chemical Processing of Textiles', 1st Edn., NCUTE, Department of Textile Technology, IIT-Delhi, **2000**.
2. Padma Vankar, 'Textile Effluents', 1st Edn., NCUTE, Department of Textile Technology, IIT-Delhi, **2002**.
3. B. Edmund, 'The Treatment of Industrial Wastes', 2nd Edn., McGraw-Hill kogaskusha, New Delhi, **1976**.
4. Peavy, Rowe and Tchobanoglous, 'Environmental Engineering', 2nd Edn., McGraw-Hill, Singapore, **1985**.
5. O.P. 'Khanna, Industrial Engg. and Management'.

TECHNICAL TEXTILES

Subject Code: BTEX 1-865	LT P C 3 1 0 4	Duration-40 Hours

UNIT-I (10 Hours)

Introduction: Definition and scope of Technical Textiles, Brief idea about technical fibres, composite materials and uses.

Filtration Textiles: Textiles as filter media. Characteristics of filter material. Basic idea of theory of filtration. Characteristics of fibres to use in different filter media. Application of woven, nonwoven and knitted fabric in filter media.

UNIT-II (11 Hours)

Medical Textiles: Introduction, Classification of Medical textiles, Textiles as hygienic products. Description of different Medical Textiles, Mechanisms of absorption and distribution of liquids in absorbent products like diapers.

Protective Textiles: Introduction to protective clothing, functional requirement of textiles in defense, Brief idea about ballistic protective clothing, Chemical protective clothing, flame retardant fabrics.

UNIT-III (5 Hours)

Sports Textiles: Functional requirement of different types of products. Cords: Method of production and applications.

UNIT-IV (14 Hours)

Geotextiles: Brief idea about geosynthetic. Geogrid, Geomembrane and Geocomposite. Designing and manufacture of geotextiles. Geotextiles properties and test methods. Geotextiles - functions and mechanism in separation, reinforcement, stabilization filtration & drainage. Agricultural application of Textile.

Recommended Books:

1. A.R. Horrocks and S.C. Anand, 'Hand Book of Technical Textile', Woodhead Publishing Ltd, Cambridge, **2002**.

2. G.V. Rao and G.V.S. Raju, ‘Engineering with Geosynthetic’, Tata McGraw Hills Publication, New Delhi., **1990**.
3. Adanaur, Sabit, ‘Wellington Sears Hand book of Industrial Textiles’, Technimic Publishing company Pennsylavania USA., **1995**.
4. V.K. Kothari, ‘Progress in Textile: Science & Technology’, Vol. 3, ‘Technical Textile: Technology’, Developments and Applications, IAFL Publications, New Delhi, **2008**.

HIGH PERFORMANCE AND SPECIALITY FIBRES

Subject Code: BTEX1-866 **LT P C** **Duration-40 Hours**
3 1 0 4

UNIT-I (10 Hours)

Polymerization, spinning and properties of aromatic polyamides, high molecular weight polyester, rigid rod and ladder polymers such as BBL, PBZT, PBO, PBI.

UNIT-II (10 Hours)

Manufacturing of carbon fibres from PAN precursors, viscose and pitch fibres. Glass fibres. Liquid crystal fibres. Gel spinning of polyethylene. Aramids- Introduction, polymer preparation, Spinning, Structure and properties, applications.

UNIT-III (10 Hours)

Hollow and profile fibres, design of spinnerets for such fibres. Membrane technology. Blended and Bicomponent fibres. Medical textiles. Super absorbent fibres.

UNIT-IV (10 Hours)

Plasma modification. Radiation processing. Industrial tapes. Biaxially oriented films and film fibres. Barrier films and coating.

Recommended Books:

1. N.G. Mc Crum, C.P. Buckley and C.B. Bucknall, ‘Principle of Polymer Engineering’, Oxford University Press, New York, **1990**.
2. ‘High Performance Fibres’. Ed. J.W. Stteare, Woodhead Publishing Co., England, **2001**.
3. D. Hull, ‘An Introduction to Composite Materials’, Cambridge University Press, UK, **1981**.
4. H. Broody, ‘Synthetic Fiber Materials’, Longman Scientific and Technical, UK, **1994**.
5. T. Hongu, New fibres, Ellis Horwood, New York, **1990**.

MULTI-FIBRE PROCESS

Subject Code: BTEX1-867 **LT P C** **Duration-40 Hours**
3 1 0 4

UNIT-I (10 Hours)

Survey of established practices for the spinning of man- made fibres using different spinning system with emphasis on fibre and yarn properties and involving engineering principle.

UNIT-II (10 Hours)

Purpose of blending of manmade fibres. Selection of fibre specifications for blending. Measures of blend intimacy. Effect of blend composition & fibre characteristics on properties of blended yarn. Blend mechanics. Advantages & disadvantages of different blending technique. Tinting for a blend.

UNIT-III (10 Hours)

Processing of short & long staple manmade fibres on cotton system of spinning. Spinning of dyed fibres. Spinning of manmade fibres on rotor spinning system.

UNIT-IV (10 Hours)

Processing of long fibres on worsted/woolen system of spinning. Silk reeling. Introduction to twisting & spinning of silk fibres. Introduction to Jute spinning. Jute blending. End uses of jute and jute blended yarn & fabrics.

Recommended Books:

1. K.R. Salhotra, Spinning of Man-Made & its Blend on Cotton System’.
2. R.R. Atkinson, ‘Jute Spinning’.
3. Ya. Lipenkov, ‘Wool Spinning’, Vol.-I, II.
4. ‘Manual of Silk Reeling & Spinning’, F.A.O.

NONCONVENTIONAL FABRIC MANUFACTURE

Subject Code: BTEX1-868	**LT P C** **3 1 0 4**	**Duration-40 Hours**

UNIT-I (10 Hours)

Yarn preparation for shuttle less Weaving: Weft Preparation for shuttle less loom, warping and Sizing. Maximum speed of shuttle loom, Design problem of shuttle Loom, Basic concept in increasing the weft insertion rate in weaving machine.

Projectile Weaving machine: Basic principle of projectile loom, sequence of weft Insertion, cam drive shedding mechanism, beat-up torsion bar Picking system, loom timing, checking of gripper, Let-off and Take-up motion, Tuck-in selvedge formation, returns of gripper. Technical specifications.

UNIT-II (10 Hours)

Air jet weaving machine: Problem of air jet principle of weft Insertion. Path of the yarn in the air jet loom sequence of Weft invention in air jet loom. Design of Elite confuser Guide, Design of profile reed, & relay jet.

Loom Timing: Technical specification. Water-jet: Weft incretion mechanism, quality of warp Required for water- jet, selvedge formation, Environment

Problem in quality of water, Problem of water-jet loom.

Rapier Weaving Machine: Different types of rapier weaving Machines. Weft insertion sequence in rapier weaving process. Different methods to drive the rapier head. Single phase Double acting rapier.

Velocity of the rapier. Loom timing, Technical Specification of rapier weaving machine.

UNIT-III (10 Hours)

Multiphase Weaving Machine: Basic concept of multiphase weaving. Shedding operation in warp way and weft way Multiphase loom. Advantages & disadvantages of multiphase Weaving process.

Circular Loom: Yarn path & Weft incretion in Circular loom.

Narrow Fabric Loom: Different type of narrow fabric mechanism of weft insertion and fabric formation in narrow fabric weaving machine.

Carpet Weaving: Woven carpet, its design, and process of manufacturing, (wilt on & Brussels). Technical specifications and its uses.

UNIT-IV (10 Hours)

Nonwoven Technology: Fibers used in non-woven, on woven Fabric and its classification reason for development, Web making (Parallel, transverse, cross and random lay Web). Elementary idea about manufacturing adhesive bonded and needle punch fabric. Uses of nonwovens.

Multiracial Warp Knitted Fabric: Concept of multiracial Fabric. Method of manufacturing the multiracial Warp knitted Fabric, its uses as Technical Textiles.

Recommended Books:

1. Albrecht, Wilhelm, ‘Nonwoven Fabrics: Raw Materials, Manufacture, Applications, Characteristics, Testing Processes’, Wiley VCH, **2006**.
2. S. Russel, ‘Handbook of Nonwovens’, Woodhead Publishing, **2006**.
3. R. Marks and A.T.C. Robinson, ‘Principles of Weaving’, Textile Institute, **1976**.
4. Banerjee, Prabir Kumar, ‘Principles of Fabric Formation’, CRC Press, **2015**.
5. P.R Lord & M.H. Mohamod, ‘Weaving: Conversion of Yam to Fabric, Merrow Publishing Co. Ltd., **1992**.
6. V. Choogin and Valeriy, ‘Mechanisms of Flat Weaving Technology, Woodhead Publishing, **2013**.

B. TECH. MECHANICAL ENGINEERING (2nd YEAR)

Total Contact Hours = 34 Total Marks = 1100 Total Credits = 26

SEMESTER 3rd		Contact Hrs			Marks			Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
BMEE1- 301	Strength of Material-I	3	1	0	40	60	100	4
BMEE1-302	Theory of Machines-I	3	1	0	40	60	100	4
BMEE1-303	Machine Drawing using CAD	1	0	4	40	60	100	3
BMEE1-304	Applied Thermodynamics-I	3	1	0	40	60	100	4
BMEE1-305	Manufacturing Processes	2	0	0	40	60	100	2
BSOS0-F91	Soft Skill - I	0	0	2	60	40	100	1
BMEE1-306	*Workshop Training	0	0	4	60	40	100	2
BMEE1-307	Strength of Material Lab.-I	0	0	2	60	40	100	1
BMEE1-308	Applied Thermodynamics Lab--I	0	0	2	60	40	100	1
BMEE1-309	Manufacturing Processes Lab	0	0	2	60	40	100	1
Department Elective - I		3	0	0	40	60	100	3
BMEE1-356	Non - Conventional Energy Recourses							
BMEE1-357	Industrial Engineering							
BMEE1-358	Product Design and Development							
Total	**Theory = 6 Labs = 4**	**15**	**3**	**16**	**540**	**560**	**1100**	**26**

**Workshop training will be imparted in the institution at the end of 2nd semester for four-week duration*

(Minimum 36 hrs. per week) industrial tour will also from the part of this training.

MRSPTU

Total Contact Hours = 32 Total Marks = 1100 Total Credits = 27

SEMESTER 4th		Contact Hrs			Marks			Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
BMEE1- 410	Strength of Material-II	3	1	0	40	60	100	4
BMEE1- 411	Theory of Machines-II	3	1	0	40	60	100	4
BMEE1- 412	Fluid Mechanics	3	1	0	40	60	100	4
BMEE1- 413	Applied Thermodynamics-II	3	1	0	40	60	100	4
BMEE1- 414	Material Science & Metallurgy	3	0	0	40	60	100	3
BSOS0 – F92	Soft Skill – II	0	0	2	60	40	100	1
BMEE1- 415	Theory of Machines-II Lab	0	0	2	60	40	100	1
BMEE1- 416	Fluid Mechanics Lab	0	0	2	60	40	100	1
BMEE1- 417	Applied Thermodynamics-II Lab	0	0	2	60	40	100	1
BMEE1- 418	Material Science & Metallurgy Lab.	0	0	2	60	40	100	1
Department Elective - II		3	0	0	40	60	100	3
BMEE1- 459	Composite Material							
BMEE1- 460	Welding Technology							
BMEE1- 461	Materials Management							
Total	**Theory = 6 Labs = 5**	**18**	**4**	**10**	**540**	**560**	**1100**	**27**

Total Contact Hours = 27 Total Marks = 1200 Total Credits = 24

SEMESTER 5th		Contact Hrs			Marks			Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
BMEE1- 519	Design of Machine Element-I	2	0	0	40	60	100	2
BMEE1- 520	Mechanical Measurement and Metrology	3	0	0	40	60	100	3
BMEE1- 521	Automobile Engineering	3	0	0	40	60	100	3
BMEE1- 522	Industrial Automation & Robotics	3	0	0	40	60	100	3
BSOS0 –F93	Soft Skill – III	0	0	2	60	40	100	1
BMEE1- 523	Design of Machine Element-I Lab	0	0	2	60	40	100	1
BMEE1- 524	Mechanical Measurement and Metrology Lab.	0	0	2	60	40	100	1
BMEE1- 525	Automobile Engineering Lab	0	0	2	60	40	100	1
BMEE1- 526	Industrial Automation & Robotics Lab.	0	0	2	60	40	100	1
BMEE1-527	*Industrial Training	0	0	0	60	40	100	2
Department Elective – III		3	0	0	40	60	100	3
BMEE1-562	Fluid Mechanics-II							
BMEE1-563	Tool Design							
BMEE1-564	Finite Element Method							
Open Elective – I		3	0	0	40	60	100	3
Total	**Theory = 6 Labs = 5**	**17**	**0**	**10**	**600**	**600**	**1200**	**24**

**Industrial training to be imparted at the end of 4th semester for six weeks*

MRSPTU

Total Contact Hours = 27 Total Marks = 1000 Total Credits = 23

SEMESTER 6th		Contact Hrs			Marks			Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
BMEE1- 628	Design of Machine Element-II	2	0	0	40	60	100	2
BMEE1- 629	Heat Transfer	3	1	0	40	60	100	4
BMEE1- 630	Fluid Machinery	3	1	0	40	60	100	4
BSOS0 – F94	Soft Skill - IV	0	0	2	60	40	100	1
BMEE1- 631	Design of Machine Element-II Lab	0	0	2	60	40	100	1
BMEE1- 632	Heat Transfer Lab	0	0	2	60	40	100	1
BMEE1- 633	Fluid Machinery Lab	0	0	2	60	40	100	1
Department Elective – IV (Select any one)		3	0	0	40	60	100	3
BMEE1-665	Operation Management							
BMEE1-666	Industrial Tribology							
BMEE1-667	Modelling & Simulation							
BMEE1-668	Mechatronics							
Department Elective – V (Select any one)		3	0	0	40	60	100	3
BMEE1-669	Management Information System							
BMEE1-670	Solar Energy							
BMEE1-671	Energy Conservation & Management							
BMEE1-672	Industrial Automation and Robotics							
Open Elective – II (Select any one)		3	0	0	40	60	100	3
Total	**Theory = 6 Labs = 4**	**17**	**2**	**8**	**480**	**520**	**1000**	**23**

Total Contact Hours = 18 Total Marks = 600 Total Credits = 15

SEMESTER 7th		**Contact Hrs**			**Marks**			**Credits**
Subject Code	**Subject Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
BMEE1-734	Refrigeration & Air Conditioning	3	1	0	40	60	100	4
BMEE1-735	Refrigeration & Air Conditioning Lab.	0	0	2	60	40	100	1
BMEE1-736	Project	0	0	6	60	40	100	2
BMEE1- 737	*Industrial Training	0	0	0	60	40	100	2
Department Elective – VI (Select any one)		3	0	0	40	60	100	3
BMEE1-773	Mechanical Vibration							
BMEE1-774	Non Traditional Manufacturing							
BMEE1-775	Heat Exchanger Design							
Department Elective – VII (Select any one)		3	0	0	40	60	100	3
BMEE1-776	Maintenance Engineering							
BMEE1-777	Non Destructive Testing							
BMEE1-778	Automotive Control							
Total	**Theory = 4 Labs = 2**	**9**	**1**	**8**	**300**	**300**	**600**	**15**

**The industrial Training to be imparted at the end of 6th semester for Eight weeks*

Total Contact Hours = 15 Total Marks = 500 Total Credits = 15

SEMESTER 8th		**Contact Hrs**			**Marks**			**Credits**
Subject Code	**Subject Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
BMEE1-838	CAD/CAM	3	1	0	40	60	100	4
BMEE1-839	Operation Research	3	1	0	40	60	100	4
BMEE1-840	Seminar	0	0	2	100	0	100	1
Department Elective – VIII (Select any one)		3	0	0	40	60	100	3
BMEE1-879	Optimization Technique							
BMEE1-880	Lean Manufacturing							
BMEE1-881	Group Technology							
Department Elective – IX (Select any one)		3	0	0	40	60	100	3
BMEE1-882	Statistical Quality Control							
BMEE1-883	Additive Manufacturing							
Total	**Theory = 4 Labs = 1**	**12**	**1**	**2**	**260**	**240**	**500**	**15**

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Total Credits: 25 + 25 + 26 + 27 + 24 + 23 + 15 + 15 = 180

STRENGTH OF MATERIALS – I

Subject Code: BMEE1- 301 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

Course Objective/s and Expected Outcome/s: The course is designed to understand the basic concepts of stress, strain and their variations due to different type of loading. The concept of mechanical properties, Poisson's ratio, bulk modulus, elastic modulus, modulus of rigidity, combined stress and strain, principal stress, principal plane, bending moment and shear force in beams under various loading conditions, understanding of torsional shear stress in solid and hollow shaft; principal and maximum shear stress in a circular shaft subjected to combined stresses, forces and reactions in frames, stresses in struts and columns subjected to axial load; bending stress, slope and deflection under different loading and supporting conditions.
After studying the course, the student will be able to analyze different stresses, strains and deflection for designing a simple mechanical element e.g. beams, shafts, columns and frames under various loading conditions.

UNIT-I (12 Hrs.)

Stresses and Strains: Basic definitions: Stress and strain and their types, fatigue, creep, ductility, brittleness, hardness, toughness, impact strength, stress concentration, Hook's law, longitudinal and lateral strain, Poisson's ratio, stress-strain diagram for ductile and brittle materials, extension of a bar with or without self-weight, bar of uniform strength, elastic constants and their significance, Young's modulus of elasticity, modulus of rigidity and bulk modulus, thermal stress and strain in single and compound bars. Two dimensional stress system, stress at a point on a plane, principal stresses and principal planes, Mohr's circle of stress. Generalized Hook's law, principal stresses related to principal strains.

UNIT-II (11 Hrs.)

Bending Moment (B.M) and Shear Force (S.F.) Diagrams: S.F and B.M definitions; relation between load, shear force and bending moment; B.M and S.F diagrams for cantilevers, simply supported beams with or without overhangs, and calculation of maximum B.M and S.F and the point of contra flexure under the following loads:
a) Concentrated loads
b) Uniformly distributed loads over the whole span or part of span
c) Combination of concentrated and uniformly distributed load
d) Uniformly distributed load (optional)
e) Application of moments

Bending Stresses in Beams: Derivation of bending equation and its application to find stresses in beams of rectangular, circular and channel, I and T- sections. Flexural Rigidity, combined direct and bending stresses in afore-mentioned sections, stresses in composite / flitched beams**.**

UNIT–III (12 Hrs.)

Slope and Deflection: Relationship between moment, slope and deflection; double integration method, Macaulay's method and use of these methods to calculate slope and deflection for:
a) Cantilevers
b) Simply supported beams with or without overhang
c) beams under concentrated loads, uniformly distributed loads and their combination.

Columns and Struts: Introduction of columns and struts, end conditions, failure of columns, Euler's formula, empirical formulas to find buckling load.

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UNIT-IV (10 Hrs.)

Torsion: Derivation of torsion equation and its application to the hollow and solid circular shafts. Torsional rigidity, Angle of twist, combined torsion and bending of circular shafts; Principal stress and maximum shear stresses under combined loading of bending and torsion.

Frames: Introduction and types of frames, assumptions made in finding out the forces in frame, reactions of the supports of a frames, analysis of frames: method of joints, method of sections, graphical methods and its applications.

Recommended Books

1. Sadhu Singh, 'Strength of Materials', Khanna Publishers.
2. Kirpal Singh, 'Mechanics of Materials', Standard Publishers.
3. G.H. Ryder, 'Strength of Materials', Macmillan India Ltd.
4. S.S. Rattan, 'Strength of Materials', Tata McGraw Hills.
5. Timoshenko and Gere, 'Mechanics of Materials', CBS Publishers.
6. E.P. Popov, 'Mechanics of Materials', Pearson Education.

THEORY OF MACHINES-I

Subject Code: BMEE1-302	**L T P C** **3 1 0 4**	**Duration: 45 Hrs.**

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Learning Objectives & Learning Outcomes:

The course under Theory of Machine-I has been designed to cover the basic concepts of kinematic aspects of mechanical machines and major parts used in running of the machines. The students will understand the basic concepts of machines and able to understand constructional and working features of important machine elements. The students should be able to understand various parts involved in kinematics of machines. The students shall also be able to understand requirements of basic machine parts which would help them to understand the design aspects of the machine parts

UNIT-I (12 Hrs.)

Basic Concept of Machines: Link, Mechanism, Kinematic Pair and Kinematic Chain, Principles of Inversion, Inversion of a Four Bar Chain, Slider-Crank-Chain and Double Slider-Crank-Chain. Graphical and Analytical methods for finding: Displacement, Velocity, and Acceleration of mechanisms.

Belts, Ropes and Chains: Flat and V-belts, Rope & Chain Drives, Idle Pulley, Intermediate or Counter Shaft Pulley, Velocity Ratio, Crowning of Pulley, Loose and fast pulley, stepped or cone pulleys, ratio of tension on tight and slack side of belts, Length of belt, Power transmitted by belts, Creep and Slip, Centrifugal Tensions

UNIT-II (11 Hrs.)

Cams: Types of cams and follower, definitions of terms related with cams. Displacement, velocity and acceleration diagrams for cam followers. Analytical and Graphical design of cam profiles with various motions (SHM, uniform velocity, uniform acceleration and retardation, cycloidal Motion).

UNIT-III (11 Hrs.)

Friction Devices: Types of brakes function of brakes. Braking of front and rear tyres of a vehicle, Determination of braking capacity, Types of dynamometers, (absorption, and transmission).

Flywheels: Turning moment and crank effort diagrams for reciprocating machines' Fluctuations of speed, coefficient of fluctuation of speed and energy, Determination of mass and dimensions of flywheel.

UNIT-IV (11 Hrs.)

Governors: Function, Porter and Proell governors, Hartnell and Willson-Hartnell spring loaded governors, Sensitivity, stability, isochronism and hunting of governor, Governor effort and power, controlling force curve, effect of sleeve friction.

Recommended Books

1. S.S. Rattan, 'Theory of Machines', Tata McGraw Hill, New Delhi.
2. Jagdish Lal, 'Theory of Machines and Mechanisms', Metropolitan Book Co.
3. V.P. Singh, 'Theory of Machines', Dhanpat Rai Publication.

MACHINE DRAWING USING CAD

Subject Code: BMEE1-303 **L T P C** **Duration: 43 Hrs.**
1 0 4 3

UNIT-I (10 Hrs.)

Introduction to Mechanical Drawing: Classification of drawings, Principles of drawing, Conventions according to IS, Sectional Views and rules of sectioning, Machining and Surface Finish symbols indicating tolerances in dimensioning, Detailed Drawings. Manual Drafting and Computer Aided Drafting using s/w like Pro-desktop or Pro-E or AutoCAD, Standards and Types.

UNIT-II (08 Hrs.)

Machine Components: Practical applications and working of Screw fasteners, Keys cotters and joints, Shaft couplings, Pipe joints and fittings, Riveted joints and welded joints.

UNIT-III (11 Hrs.)

Assemblies: Bearings (Plumber Block, Footstep, Swivel), Hangers and Brackets, Steam and I.C. Engine Parts, Machine components, Valves.

Case Studies in Computer Plots and Industrial Blueprints.

UNIT-IV (14 Hrs.)

Computer Aided Drafting (CAD)

Using s/w like Pro-E or AutoCAD) of:

(a) Machine Components: Screw fasteners, Keys cotters and joints, Shaft Couplings, Pipe joints and fittings, Riveted joints and welded joints.
(b) Assemblies: Bearings (Plumber Block, Footstep, Swivel), Hangers and Brackets, Engine Parts, Machine components, Valves. Exercise in computer plots of drawings/ blueprints.

Learning Outcomes

The students will be able to:

1. Use standards used in machine drawing of machine components and assemblies.
2. Create and read production drawings for mechanical components and systems and deduce their functions.
3. Use CAD tools for making drawings of machine components and assemblies.
4. Assemble components given only component drawings and make

Sectioned views of the mechanical system assembly and interpret it's working.

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Recommended Books

1. P.S. Gill, 'Machine Drawing', S.K. Kataria and Sons, **2013.**
2. N.D. Bhatt, 'Machine Drawing', Charotar Publishing House, **2008.**
3. G. Pohit, 'Machine Drawing with AutoCAD', Pearson Education Asia, **2007.**
4. R.K. Dhawan, 'Machine Drawing', S. Chand & Company Limited, **2003.**
5. K.L. Narayana, P. Kannaiah and K.V. Reddy, 'Machine Drawing', New Age International Publishers, **2002.**

APPLIED THERMODYNAMICS –I

Subject Code: BMEE1-304 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

Unit –I

Combustion

Combustion Equations (Stoichiometric and non- Stoichiometric). Combustion problems in Boilers and IC engines/Calculations of air fuel ratio, Analysis of products of combustion, Conversion of volumetric analysis into gravimetric analysis and vice-versa, Actual weight of air supplied, Use of mols, for solution of combustion problems, Heat of formation, Enthalpy of formation, Enthalpy of reaction, Adiabatic flame temperature.

IC Engines

Introduction: Actual Engine Indicator diagrams and valve-timing diagrams for two stroke and four stroke S.I. and C.I. Engines; Construction and Working Principle of Wankel rotary engine; Principle of simple carburator, Injection systems in Diesel and Petrol Engines (Direct Injection, MPFI in SI and CI Engines, respectively). Essential requirements for Petrol and Diesel Fuels. Theory of combustion in SI and CI Engines; Various stages of combustion; Pressuretime/crank - Angle diagrams; Various phenomenon such as turbulence, squish and swirl, dissociation, pre-ignition/auto- ignition, and after burning etc.; Theory of knocking (ie,. detonation) in SI and CI Engines; Effect of engine variables on the Delay Period in SI and CI engines; Effect of various parameters on knock in SI and CI Engines; Methods employed to reduce knock in SI and CI Engines; Octane and Cetane rating of fuels; Knockmeter; Dopes and inhibitors; Performance curves/maps of SI and CI Engines; Effect of knocking on engine performance; Effect of compression ratio and air-fuel ratio on power and efficiency of engine; Variation of engine power with altitude; Supercharging and turbo charging of SI and CI Engines; Advantages and applications of supercharging.

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Unit –II

Properties of Steam

Pure substance; Steam and its formation at constant pressure: wet, dry, saturated and super-heated steam; Sensible heat(enthalpy), latent heat and total heat (enthalpy) of steam; dryness fraction and its determination; degree of superheat and degree of sub-cool; Entropy and internal energy of steam; Use of Steam Tables and Mollier Chart; Basic thermodynamic processes with steam (isochoric, isobaric, isothermal, isentropic and adiabatic process) and their representation on T-S Chart and Mollier Charts(h-s diagrams). Significance of Mollier Charts.

Steam Generators

Definition: Classification and Applications of Steam Generators; Water Tube, Fire Tube and Super Critical boilers. Advantages of forced circulation; Description of boiler mountings and accessories; Boiler performance: equivalent evaporation, boiler efficiency, boiler trial and heat balance; Types of draught and Calculation of chimney height.

Unit –III

Vapour Power Cycle

Carnot Cycle and its limitations; Rankine steam power cycle, Ideal and actual; Mean temperature of heat addition; Effect of pressure, temperature and vacuum on Rankine Efficiency; Rankine Cycle Efficiency and methods of improving Rankine efficiency: Reheat cycle, Bleeding (feed-water-heating), Regenerative Cycle, Combined reheat-regenerative cycle; Ideal working fluid; Binary vapour cycle, Combined power and heating cycles.

Steam Nozzles

Definition, types and utility of nozzles; Flow of steam through nozzles; Condition for maximum discharge through nozzle; Critical pressure ratio, its significance and its effect on discharge; Area of throat and at exit for maximum discharge; Effect of friction; Nozzle efficiency; Convergent and convergent-divergent nozzles; Calculation of Nozzle dimensions (length and diameters of throat and exit); Supersaturated (or metastable) flow through nozzle.

Unit –IV

Steam Turbines

Introduction; Classification; Impulse versus Reaction turbines. Simple impulse turbine: pressure and velocity variation, Velocity diagrams/triangles; Combined velocity diagram/triangle and calculations for force, axial thrust, work, power, blade efficiency, stage efficiency, maximum work and maximum efficiency, effect of blade friction on velocity diagram, effect of speed ratio on blade efficiency, condition for axial discharge of simple Impulse and Reaction Turbine.

Compounding of impulse turbine, Degree of reaction, combined velocity diagram/triangle and calculations for force, axial thrust, work, power, blade efficiency, stage efficiency, overall efficiency and relative efficiency, maximum work and maximum efficiency; Calculations of blade height; Multistaging: Overall efficiency and relative efficiency; Reheating, Reheat factor and condition curve; Losses in steam turbines; Back pressure and extraction turbines; Co-generation; Governing of steam turbines.

Steam Condensers

Function; Elements of condensing unit; Types of condensers; Dalton's law of partial pressures applied to the condenser problems; Condenser and vacuum efficiencies; Cooling water calculations; Effect of air leakage; Method to check and prevent air infiltration; Description of air pump and calculation of its capacity.

Recommended Books:

1. R. Yadav, Sanjay and Rajay, Applied Thermodynamics, Central Publishing House.
2. J.S. Rajadurai, Thermodynamics and Thermal Engineering, New Age International (P) Ltd. Publishers.
3. D.S. Kumar and V.P. Vasandani, 'Heat Engineering', Metropolitan Book Co. Pvt. Ltd.
4. K. Soman, 'Thermal Engineering', PHI Learning Pvt. Ltd.
5. G. Rogers and Y. Mayhew, 'Engineering Thermodynamics', Pearson.
6. W.A.J. Keartan, 'Steam Turbine: Theory and Practice', ELBS Series.
7. Heywood, 'Fundamentals of IC Engines', McGraw Hill.
8. V. Ganeshan, Internal Combustion Engines, Tata McGraw Hill.

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MANUFACTURING PROCESSES

Subject Code: BMEE1-305 **L T P C** **Duration: 43 Hrs.**
3 1 0 4

Learning Objectives: To expose the students to the principles of the metal joining methods with principle of operations and power sources for different welding techniques, process parameters and their effects on joint quality, joint quality checking, weld ability issues. To impart the knowledge on metal cutting mechanics, cutting force, stress, strain etc., effect of process parameters, grinding and abrasive machining techniques. To study metal forming techniques, extrusion, rolling, drawing, and sheet metal forming and shearing operations, some design aspects and knowledge about process behavior.

UNIT –I (11 Hrs.)

Metal Casting: Review of sand casting, sand testing, machine moulding, inspection of castings, casting defects; Shell moulding; investment casting; die casting; centrifugal casting. Elements of gating system and risers and their design, Design considerations of castings, Cores: function, types, core making process, core-prints, chaplets.

Welding: Review of welding processes, weldability, principles and application of TIG and MIG welding, Advanced welding processes: friction stir welding, ultrasonic welding, laser beam welding, plasma arc welding, electron beam welding.

UNIT-II (12 Hrs.)

Metal Forming: Hot and cold forming, forming processes, forging machines, forging design considerations, forging defects; High energy rate forming processes. Press working: press types, operations, press tools, progressive and combination dies.

Shaping Non-Metallic Materials: Basic manufacturing processes for processing of plastics and ceramics.

Powder Metallurgy: Introduction, advantages, limitations, and applications
methods of producing metal powders, briquetting and sintering.

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UNIT-III (11 Hrs.)

Metal Cutting: Introduction to machining processes, classification, Mechanics of chip formation process, concept of shear angle, chip contraction and cutting forces in metal cutting, Merchant theory, tool wear, tool life, machinability. Numerical problems based on above mentioned topics, Cutting tools: types, geometry of single point cutting tool, twist drill and milling cutter, tool signature. Cutting tool materials: high carbon steels, alloy carbon steels, high speed steel, cast alloys, cemented carbides, ceramics and diamonds, and CBN.

UNIT –IV (10 Hrs.)

Machine Tools: Classification, description and operations of lathe, kinematic scheme of lathe, Shaper, planer, classification, milling machine, Drilling machine. Grinding machines: wheel selection, grinding wheel composition and nomenclature of grinding wheels, dressing and truing of grinding wheels.

WORKSHOP TRAINING

Subject Code: BMEE1-306 **L T P C** **Duration: 36 Hrs.**
0 0 4 2

Workshop/Institutional Training will be imparted in the institutional workshop and respective departmental labs at the end of 2nd Semester for 4-Week duration (Minimum 36 hours per week).

The objective is to provide intensive training to the students in respect of different manufacturing practices and developing familiarity with their concerned stream. Industrial tour will be part of this training.

MANUFACTURING PROCESSES LAB.

Subject code: BMEE1-309 **L T P C**
0 0 2 1

List of Experiments

Sand Testing Shop

1. Determination of the clay content in a sample of moulding sand.
2. Estimation of moisture content of the sample of green sand using Rapid Moisture teller / Rapid Drier.
3. To determine shatter index of the moulding sand.
4. To determine the permeability of a given sample of green sand and dried sand.
5. Determination of mould / core hardness using portable and sand hardness tester.
6. To prepare the green sand for sand moulding, Study of mechanical sand rammer for sand moulding. Relationship between mulling time & green strength, percentage clay contains and green compressive strength.

Foundry Shop

1. Study of casting defects and remedies.

Machine Shop

1. Spur Gear cutting on Milling Machine.
2. Demonstration on milling machine: Up & Down milling.
3. Demonstration on Shaper, Drilling machines.

Welding Shop

1. Demonstration on arc welding processes.
2. Testing the strength of a welded joint using MIG welding.
3. Demonstrations of various Resistance Welding Techniques.

Learning Outcomes:

After studying this course, students shall be able to:

1. To understand the basic concepts of sand testing.
2. To understand working of various machine tools.
3. To use various welding processes.

NON-CONVENTIONAL ENERGY RESOURCES

Subject Code: BMEE1-356 **L T P C** **Duration: 38 Hrs.**
3 0 0 3

UNIT-1

Introduction: Renewable and non-renewable energy sources, their availability and growth in India; Energy consumption as a measure of Nation's development; strategy for meeting the future energy requirements.

Solar Energy: Solar radiation - beam and diffuse radiation; earth sun angles, attenuation and measurement of solar radiation; Optical properties of materials and selective surfaces; Principles, general description and design procedures of flat Platte and concentrating collectors;

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Performance analysis of cylindrical and parabolic collectors; Solar energy storage systems - their types, characteristics and capacity; solar ponds. Applications of solar energy in water, space and process heating, solar refrigeration and air conditioning; water desalination and water pumping; solar thermal power generation; solar cells and batteries; economic analysis of solar systems.

UNIT-II

Wind Energy: Principle of wind energy conversion; Basic components of wind energy conversion systems; wind mill components, various types and their constructional features; design considerations of horizontal and vertical axis wind machines: analysis of aerodynamic forces acting on wind mill blades and estimation of power output; wind data and site selection considerations.

UNIT-III

Direct Energy Conversion Systems:

(i) Magnetic Hydrodynamic (MHD) Generator: gas conductivity and MHD equations; operating principle, types and working of different MHD systems – their relative merits; MHD materials and production of magnetic fields.

(ii) Thermo-electric generators: Thermo-electric effects and materials; thermo-electric devices and types of thermo-electric generators; thermo-electric refrigeration.

(iii) Thermionic generators: thermionic emission and materials; working principle of thermionic convertors.

(iv) Fuel Cells: thermodynamic aspects; types, components and working of fuel cells.

(v) Performance, applications and economic aspects of above mentioned direct energy conversions systems.

UNIT-IV

Miscellaneous Non-Conventional Energy Systems:

(i) Bio-mass: Concept of bio-mass conversion, photo-synthesis and bio-gasification; Bio gas generators and plants - their types, constructional features and functioning; digesters and their design; Fuel properties of bio gas and community bio gas plants

(ii) Geothermal: Sources of geothermal energy - types, constructional features and associated prime movers.

(iii) Tidal and Wave Energy: Basic principles and components of tidal and wave energy plants; single basin and double basin tidal power plants; conversion devices Advantages / disadvantages and applications of above mentioned energy systems.

Recommended Books

1. H.P. Garg and Jai Prakash, ‘Solar Energy: Fundamentals and Applications’, Tata McGraw Hill.
2. S.P. Sukhatme, ‘Solar Energy: Principles of Thermal Collection and Storage’, Tata McGraw Hill.
3. John A. Duffic and W.A. Beckman, ‘Solar Engineering of Thermal Processes’, John Wiley.
4. S.L. Sheldon, Chang, ‘Energy Conversion’, Prentice Hall.
5. O.M. Bockris and S. Srinivasan, ‘Fuel Cells’, McGraw Hill.
6. G.D. Rai, ‘Non-Conventional Energy Sources’, Khanna Publishers, New Delhi.
7. B.H. Khan, ‘Non-Conventional Energy’, Tata McGraw-Hill, New Delhi.
8. Ashok V. Desai, ‘Nonconventional Energy’, New Age International Publishers Ltd.

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INDUSTRIAL ENGINEERING

Subject Code: BMEE1-357 **L T P C** **Duration: 38 Hrs.**
3 0 0 3

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UNIT-I

Introduction to Industrial Engineering

Relevance of industrial engineering for achieving performance excellence in industry.

Productivity Management: Productivity measurement and improvement, Resource waste minimization, Lean manufacturing.

Plant Location & Layout: Factors effecting plant location, Selection of plant site, Quantitative techniques of plant location decision, Plant layout, Principles of layout design, Methods for evaluation of a layout, Quantitative techniques of developing layouts.

UNIT-II

Materials Management: Objectives and functions, Procurement, Types of inventories, Inventory costs, Inventory control models, Determination of EOQ (under deterministic conditions), MRP, Bill of materials.

Product Engineering: Product design considerations, Product development, Detailing, Value Engineering and its role in product design and cost rationalization.

UNIT-III

Work Science: Purpose and scope, Productivity and work-study, Method Study and Work Measurement, Principles of Motion Economy, Elements of Work Sampling, Predetermined Motion Time Systems, Principles of Work Design.

Ergonomics: Role of Ergonomics in industry, Introduction to anthropometry, Task analysis to reduce Musclo-Skeletal disorders, Posture analysis, Introduction to bio-mechanics, Effect of physical environment on performance.

UNIT-IV

Maintenance Management: Objectives, Nature of maintenance problems, Maintenance strategies, Organization, Maintenance Information Systems, Spare Parts Management, Maintenance Cost Control, Introduction to Total Productive Maintenance.

Learning Outcomes:

The students will be able to

1. Evaluate and improve the business process for effective utilization of all the industrial resources.
2. Manage and plan the general inventory in industry.
3. Develop better methods for workplace improvement and new products.
4. To develop improved techniques/methods.

Recommended Books

1. R. Shankar, ‘Industrial Engineering and Management’, Galgotia Publications, **2003.**
2. J.G. Monks, ‘Production/Operations Management’, McGraw Hill, **2004.**
3. A.K. Chitale and R.C. Gupta, ‘Product Design and Manufacturing’, McGraw Hill, **2005.**
4. M. Sanders and E. McCormic, ‘Human Factors in Engineering’, McGraw Hill, **1993.**
5. R. Curie, ‘Introduction to Work Study’, McGraw Hill, **1992.**

PRODUCT DESIGN AND DEVELOPMENT

Subject Code: BMEE1-358 **L T P C** **Duration: 35 Hrs.**
3 0 0 3

UNIT-I

Introduction: Product design objectives, concept, terminology, principles, requirements of a good product design, product types and design considerations for engineering, product life cycle, product specification and range, safety, liability and warranty aspects, patents and copyrights.

UNIT-II

Product Development –Technical and Business Concerns: Technology forecasting and technology S-Curve (Technology Stage), mission statement and technical questioning, economic analysis of product, customer needs and satisfaction, customer population and market segmentation, customer needs-types and models, gathering customer needs information, analysis of gathered information.

UNIT-III

Designing for Specific Requirements: Design features and requirements with regard to manufacturing and assembly, safety, ergonomics, energy conservation, storage, transportation and maintenance, quality and reliability as a factor in product design, quality v/s cost, packaging design, role of national and international standards.

Visual Design: Objectives, form, function, material and process, relationship, product graphics, role of color.

Product Detailing: Need and objectives, considerations affecting detailing decisions, illustration of detailing.

UNIT-IV

Product Development: Concepts and objectives, information sources, role of innovation in product development and competitiveness, part approval process, advanced product quality planning, design failure mode and effect analysis, use of computers in product design and development, introduction to reverse engineering and rapid prototype development, the CAD-CAM link.

Learning Outcomes

The students will be able to:

1. Understand the basic product design objectives and requirements.
2. Understand the design principles for manufacturing
3. Understand the different design principles like designing for assembly, Maintenance, storage, transportation etc.
4. Understand the visual design with respect to form, function, material, Process, color etc.

Recommended Books

1. Neibel and Draper, ‘Product Design and Process’, McGraw Hill, New York, **2004.**
2. Mayal, ‘Industrial Design’, McGraw Hill, New York, **1999.**
3. Trott, ‘Innovation Management and New Product Development’, Pearson Education Asia, New Delhi, **2007.**
4. M. Asimov, ‘Fundamentals of Engineering Design’, PHI, New Delhi, **2000.**
5. Chitale and Gupta, ‘Product Design and Manufacturing’, PHI, New Delhi, **2007.**

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STRENGTH OF MATERIALS-II

Subject Code: BMEE1- 410	**L T P C** **3 1 0 4**	**Duration: 46 Hrs.**

Learning Objectives and Outcomes: The course is designed to understand the concepts of strain

energy, resilience, stress under impact loading; shear stress distribution in a beam of various cross sections; stress in curved beams; stresses in helical, spiral, leaf and flat spiral springs; stress and strain analysis of thin, thick cylinder and spheres subjected to internal pressure; various theories of failure. The outcome of the course is to understand the stress analysis in various mechanical members e.g. thin and thick cylinders, rotating discs, curved beams and springs under various load conditions. The student will be able to properly analyze and design these mechanical members from the strength point of view.

UNIT-10 (Hrs.)

Strain Energy: Introduction to strain energy, energy of dilation and distortion. Resilience, stress due to suddenly applied and impact loading. Castigliano’s theorem.

Theories of Failure: Maximum principal stress theory, maximum shear stress theory, maximum principal strain theory, total strain energy theory, shear strain energy theory. Graphical representation and derivation of equation for these theories and their application related to two dimensional stress systems.

UNIT-II (13 Hrs.)

Thin Cylinders and Spheres: Calculation of Hoop stress, longitudinal stress in a thin cylinder, effects of joints, change in diameter, length and internal volume. Principal stresses in sphere, change in diameter and internal volume.

Thick Cylinders: Derivation of Lame’s equations, calculation of radial, longitudinal and hoop stresses and strains due to internal pressure in thick cylinders, compound cylinders, shrinkage allowance and shrinkage stress.

Rotational discs: Stresses in rotating discs and rims of uniform thickness; disc of uniform strength.

UNIT –III (11 Hrs.)

Bending of Curved Beams: Calculation of stresses in cranes or chain hooks, rings of circular and trapezoidal section and chain links with straight sides.

Shear Stresses in Beams: Shear stress distribution in rectangular, circular, triangular, I, T and channel section beams.

UNIT-IV (10 Hrs.)

Springs: Types of springs, derivation of strain energy (S.E.) equation, stress and S.E. in open and closed coiled helical springs under the action of axial load and/or couple. Bending stress, deflection and S.E. in Leaf spring, S.E. in flat spiral springs.

Recommended Books

1. Sadhu Singh, ‘Strength of Materials’, Khanna Publishers.
2. Kirpal Singh, ‘Mechanics of Materials’, Standard Publishers.
3. G.H. Ryder, ‘Strength of Materials’, Macmillan India Ltd.
4. S.S. Rattan, ‘Strength of Materials’, Tata McGraw Hills.
5. Timoshenko and Gere, ‘Mechanics of Materials’, CBS Publishers.
6. E.P. Popov, ‘Mechanics of Materials’, Pearson Education.
7. Beer and Johnsons, ‘Strength of Materials’, Macgraw Hills.

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THEORY OF MACHINES – II

Subject Code: BMEE1-411 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

Learning Objectives & Learning Outcomes: The students will understand the basic concepts of inertia forces & couples applied to reciprocating parts of a machine. Students should be able to understand balancing of masses and design of gears & gear trains. They will also gain knowledge of kinematic synthesis and different applications of gyroscopic effect.

UNIT-I (12 Hrs.)

Static Force Analysis: Concept of force and couple, free body diagram, condition of equilibrium, static equilibrium of mechanism, methods of static force analysis of simple mechanisms. Power transmission elements, considerations of frictional forces

Dynamic Force Analysis: Determination of forces and couples for a crank, inertia of reciprocating parts, dynamically equivalent system, analytical and graphical method, inertia force analysis of basic engine mechanism, torque required to overcome inertia and gravitational force of a four bar linkage.

UNIT-II (11 Hrs.)

Balancing: Necessity of balancing, static and dynamic balancing, balancing of single and multiple rotating masses, partial unbalanced primary force in an engine, balancing of reciprocating masses, and condition of balance in multi cylinder in line V-engines, concept of direct and reverse crank, balancing of machines, rotors, reversible rotors.

UNIT-III (11 Hrs.)

Gears: Toothed gears, types of toothed gears and its terminology. Path of contact, arc of contact, conditions for correct gearing, forms of teeth, involutes and its variants, interference and methods of its removal. Calculation of minimum number of teeth on pinion/wheel for in volute rack, helical, spiral, bevel and worm gears Center distance for spiral gears and efficiency of spiral gears

Gear Trains: Types of gear trains, simple, compound and epicyclic gear trains, problems involving their applications, estimation of velocity ratio of worm and worm wheel.

UNIT-IV (11 Hrs.)

Gyroscopic Motion and Couples: Effect on supporting and holding structures of machines. Stabilization of ships and planes, gyroscopic effect on two and four wheeled vehicles and stone crusher, Lower and higher Pairs: Universal Joint, Calculation of maximum Torque, Steering Mechanisms including Ackerman and Davis approximate steering mechanism,

Recommended Books

1. S.S. Rattan, 'Theory of Machines', Tata McGraw Hill.
2. John, Gordon, and Joseph, 'Theory of Machines and Mechanisms', Oxford University Press.
3. Hams Crone and Roggers, 'Theory of Machines'.
4. Shigley, 'Theory of Machines', McGraw Hill.
5. V.P. Singh, Theory of Machines, Dhanpat Rai and Sons.

MRSPTU

FLUID MECHANICS-I

Subject Code: BMME1-412	L T P C 3 1 0 4	Duration: 45 Hrs.

Learning Objectives

1. To understand the behavior of fluids at rest and in motion.
2. To understand effects of the fluids on the boundaries of various cross sectional elements.
3. To understand analytical abilities related to fluid flow.
4. To conceptual understanding of fluids and their properties.
5. To understand the concept of modeling, prototype and simulation of fluid elements.

UNIT-I (12 Hrs.)

Fluid and their properties: Concept of fluid; ideal and real fluids; capillarity, vapour pressure, surface tension, viscosity, compressibility and bulk modulus; Newtonian and non- Newtonian fluids.

Fluid Statics: Concept of pressure, Pascal's law and its engineering applications, Hydrostatic paradox. Action of fluid pressure on a plane (horizontal, vertical and inclined) submerged surface, resultant force and center of pressure, force on a curved surface due to hydrostatic pressure. Buoyancy and flotation, stability of floating and submerged bodies, metacentric height and its determination, periodic time of oscillation.

UNIT-II (11 Hrs.)

Fluid Kinematics: Classification of fluid flows, velocity and acceleration of fluid particle, local and convective acceleration, normal and tangential acceleration, streamline, path line and streak line, stream and velocity potential functions, continuity equation in Cartesian and cylindrical coordinates. Rotational flows, rotation velocity and circulation and flow net.

Fluid Dynamics: Euler's equation, Bernoulli's equation and steady flow energy equation; representation of energy changes in fluid system, impulse momentum equation, kinetic energy and momentum correction factors.

UNIT-III (11 Hrs.)

Dimensional Analysis and Similitude: Fundamental and derived units and dimensions, dimensional homogeneity. Rayleigh's and Buckingham's Pi method for dimensional analysis. Dimensionless numbers and their significance, geometric, kinematic and dynamic similarity, model studies.

UNIT-IV (11 Hrs.)

Laminar and Turbulent Flows: Flow regimes and Reylods number, critical velocity and critical Reynolds number, laminar flow in circular cross- section pipes.

Turbulent flows and flow losses in pipes, Darcy equation, chezy's formula, minor head losses in pipes and pipe fittings, hydraulic and energy gradient lines.

Flow Measurement: Manometers, rotameter, pitot tubes, venturimeter, orifice meters, mouthpieces, notches and weirs.

Recommended Books

1. D.S. Kumar, 'Fluid Mechanics and Fluid Power Engineering', S.K. Kataria and Sons. Publishers.
2. B.S. Massey, 'Mechanics of Fluids', Van Nostrand Reinhold Co.
3. V.L. Streets and E.B. Wylie, 'Fluid Mechanics', McGraw Hill Book Co.

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APPLIED THERMODYNAMICS – II

Subject Code: BMEE1- 413 **L T P C** **3 1 0 4** **Duration: 45 Hrs.**

Unit –I

Air Compressors- Introduction: Classification of Air Compressors; Application of compressors and use of compressed air in industry and other places; Complete representation of compression process on P-v and T-s coordinates with detailed description of areas representing total work done and polytropic work done; Areas representing ***energy lost*** in internal friction, *energy carried away by cooling water* and ***additional flow work*** being done for un-cooled and cooled compression on T-S coordinates; Best value of index of compression; Isentropic, polytropic and isothermal efficiencies and their representation in terms of ratio of areas representing various energy transfers on T-s coordinates.

Reciprocating Air Compressors

Single stage single acting reciprocating compressor (with and without clearance volume): construction, operation, work input and best value of index of compression, heat rejected to cooling medium, isothermal, overall thermal, isentropic, polytropic, mechanical efficiency, **Clearance Volumetric efficiency**, Overall volumetric efficiency, effect of various parameters on volumetric efficiency, free air delivery; Multistage compressors: purpose and advantages, construction and operation, work input, heat rejected in intercoolers, minimum work input, optimum pressure ratio; ***isothermal***, ***overall thermal***, ***isentropic***, ***polytropic*** and ***mechanical*** efficiencies; Performance curves.

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Unit –II

Positive Displacement Rotary Compressors Introduction: Comparison of rotary positive displacement compressors with reciprocating compressors; Classification of rotary compressors; Construction, operation, work input and efficiency of positive displacement type of rotary compressors like Roots blower, Lysholm compressor and Vane Type Blower.

Thermodynamics of Dynamic Rotary Compressors: Applications of Steady Flow Energy Equation and thermodynamics of dynamic (i.e., *centrifugal* and *axial flow m/cs*) compressors; Stagnation and static values of pressure, Temperature and enthalpy etc. for flow through dynamic rotary machines; Complete representation of compression process on T-S coordinates with detailed description of areas representing total work done, polytropic work done; ideal work required for compression process, areas representing energy lost in internal friction, energy carried away by cooling water on TS coordinates for an uncooled and cooled compression; ***isentropic***, ***polytropic***, and ***isothermal efficiencies*** as ratios of the areas representing various energy transfers on T-S coordinates.

Unit –III

Centrifugal Compressors: Complete thermodynamic analysis of centrifugal compressor stage; Polytropic, isentropic and isothermal efficiencies; Complete representation of compression process in the centrifugal compressor starting from ambient air flow through the suction pipe, Impeller, Diffuser and finally to delivery pipe on T-S coordinates; Pre-guide vanes and pre-whirl; Slip factor; Power input factor; Various modes of energy transfer in the impeller and diffuser; Degree of Reaction and its derivation; Energy transfer in backward, forward and radial vanes; Pressure coefficient as a function of slip factor; Efficiency and out-coming velocity profile from the impeller; Derivation of non-dimensional parameters for plotting compressor characteristics; Centrifugal compressor characteristic curves; Surging and choking in centrifugal compressors.

Axial Flow Compressors

Different components of axial flow compressor and their arrangement; Discussion on flow passages and simple theory of aerofoil blading; Angle of attack; coefficients of lift and drag; Turbine versus compressor blades; Velocity vector; Vector diagrams; Thermodynamic analysis; Work done on the compressor and power calculations; Modes of energy transfer in rotor and stator blade flow passages; Detailed discussion on work done factor, degree of reaction, blade efficiency and their derivations; ***Isentropic***, ***polytropic*** and ***isothermal efficiencies***; Surging, Choking and Stalling in axial flow compressors; Characteristic curves for axial flow compressor; flow parameters of axial flow compressor like Pressure Coefficient, Flow Coefficient, Work Coefficient, Temperature-rise Coefficient and Specific Speed; Comparison of axial flow compressor with centrifugal compressor and reaction turbine; Field of application of axial flow compressors.

Unit –IV

Gas Turbines Classification and comparison of the Open and Closed cycles; Classification on the basis of combustion (at ***constant volume*** or ***constant pressure***); Comparison of gas turbine with a steam turbine and IC engine; Fields of application of gas turbines; Position of gas turbine in power industry; Thermodynamics of constant pressure gas turbine cycle (Brayton cycle); Calculation of net output, work ratio and thermal efficiency of ideal and actual cycles; Cycle air rate, temperature ratio; Effect of changes in specific heat and that of mass of fuel on power and efficiency; Operating variables and their effects on thermal efficiency and work ratio; Thermal refinements like regeneration, inter-cooling and re-heating and their different combinations in the gas turbine cycle and their effects on gas turbine cycle i.e. gas turbine cycle. Multistage compression and expansion; Blade materials and selection criteria for these materials and requirements of blade materials.

MRSPTU

Jet Propulsion Principle of jet propulsion; Speed of sound and Mach Number, Description of different types of jet propulsion systems like rockets and thermal jet engines, like **(i) Athodyds** (ramjet and pulsejet), **(ii)** Turbojet engine, and **(iii)** Turboprop engine. Thermodynamics of turbojet engine components; Development of thrust and methods for its boosting/augmentation; Thrust work and thrust power; Propulsion energy, Propulsion and thermal (internal) efficiencies; Overall thermal efficiency; Specific fuel consumption**;** Rocket propulsion, its thrust and thrust power; Propulsion and overall thermal efficiency; Advantages and disadvantages of jet propulsion over other propulsion systems; Brief introduction to performance characteristics of different propulsion systems; Fields of application of various propulsion units.

Recommended Books:

1. R. Yadav, Sanjay and Rajay, ‘Applied Thermodynamics’, Central Publishing House.
2. J.S. Rajadurai, ‘Thermodynamics and Thermal Engineering’, New Age International (P) Ltd. Publishers.
3. D.S. Kumar and V.P. Vasandani, ‘Heat Engineering’, Metropolitan Book Co. Pvt. Ltd.
4. K. Soman, ‘Thermal Engineering’, PHI Learning Pvt. Ltd.
5. G. Rogers and Y. Mayhew, ‘Engineering Thermodynamics’, Pearson.
6. D.G. Shephered, ‘Principles of Turbo Machinery’, Macmillan.
7. H. Cohen, G.F.C. Rogers and M. Sarvan, ‘Gas Turbine Theory’, Longmans.

MATERIALS SCIENCE & METALLURGY

Subject Code: BMEE1-414 **L T P C** **Duration: 36 Hrs.**
3 0 0 3

Learning Objectives

1. To understand the fundamental concepts of crystallography, phase transformation and heat treatment processes.
2. To understand the atomic structure of metals, imperfections, diffusion mechanisms and theories of plastic deformation.
3. To understand equilibrium diagrams, time-temperature transformation curves and heat treatment processes.
4. To understand the phase diagrams which are useful for design and control of heat treating processes.

Learning Outcomes:

CO1: To develop fundamental concepts of crystallography, atomic structure imperfections.
CO2: The students will learn phase transformations, the theories of plastic deformation of metals and diffusion mechanisms
CO3: They will understand equilibrium diagrams, time-temperature transformation curves for design and control of heat treating processes.
CO4: Upon completion of the course, the students will be able to understand the interpretations of microstructure of metals and heat treatment processes.
CO5: Student understands composition of alloys and effect of alloying elements on the structures and properties of steel. Student will also able to classify ferrous metals and their alloys.

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UNIT-I (12 Hrs.)

Crystallography: Atomic structure of metals, atomic bonding in solids, crystal structures, crystal lattice of body centered cubic, face centered cubic, closed packed hexagonal; crystalline and non-crystalline materials; crystallographic notation of atomic planes; polymorphism and allotropy; imperfection in solids: theoretical yield strength, point defects, line defects and dislocations, interfacial defects, bulk or volume defects. Diffusion: diffusion mechanisms, steady-state and non-steady -state diffusion, factors affecting diffusion. Theories of plastic deformation, recovery, re-crystallization.

UNIT-II (11 Hrs.)

Phase Transformation: General principles of phase transformation in alloys, phase rule and equilibrium diagrams, Equilibrium diagrams of Binary systems. Iron carbon equilibrium diagram and various phase transformations. Time temperature transformation curves (TTT curves): fundamentals, construction and applications.

UNIT-III (12 Hrs.)

Heat Treatment: Principles and applications. Processes viz. annealing, normalizing, hardening, tempering. Surface hardening of steels: Principles of induction and oxyacetylene flame hardening. Procedure for carburising, nitriding and cyaniding. Harden-ability: determination of harden-ability. Jominy end-quench test. Defects due to heat treatment and their remedies; effects produced by alloying elements. Composition of alloy steels.

Unit –IV (10 Hrs.)

Ferrous Metals and their Alloys: Introduction, classification, composition of alloys, effect of alloying elements (Si, Mn, Ni, Cr, Mo, W, Al) on the structures and properties of steel.

Recommended Books

1. Y. Lakhin, 'Engineering Physical Metallurgy', Mir Publishers.
2. Sidney H. Avner, 'Introduction to Physical Metallurgy, Tata McGraw Hill.
3. V. Raghavan, Physical Metallurgy: Principles and Practice, PHI Learning.
4. T. Goel and R.S. Walia, 'Engineering Materials & Metallurgy'.
5. B. Zakharov, 'Heat Treatment of Metals', University Press.

FLUID MECHANICS-I LAB.

Subject Code- BMEE1-416 **L T P C**
0 0 2 1

1. To determine the metacentric height of a floating vessel under loaded and unloaded conditions.
2. To study the flow through a variable area duct and verify Bernoulli's energy equation.
3. To determine the coefficient of discharge for an obstruction flow meter (venturi meter/ orifice meter)
4. To determine the discharge coefficient for a V- notch and rectangular notch.
5. To study the transition from laminar to turbulent flow and to ascertain the lower critical Reynolds number.
6. To determine the hydraulic coefficients for flow through an orifice.
7. To determine the friction coefficients for pipes of different diameters.
8. To determine the head loss in a pipe line due to sudden expansion/ sudden contraction/ bend.

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MATERIALS SCIENCE & METALLURGY LAB.

Subject Code: BMME1-418 **L T P C**
0 0 2 1

Learning Objectives

1. To understand the fundamental concepts of crystallography and heat treatment processes.
2. To recognize the specimen preparations for microstructure study of metals.
3. To appreciate equilibrium diagrams, time-temperature transformation curves.

Learning Contents

1. Preparation of models/charts related to atomic/crystal structure of metals.

2. Annealing the steel specimen and study the effect of annealing time and temperature on hardness of steel.

3. Hardening the steel specimen and study the effect of quenching medium on hardness of steel.

4. Practice of specimen preparation (cutting, mounting, polishing, etching) of mild steel, aluminium and hardened steel specimens.

5. Study of the microstructure of prepared specimens of mild steel, Aluminium and hardened steel.

6. Identification of ferrite and pearlite constituents in given specimen of mild steel.

7. Determination of hardenability of steel by Jominy End Quench Test.

COMPOSITE MATERIALS

Subject Code: BMEE1-459 **L T P C** **Duration: 35 Hrs.**
3 0 0 3

Learning Objectives: This subject introduces to the students the different types of composite materials, their properties and applications.

UNIT-I

Introduction to Composites: Fundamentals of composites - need for composites – Enhancement of properties - classification of composites – Matrix-Polymer matrix composites (PMC), Metal matrix composites (MMC), Ceramic matrix composites (CMC) – Reinforcement – Particle reinforced composites, Fibre reinforced composites. Applications of various types of composites.

UNIT-II

Polymer Matrix Composites: Polymer matrix resins – Thermosetting resins, thermoplastic resins – Reinforcement fibres – Rovings – Woven fabrics – Non woven random mats – various types of fibres. PMC processes - Hand lay-up processes – Spray up processes – Compression moulding – Reinforced reaction injection moulding - Resin transfer moulding – Pultrusion – Filament winding – Injection moulding. Fibre reinforced plastics (FRP), Glass fibre reinforced plastics

UNIT-III

Metal Matrix Composites: Characteristics of MMC, Various types of Metal matrix composites Alloy vs. MMC, Advantages of MMC, Limitations of MMC, Metal Matrix, Reinforcements – particles – fibres. Effect of reinforcement - Volume fraction – Rule of mixtures. Processing of MMC – Powder metallurgy process - diffusion bonding – stir casting – squeeze casting.

UNIT-IV

Ceramic Matrix Composites: Engineering ceramic materials – properties – advantages – limitations – Monolithic ceramics - Need for CMC – Ceramic matrix - Various types of Ceramic Matrix composites- oxide ceramics – non oxide ceramics – aluminium oxide – silicon nitride – reinforcements – particles- fibres- whiskers. Sintering - Hot pressing – Cold isostatic pressing (CIPing) – Hot isostatic pressing (HIPing). **ADVANCES IN COMPOSITES:** Carbon / carbon composites – Advantages of carbon matrix – limitations of carbon matrix Carbon fibre – chemical vapour deposition of carbon on carbon fibre perform. Sol gel technique. Composites for aerospace applications.

Recommended Books

1. K.K. Chawla, ‘Composite Materials, Springer – Verlag’, **1987.**
2. S.C. Sharma, ‘Composite Materials, Narosa Publications, **2000**.
3. A.B. Strong, ‘Fundamentals of Composite Manufacturing, SME, **1989**.

WELDING TECHNOLOGY

Subject Code: BMEE1-460 **L T P C** **Duration: 35 Hrs.**
3 0 0 3

UNIT–I

Introduction: Basic classification of welding processes, weld thermal cycle, weld metallurgy, solidification mechanism and micro-structural products in weld metal, epitaxial, cellular and dendritic solidification, metallurgical changes in weld metal, properties of weld metal. Heat affected zone, re-crystallization and grain growth of HAZ, effects of alloying elements on welding of ferrous metals.

Welding Arc: Arc characteristics, arc column, arc blow, electrical characteristics of an arc, types of welding arcs, mechanism of arc initiation and maintenance, role of electrode polarity on arc behavior and arc stability.

UNIT-II

Welding Processes

Manual Metal Arc Welding (MMAW): welding circuit, SMAW operation, striking & restriking, metal fusion and weld penetration, Electrode motions and applications of SMAW.

Submerged Arc Welding: Circuit & setup for SAW, SAW process and operation, process variables, SAW wires and SAW fluxes, applications of SAW.

GAS Metal Arc Welding: power source, wire feed units, Welding circuit and setup, GMAW variables GMAW operation & technique, applications of GMAW.

UNIT-III

Welding Power Sources: Requirements for an arc welding power source, constant current characteristics, duty cycles, operating principles of a welding transformer, requirements of welding transformer,

UNIT-IV

Solid State Welding Processes: Forge welding, Friction welding, diffusion welding Explosive welding, ultrasonic welding, Electron beam welding, Laser welding, allied processes- Soldering, Brazing, Adhesive bonding, surfacing and Thermal spraying.

Recommended Books

1. R.S. Parmar, 'Welding Processes & Technology', Khanna Publishers.
2. R.S. Parmar, 'Welding Engineering & Technology', Khanna Publishers.
3. S.V. Nandkarni, 'Modern Arc Welding Technology', Oxford & IDH Publishing Co.
4. Lancaster, 'The Physics of Welding', Pergaman Press.
5. Richard L. Little, 'Welding & Welding Technology', McGraw Hill.

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MATERIAL MANAGEMENT

Subject Code: BMEE1-461 **L T P C** **Duration: 35 Hrs.**
3 0 0 3

UNIT-I

Introduction: Introduction to material management and productivity, functions of material management, organization structures in material management, role of material management techniques in improved material productivity.

Material Planning: objectives, material requirement planning, manufacturing resource planning, JIT production planning, strategic material planning, material control: acceptance, sampling, inspection, make or buy decision, simple cost analysis, economic analysis, break even analysis, breakeven point theory, whether to add or drop a product line store management and warehousing, product explosion

UNIT-II

Purchasing: Importance of good purchasing system, organization of purchasing functions, purchase policy and procedures, responsibility and limitations, purchasing decisions, purchasing role in new product development, role of purchasing in cost reduction, negotiations and purchase, purchasing research: identification of right sources of supply, vendor rating, standardization, vendor certification plans, vendor and supply reliability, developing new source of supply.

UNIT-III

Cost Reduction: cost control v/s cost reduction, price analysis, material cost reduction techniques, variety reduction, cost reduction and value improvement, techniques of cost control, standard costing, cost effectiveness, cost analysis for material management, material flow cost control.

Unit-IV

Inventory Management: Inventory v/s stores, types of inventory, inventory control, inventory build –up, EOQ, various inventory models, inventory models with quantity discount, exchange curve concept, coverage analysis, optimal stocking and issuing policies, inventory management of perishable commodities, ABC – VED analysis, design of inventory distribution systems, surplus management, information system for inventory management, case studies.

Learning Outcomes (CO)

1. To expose the students to the different components and functions of material Management.
2. To Under Stand the Inventory controls procedure.
3. To Understand the Codification of materials.
4. To Understand Purchase policies and procedures.

Recommended Books

1.W.R. Stelzer, 'Material Management', Prentice Hall of India.
2. D.S. Ammer & Richard Erwin Inc., 'Material Management'.
3. A.K. Dutta, 'Material Management', Prentice Hall of India.
4. P. Gopal, A. Krishnan & M. Sundersen, 'Material Management', Prentice Hall of India.

MRSPTU

DESIGN OF MACHINE ELEMENTS-I

Subject code: BMEE1-519 **L T P C** **Duration: 25 Hrs.**
2 0 0 2

Learning Objectives: To present the basic knowledge of design procedure for simple components like keys, cotters, fasteners, shafts, couplings, pipe joints and levers under static and fatigue loading. At the end of this course, the student should be able to develop mechanical systems consisting of wide range of machine elements. Basic design of different machine elements will be discussed

UNIT-I

Basic Design Considerations: Meaning of machine design, Empirical design, Rational design, Aesthetic design, Ergonomic design, design process, stress-concentration, endurance limit, fatigue and reliability considerations, factor of safety and its selection, basics of tolerance, basics of fits, Introduction to creep.

Material Selection and Material Properties: Designation of materials according to Indian standards code, Selection of material, mechanical properties of materials.

UNIT-II

Analysis and Design of Fasteners

a) Riveted joints-boiler joints, structural joints, lozenge joints, eccentrically loaded joints.
b) Welded joints in torsion, shear and direct loads, eccentrically loaded joints.
c) Bolts and bolted joints with and without initial tightening loads, Bolted joints under eccentric loading.

Design of Cottered Joints
a) Design of spigot and socket cotter joint,
b) Design of Gib and cotter joint
c) Design of knuckle joint.

UNIT-III

Design of Shaft: Design of solid and hollow shafts for transmission of torque, Shafts subject to pure torsion, pure bending and shafts under combined loading, design of shaft on the basis of rigidity.

Design of Couplings, Keys and Splines: a) Rigid Coupling: design of sleeve, split muff coupling and Flanged coupling. b) Flexible coupling: design of pin type flexible coupling and Universal joint. Type of keys, Design of keys based on shear and crushing failures, Advantages of splines and their design.

UNIT-IV

Design of Pipe Joints: Type of joints, Design of Circular, oval and square flanged pipe joints.

Design of levers: Levers of type I, II and III, Mechanical advantage, leverage, Design of levers (foot lever, hand lever, cranked lever, bell crank lever, safety valve lever and shoe brake lever).

Learning Outcomes: The students will be able to:

1. Understand the basic of machine design, process and requirements for design of machine elements.
2. Select the suitable materials.
3. Design simple components like fasteners, shafts, keys, couplings, pipe joints, levers etc.

Recommended Books

1. V.B. Bhandari, 'Design of Machine Elements', Tata McGraw Hill, New Delhi, **2007.**
2. J. Shigley, 'Mechanical Engineering Design', McGraw Hill Book Company Inc., New York, **2003.**
3. M.F. Spotts and T.E. Shoup, 'Design of Machine Elements', Pearson Education, New Delhi, **2003**.
4. R.L. Norton, 'Machine Design: An Integrated Approach', Pearson Education, New Delhi, **2006.**
5. C.S. Sharma and K. Purohit, 'Design of Machine Elements', Prentice Hall, New Delhi, **2003.**

Note: 1. Design data book is not allowed.

MECHANCIAL MEASUREMENTS AND METROLOGY

Subject code: BMEE1-520	**L T P C** **3 0 0 3**	**Duration: 35 Hrs.**

UNIT-I

Introduction: Definition, Significance, modes and applications of measurement systems, Instrument classification, generalized measurement system and its functional elements, Input-output configuration of measuring instruments, Methods of correction for interfering & modifying inputs, Standards, Calibration, Introduction to Static characteristics and Dynamic characteristics, Selection of instruments, Loading effects.

UNIT-II

Errors in Measurement: Sources of errors; Gross, Systematic and Random errors; Statistical analysis of test data- single sample test and multi sample test; Probable error –average and standard deviation for normal curves; Rejection of test data.

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Metrology: Line; end and wavelength standards. Linear measurements; comparators - their types; relative merits and limitations. Angular measurements - sine bar; clinometers; angle gauge. Concept and measurement of straightness and flatness by interferometry. Surface 14 roughness - specifications and measurement. Measurement of major diameter; minor diameter; effective diameter; pitch; angle and form of threads for internal and external threads. Measurement of tooth thickness; pitch and checking of profile for spur gears.

UNIT-III

Functional Elements: Introduction to sensors and transducers; types of sensors; review of electro-mechanical sensors and transducers - variable resistance; inductance and capacitive pickups; photo cells and piezoelectric transducers and application of these elements for measurement of position/displacement; speed / velocity / acceleration; force and liquid level. Resistance strain gauges; gauge factor; bonded and unbounded gauges; temperature compensation; application of strain gauges for direct; bending and torsional loads. Introduction to amplifying transmitting and recording devices.

Pressure and Flow Measurement: Bourdon tube; diaphragm and bellows; Vacuum measurement –McLeod gauge; thermal conductivity gauge and ionization gauge; dead weight gauge tester. Electromagnetic flux meters; ultra-sonic flow meters and hot wire anemometer. Flow visualization techniques.

UNIT-IV

Temperature Measurement: Thermal expansion methods - bimetallic thermometers; liquid-in-glass thermometer and filled-in-system thermometers; thermo-electric sensors - common thermocouples; reference junction considerations; special materials and configurations; metal resistance thermometers and thermistor; optical; total radiation pyrometers; calibration standards.

Speed; Force; Torque and Shaft Power Measurement: Mechanical tachometers; vibration reed tachometer and stroboscope; proving ring; hydraulic and pneumatic load cells; torque on rotating shafts; Absorption; transmission and driving dynamometers.

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Learning Outcomes

After studying this course, students shall be able to:

1. Understand the classification of measurements and measurement standards used in industrial applications
2. Understand about various errors in measuring systems and evaluate the errors by statistical methods.
3. Know about functions and types of sensors and transducers and their utility in instrumentation.
4. Use various instruments for measurements like pressure, flow, temperature etc. in manufacturing or process industry.

Recommended Books

1. E.O. Doebelin, 'Measurement System: Application and Design', McGraw Hill, **2008**.
2. A. Bewoor and V. Kulkarni, 'Metrology and Measurement', McGraw-Hill, **2009.**
3. R.K. Rajput, 'Mechanical Measurement and Instrumentations', S.K. Kataria Publishers, **2012.**
4. Morris Alan S., 'The Essence of Measurement', Prentice Hall of India, **1996.**

AUTOMOBILE ENGINEERING

Subject Code: BMEE1-521 **L T P C** **Duration: 35 Hrs.**
3 0 0 3

UNIT-I

Introduction: Basic structure, general layout and type of automotive vehicles, Frameless and unitary construction; position of power unit; Components of the Automobile; Functions of Major Components of an Automobile

Power Unit: Power requirements - motion resistance and power loss, tractive effort and vehicle performance curves; selection of power unit and engine performance characteristics; pollution due to vehicle emission and exhaust emission control system, silencers, types of pistons and rings

Fuel Supply System: Air cleaner and fuel pumps; Air fuel requirements and carburation; constructional details of Carter carburetors and fuel injection systems; MPFi (Petrol), Diesel fuel system - cleaning, injection pump, injector and nozzles, Common Rail fuel supply system

UNIT-II

Lubrication and Cooling Systems: Necessity of lubrication; Desirable properties of lubricants; various types of lubricants and oil additives; different systems of lubrication - oil filters, oil pumps and oil pressure indicator; crank case ventilation and dilution. Purpose of cooling, air and water cooling systems; radiator, thermostat, pump and fan.

Chassis and Suspension: Loads on the frame, considerations of strength and stiffness, engine mounting, independent suspension systems (Mac Pherson, Trailing Links, Wishbone), shock absorbers and stabilizers; wheels and tyres, tyre wear types, constructional details of plies

UNIT-III

Transmission System: Basic requirements and standard transmission systems; constructional features of automobile clutch, gear box, differential, front and rear axles; overdrives, propeller shaft, universal joint and torque tube drive; Rear wheel vs front wheel drive, principle of automatic transmission

Steering System: Requirement and steering geometry; castor action, camber and king pin angle, toe-in of front wheels, steering linkages and steering gears; wheel alignment; power steering, Ball re-circulating mechanism

Braking System: General braking requirements; Mechanical, hydraulic, vacuum power and servo brakes; Weight transfer during braking and stopping distances, Anti-Braking systems.

UNIT-IV

Starting System: Principle, starting torque, engine resistance torque, and power required for starting of engine. Starter motor and its circuit. Types of drive mechanisms: Bendix drive, pinion type, axial sliding armature starter. Slipping and overrunning of clutches, automatic switches for starting, cold starting devices: Glow plug & choke.

Electric System: Classification, Introduction to Conventional and transistorized ignition systems; Charging, capacity ratings and battery testing; starter motor and drive arrangements: voltage and current regulation, wiring, fuse system, circuit breakers, Relays, Switches. Layout and Wiring diagram for 2, 3 and 4 wheeler vehicles, Buses and Commercial vehicles

Maintenance: Preventive maintenance, trouble shooting and rectification in different systems; engine tuning and servicing, major tools used for maintenance of automobiles

Learning Outcomes - The student will be made to learn

1. Identify the different parts of the automobile

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2. The location and importance of each part
3. The functioning of the engine and its accessories, gear box, clutch, brakes, steering, axles and wheels
4. Suspension, frame, springs and other connections
5. Emissions, ignition, controls, electrical systems and ventilation
6. Develop a strong base for understanding future developments in the automobile industry

Recommended Books

1. Kamaraju Ramakrishna, 'Automobile Engineering', PHI Learning, New Delhi, **2012.**
2. Jain & Asthana, 'Automobile Engineering', Tata McGraw-Hill, New Delhi, **2002**.
3. W.H. Crouse, 'Automotive Mechanics', McGraw Hill.
4. J. Heitner, 'Automotive Mechanics', East West Press.
5. Kirpal Singh, 'Automobile Engineering', Vol. I and II, Standard Publishers.
6. J. Webster, 'Auto Mechanics', Glencoe Publishing Co.
7. P.S Gill, 'Automobile Engineering', S.K. Kataria.

INDUSTRIAL AUTOMATION AND ROBOTICS

Subject code: BMEE1-522 **L T P C** **Duration: 37 Hrs.**
3 0 0 3

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UNIT-I

Introduction: Concept and scope of automation: Socio economic impacts of automation Types of Automation, Low Cost Automation

Fluid Power: Fluid power control elements, Standard graphical symbols, Fluid power generators Hydraulic and pneumatic Cylinders - construction, design and mounting; Hydraulic and pneumatic Valves for pressure, flow and direction control

UNIT-II

Basic Hydraulic and Pneumatic Circuits: Direct and Indirect Control of Single/Double Acting Cylinders Designing of logic circuits for a given time displacement diagram & sequence of operations, Hydraulic & Pneumatic Circuits using Time Delay Valve & Quick Exhaust Valve Memory Circuit & Speed Control of a Cylinder Trouble shooting and "Causes & Effects of Malfunctions" Basics of Control Chain Circuit Layouts Designation of specific Elements in a Circuit.

Fluidics: Boolean algebra Truth Tables Logic Gates Coanda effect.

UNIT-III

Electrical and Electronic Controls: Basics of Programmable logic controllers (PLC) Architecture & Components of PLC Ladder Logic Diagrams.

Transfer Devices and Feeders: Classification, Constructional details and Applications of Transfer Devices Vibratory bowl feeders Reciprocating Tube Centrifugal hopper feeders.

UNIT-IV

Robotics Introduction: Classification based on geometry, control and path movement, Robot Specifications, Robot Performance Parameters Robot Programming Machine Vision, Teach pendants Industrial Applications of Robots

Recommended Books

1. Anthony Esposito, 'Fluid Power with Applications', Pearson Publications.
2. S.R. Majumdar, 'Pneumatic Control', McGraw Hill Publications.
3. S.R. Deb, 'Robotic Technology and Flexible Automation', Tata McGraw Hill Publications.

4. Saeed B. Niku, 'Introduction to Robotics', Wiley India.
5. Ashitava Ghosal, 'Robotics', Oxford Publications.

DESIGN OF MACHINE ELEMENTS-I LAB.

Subject code: BMEE1-523 **L T P C**
0 0 2 1

1. Select a suitable product and identify the design process talking the controlling parameters
2. To select a suitable material for the rim of a car/Justify the existing material
3. Design a wall bracket (bolted or riveted) which is being used in real life by actual measurement of load and justify your findings
4. Find a suitable flange coupling and justify its design by actual measurements
5. Design a shaft which is under torsion, bending and combined loading
6. Select a suitable lever setup and justify the design parameters
7. Design a Flanged pipe joint for any practical application.
8. Identify a square or rectangular key and design the same based on shearing and crushing

AUTOMOBILE ENGINEERING LAB.

Subject Code: BMEE1-525 **L T P C**
0 0 2 1

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Study and demonstration of Layout of an Automobile
1. Trouble shooting in cooling system of an automotive vehicle
2. Trouble shooting in the ignition system, setting of contact breaker points and spark plug gap
3. Demonstration of steering system and measurement of steering geometry angles and their impact on vehicle performance.
4. Trouble shooting in braking system with specific reference to master cylinder, brake shoes, overhauling of system and the adjusting of the system and its testing.
5. Fault diagnosis in transmission system including clutches, gear box assembly and differential.
6. Disassembling of engine: inspection of engine components, servicing of components, measurement of dimensions of different components of engine, compare with standard specifications, piston ring setting, assembling using special tools.

FLUID MECHANICS-II

Subject code: BMEE1-562 **L T P C** **Duration: 37 Hrs.**
3 0 0 3

UNIT-I

Potential Flow: Stream function and velocity potential functions for standard flow patterns uniforms flow, source/sink, doublet and free vortex; combination of uniform flow with certain flows to obtain flow patterns of various shapes such as flow past a half body, a cylinder, a Rankine oval body, and a cylinder with circulation: Kutta joukowski Theorem-lift on a cylinder.
Viscous Flow: Navier Stokes equation of motion; Relationship between shear stress and pressure gradient; two dimensional laminar flow between two fixed parallel planes; Plain Couette flow and its application to hydro-dynamic theory of lubrication.

UNIT-II

Turbulence: Fluctuation velocity components; intensity and scale of turbulence; Reynolds equations and turbulence modeling.

Boundary Layer: Salient features of flow pattern in a boundary layer; Velocity and shear stress distribution along the boundary; Von-Karman momentum integral equation, Quantitative correlation for boundary layer thickness, local skin friction coefficient and drag coefficient in laminar, turbulent and laminar turbulent combined boundary layer flows on a flat plate without pressure gradient; flow over a curved surface boundary layer separation and its control.

UNIT-III

Flow around Immersed Bodies: Concept of friction, pressure, wave and induced drag- lift and drag coefficients; variation of drag coefficient with Reynolds number for two dimensional bodies (flat plate, circular cylinder); Vortex shedding from cylindrical bodies; effect of streamlining; drag coefficient versus Reynolds number for flow past axisymmetric bodies (sphere); Terminal velocity; Lift of an airfoil; Airfoil of finite length-effect on drag and lift; Downwash and induced drag.

UNIT-IV

Compressible Flow: Wave propagation and sonic velocity; Mach number, Limits of incompressibility and compressible flow regimes; pressure field due to a moving source of disturbance, Mach cone and Mach angle. Basic equations for one-dimensional compressible flow; static and stagnation values; Isentropic flow relations; compressibility correction factor. Isentropic flow through a duct of varying cross-section, mass flow rate and choking in a converging passage. Normal shock and change in flow properties across a normal shock wave.

Recommended Books

1. B.S. Massey, ‘Mechanics of Fluids’, ELBS and Van Nostrand Reinhold Co.
2. Pao H.F. Richard, ‘Fluid Mechanics’, John Wiley and Sons.
3. D.S. Kumar, ‘Fluid Mechanics and Fluid Power Engineering’, S.K. Kataria and Sons, Delhi.
4. J. F. Douglas, ‘Fluid Mechanics’, Gasionckw and Swaffield J.P. Pitman.
5. V.L. Streeter and E.B. Wylie, ‘Fluid Mechanics’, McGraw Hill International.

TOOL DESIGN

Subject Code: BMEE1-563	L T P C 3 0 0 3	Duration: 37 Hrs.

UNIT-I

INTRODUCTION: General requirements to machine tools, Machine tool design recommendations, Classification of motions to shape surface, Machine tool drives for rectilinear motion, Periodic motion, reversing motion etc.

KINEMATICS OF MACHINE TOOLS: Kinematics or gearing diagram of Lathe, drilling machine, milling machine etc. Main drive and feed drive, principal specification of machine tools.

UNIT-II

DESIGN OF KINEMATICS SCHEME: Methods to determine transmission ratios for drives. Development of kinematics scheme, minimum of transmission, transmission groups, Determination of number of teeth on gears.

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SPEED AND FEED BOXES: General requirement, Design of gear trains, types of speed boxes, speed changing devices, feed boxes, characteristics of feed mechanism, types of rapid traverse mechanisms, variable devices.

UNIT-III

SPINDLE DESIGN AND SPINDLE BEARINGS: Main requirements, Materials and details of spindle design, spindle bearings, bearings, types of bearing sand their selections, bearing materials.

BED, COLUMNS, TABLES AND WAYS: Materials, typical constructions and Design.

UNIT-IV

MACHINE TOOLS CONTROL SYSTEMS: Requirement of control system, selection and construction of control systems, Mechanical control system, predilection control, remote control safety devices.

MACHINE TOOL DYNAMICS: Dynamic performance, dynamic and elastic system of Machine, tools. Dynamics of cutting forces, tool chatter.

RECOMMENDED BOOKS:

1. Sen and Bhattacharya, 'Machine Tools Design', CBS Publishers.
2. N.K. Mehta, 'Machine Tool Design', Tata McGraw Hill.
3. N. Acherkan, 'Machine Tool Design', Four Volumes, Mir Publishers.
4. P.H. Joshi, 'Machine Tools Handbook: Design and Operation', McGraw Hill Professional'
5. S.K. Basu and D.K. Pal, 'Design of Machine Tools', Oxford and IBH.

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FINITE ELEMENT METHODS

Subject Code: BMEE1-564 **L T P C** **Duration: 37 Hrs.**
3 0 0 3

UNIT – I

Introduction to Finite Element Method for solving field problems. Stress and Equilibrium. Strain -Displacement relations. Stress - strain relations.

UNIT – II

One Dimensional Problems: Finite element modeling coordinates and shape functions.

Potential Energy approach: Assembly of Global stiffness matrix and load vector. Finite element equations, Treatment of boundary conditions, Quadratic shape functions.

UNIT – III

Analysis of Beams: Element stiffness matrix for two node, two degrees of freedom per node beam element.

Finite element modelling of two dimensional stress analysis with constant strain triangles and treatment of boundary conditions.

Finite element modelling of Axisymmetric solids subjected to Axisymmetric loading with triangular elements.

UNIT – IV

Two dimensional four noded isoparametric elements and numerical integration.

Steady state heat transfer analysis: one dimensional analysis of a fin and two dimensional analysis of thin plate. Analysis of a uniform shaft subjected to torsion.

Dynamic Analysis : Formulation of finite element model, element matrices, evaluation of Eigen values and Eigen vectors for a stepped bar and a beam.

Recommended Books

1. Chandraputla Ashok and Belegundu, 'Introduction to Finite Elements in Engineering', Prentice -Hall.
2. S.S. Rao, 'The Finite Element Methods in Engineering', Pergamon.
3. J.N. Reddy, 'An Introduction to Finite Element Method', McGraw Hill.
4. Alavala, 'Finite Element Methods', TMH.
5. Kenneth H. Huebner, Donald L. Dewhirst, Douglas E. Smith and Ted G. Byrom, 'The Finite Element Method for Engineers', John Wiley & Sons. (ASIA) Pte Ltd.
6. C.S. Krishna Murthy, 'Finite Element Analysis'.

DEIGN OF MACHINE ELEMENTS-II

Subject code: BMEE1-628 **L T P C** **Duration: 25 Hrs.**
2 0 0 2

Course Objectives: To expose the students to the design and analysis of different gears, brakes, clutches, belts, chain, ropes, bearings and springs. Basics of FEM and integration of computers in design of different machine elements will be discussed.

UNIT-I

Transmission Drives: Belt and rope drives: Belt drives and its selection, Design of Flat belt, V-belt and steel rope, Design of the pulley.

Chain Drives: Types of chains, polygonal effect, power rating, selection of bush roller chain.

Gear Drives: Type of gears, Terminology, Tooth profile, gear tooth failure, strength of gear tooth, Design of spur, helical, straight bevel gears, worm and worm wheel

UNIT-II

Clutches and Brakes: Introduction, types, construction, Design of band brakes, block brakes, internal and external expanding shoe brakes. Design of friction clutches (single plate, multi plate and cone), centrifugal clutches.

Design of Flywheel: Introduction, Energy stored in a flywheel, stresses in a rim/arms, design considerations.

UNIT-III

Bearings: Selection of bearings

Sliding and Rolling contact bearings: Principle of hydrodynamic/hydrostatic lubrication, bearing performance parameters, Design of journal bearings. Rating life, Average life, Selection of ball bearings and roller bearings.

Computer aided Machine Design and Introduction to FEM: Philosophy of Computer Aided Machine Design, Interactive design software, Basic advantages of analysis Software, Design of machine components through interactive programming. Introduction of the FEM, historical background, Brief overview of the steps used in FEM.

UNIT-IV

Close-coiled Helical springs: Introduction to types and applications, spring materials, compression and extension helical closed coil springs, Design of helical springs for round wires.

Leaf Springs: Construction, Nipping, pre stressing of springs, Design of semi elliptical leaf springs

Learning Outcomes: The students will be able to:

1. Do the force analyses on different gear types i.e., spur helical, bevel and worm?
2. Do the force analysis of block brake; analysis and design of band brake, internal expanding

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3. brake, external expanding brake.
4. Design a single, multiple and cone clutch, flat, V-belts, chains and ropes.
5. Understand the sliding and rolling contact bearing.
6. Analyze and design the closed coiled helical spring and leaf spring.
7. Understand the role of computers in design

Recommended Books

1. V.B. Bhandari, 'Design of Machine Elements', Tata McGraw Hill, New Delhi, **2007.**
2. J. Shigley, 'Mechanical Engineering Design', McGraw Hill Book Company Inc., New York **2003**
3. M.F. Spotts and T.E. Shoup, 'Design of Machine Elements', Pearson Education, New Delhi, **2003.**
4. R.C. Juvinall and K.M. Marshek, 'Fundamental of Machine Component Design', John Wiley & Sons, New York**, 2005.**
5. R.L. Norton, 'Machine Design: An Integrated Approach', Pearson Education, New Delhi, **2006.**

Note: 1. Only the design data book compiled by PSG college of Engg. & Tech., Coimbatore and Machine Design data book by Balveera Reddy published by CBS publishers is allowed in Examination.

HEAT TRANSFER

Subject Code: BMEE1-629	**L T P C** **3 1 0 4**	**Duration: 40 Hrs.**

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UNIT-I

Introduction: Concept of heat transfer, Difference between the subject of "Heat Transfer" and its parent subject "Thermodynamics". Different modes of heat transfer - conditions, convection, and radiation.

UNIT-II

Conduction: Fourier's law of heat conduction, coefficient of thermal conductivity, effect of temperature and pressure on thermal conductivity of solids, liquids and gases and its measurement. Three dimensional general conduction equation in rectangular, cylindrical and spherical coordinates involving internal heat generation and unsteady state conditions. Derivation of equations for simple one dimensional steady state heat conduction from three dimensional equations for heat conduction though walls, cylinders (Hollow and solid) and spherical shells (hollow and solid) (simple and composite), logarithmic mean area, Critical thickness of insulation, electrical analogy of the heat transfer phenomenon in the cases discussed above. Influence of variable thermal conductivity on conduction through simple cases of walls / cylinders and spheres. Equivalent areas, shape factor, conduction through edges and corners of walls and critical thickness of insulation layers on electric wires and pipes carrying hot fluids. Internal generation cases along with some practical cases of heat conduction like heat transfer through piston crown, dielectric heating, through under-ground electrical cables/Hot fluid pipes etc. and case of nuclear fuel rod with and without cladding. Overall heat transfer coefficient, Thermal contact resistance Introduction to unsteady heat transfer, lumped parameter analysis, time constant and response of a thermocouple, Newtonian heating and cooling of solids; definition and explanation of the term thermal diffusivity. Numerical.

Theory of Fins: Concept of fin, classification of fins and their applications. Straight fins of uniform cross-section; e.g. of circular, rectangular or any other cross-section). Straight fins with varying cross-sectional area and having triangular or trapezoidal profile area. Circumferential fins of rectangular cross section provided on the circumference of a cylinder. Boundary conditions of the fins and the cases arising therein. Fin performance: fin effectiveness and fin efficiency, total fin effectiveness, total fin efficiency. Optimum design of straight fin of rectangular and triangular profile area. Application of fins in temperature measurement of flow through pipes and determination of error in its measurement. Heat transfer from a bar connected to the two different temperature heat sources. Numericals.

UNIT-III

Convection: Introduction to hydrodynamics, Free and forced convection. Derivation of three-dimensional mass, momentum and energy conservation equations (with introduction to Tensor notations) Boundary layer formation, laminar and turbulent boundary layers (simple explanation only and no derivation). Thermal boundary layer over a flat plate. Theory of dimensional analysis and its application to free and forced convective heat transfer. Analytical formulae for heat transfer in laminar and turbulent flow over vertical and horizontal tubes and plates. Flow across a bank of tubes. Combined free and forced convection. Numerical.

Newton's law of cooling. Overall coefficient of heat transfer. Classification of heat exchangers, Different design criterion for heat exchangers. Log mean temperature difference for evaporator and condenser tubes, and parallel and counter flow heat exchangers, Calculation of number and length of tubes in a heat exchanger effectiveness and number of transfer units (NTU); fouling factor. Numericals.

Convection with Phase Change (Boiling and Condensation): Pool boiling, forced convection boiling, heat transfer during pool boiling of a liquid. Nucleation and different theories of nucleation, different theories accounting for the increased values of h.t.c. during nucleate phase of boiling of liquids; different phases of flow boiling (theory only), Condensation, types of condensation, film wise condensation on a vertical and inclined surface; on and inside horizontal tubes. Numerical.

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UNIT-IV

Radiation: Process of heat flow due to radiation, surface emission properties, definition of emissivity, absorptivity, reflectivity and transmissivity. Concept of black and grey bodies, Plank's law of monochromatic radiation. Kirchhoff's law, Stefan Boltzmann's law and Wien's displacement law. Interchange factor. Intensity of radiation and Lambert's Cosine law.

Radiation Exchange between Surfaces: Reciprocity Theorem, Shape factor algebra and its features. Intensity of Radiation (Definition only), radiation density, irradiation, radiosity and radiation shields. Derivation formula for radiation exchange between two bodies using the definition of radiosity and irradiation and its application to cases of radiation exchange between three or four grey and black bodies and for two grey and black surfaces connected by single refractory surface (e.g. boiler or other furnaces), simplification of the formula for its application to simple bodies like two parallel surfaces, concentric cylinders and a body enveloped by another body etc. Coefficient of radiant heat transfer, Radiation from gases, vapors and flames. Error in Temperature measurement by a thermocouple probe due to radiation losses.

Recommended Books

1. Frank P. Incropera and David P. De Witt, ‘Fundamentals of Heat and Mass Transfer’, John Wiley.
2. P.S. Ghoshdastidar, ‘Heat Transfer’, Oxford Press.

3. D.S. Kumar, 'Fundamentals of Heat and Mass Transfer', S.K. Kataria & Sons.
4. A.J. Chapman, 'Heat Transfer', McGraw Hill Book Company, New York.
5. J.P. Holman, 'Heat Transfer', Tata McGraw-Hill Publishing Company Ltd.
6. A. Yunus Cengel, 'Heat and Mass Transfer', Tata McGraw Hills Education Private Ltd.

FLUID MACHINERY

Subject code: BMEE1-630	L T P C 3 1 0 4	Duration: 45 Hrs.

Learning Objectives: To expose the students to the basic fundamentals of Momentum Equation, Euler's equation for energy transfer, Impact of jets, turbines and pumps.

UNIT-I (12 Hrs.)

General Concepts: Impulse momentum principle; jet impingement on stationary and moving flat plates, and on stationary or moving vanes with jet striking at the center and tangentially at one end of the vane; calculations for force exerted, work done and efficiency of jet.

Basic components of a turbo machine and its classification on the basis of purpose, fluid dynamic action, operating principle, geometrical features, path followed by the fluid and the type of fluid etc. Euler's equation for energy transfer in a turbo machine and specifying the energy transfer in terms of fluid and rotor kinetic energy changes.

Viscous Flow: Momentum Equation, Navier Stokes Equation and its derivation, aerofoil theory, lift and drag.

UNIT-II (11 Hrs.)

Pelton Turbine: Component parts and operation; velocity triangles for different runners, work output; Effective head, available power and efficiency; design aspects such as mean diameter of wheel, jet ratio, number of jets, number of buckets with working proportions

Francis and Kaplan Turbines: Component parts and operation velocity triangles and work output; working proportions and design parameters for the runner; Degree of reaction; Draft tubes - its function and types. Function and brief description of commonly used surge tanks, Electro- Mechanical governing of turbines

UNIT-III (12 Hrs.)

Centrifugal Pumps: Layout and installation; Main elements and their functions; Various types and classification; Pressure changes in a pump - suction, delivery and manometric heads; vane shape and its effect on head-capacity relationships; Departure from Euler's theory and losses; pump output and efficiency; Minimum starting speed and impeller diameters at the inner and outer periphery; Priming and priming devices, Multistage pumps - series and parallel arrangement; submersible pumps. Construction and operation; Axial and mixed flow pumps; Trouble shooting - field problems, causes and remedies.

Similarity Relations and Performance Characteristics: Unit quantities, specific speed and model relationships, scale effect; cavitation and Thomas cavitation number; Concept of Net Positive Suction Head (NPSH) and its application in determining turbine / pump setting

UNIT-IV (10 Hrs.)

Reciprocating Pumps: Components parts and working; pressure variations due to piston acceleration; acceleration effects in suction and delivery pipes; work done against friction; maximum permissible vacuum during suction stroke; Air vessels.

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Hydraulic Devices and Systems: Construction, operation and utility of simple and differential accumulator, intensifier, fluid coupling and torque converter, Air lift and jet pumps; gear, vane and piston pumps, Hydraulic Rams.

Learning Outcomes (CLO)

The students will be able to:

1. Understand the working principle of the hydropower plant, selection of design parameters, size calculations of the hydro turbine component.
2. Understand the governing, similarity relations and unit quantities for pump and turbine.
3. Understand the basic working principle of pumps, centrifugal and reciprocating pumps, their design parameters.

Recommended Books

1. R.L. Daughaty, Hydraulic Turbines, McGraw Hill.
2. Jagdish Lal, 'Hydraulic Machines', Metropolitan Book Co.
3. D.S. Kumar, 'Fluid Mechanics and Fluid Power Engineering', S.K. Kataria and Sons.
4. K. Subramaniam, 'Hydraulic Machines', Tata McGraw Hill.
5. S.S. Rattan, 'Fluid Machines and Hydraulic Machines', Khanna Publishers, New Delhi, **2004**.
6. J.F. Douglas, J.M. Gasiorek and J.A. Swaffield, 'Fluid Mechanics', Addison-Wesley. Longman Inc., Edinburgh, U.K., **1995.**
7. R.L. Panton, 'Incompressible Fluid Flow', John Wiley & Sons, New Jersey, **2005.**
8. F.M. White, 'Viscous Fluid Flow', McGraw Hill, New York, **2006.**
9. T. Wright, 'Fluid Machinery', CRC Press, USA, **2009.**

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DESIGN OF MACHINE ELEMENTS -II LAB.

Subject Code: BMEE1-631 **L T P C**
0 0 2 1

1. Find an assembly containing the belt and pulley mechanism for a flat belt and do the complete design calculations and then justify the existing design.
2. Find an assembly containing the belt and pulley mechanism for a V belt and do the complete design calculations and then justify the existing design.
3. Locate a design a rope assembly for practical applications like cranes, recovery vans etc., and do the complete design calculations and then justify the existing design.
4. Find a transmission system involving the spur/helical gear and then find out the inputs required for its design and justify the design for the gear.
5. For a punching machine/ automobile/IC engines etc., study the flywheel location and suggest the design of the flywheel. Justify the design if flywheel is already there.
7. Design a leaf springs for practical application (Automobiles) for the given conditions and constraints and find its practical availability.
8. Selection of a suitable ball bearing based on some practical application.

HEAT TRANSFER LAB.

Subject Code: BMEE1- 632 **L T P C**
0 0 2 1

A. Two to three students in a group are required to do one or two practicals in the form of Lab. Project in the topic/s related to the subject matter and in consultation with teacher. The complete theoretical and experimental analysis of the concerned topic is required to be performed (including design and fabrication of new experimental set up, if required, or modifications/retrofitting in the existing experimental set ups). The following topics can be taken as reference:

1. Determination of thermal conductivity of:
   a) a solid insulating material by slab method
   b) powder materials by concentric spheres method / or by some transient heat transfer
   c) technique
   d) a metal by comparison with another metal by employing two bars when kept in series
   e) and / or in parallel under different boundary conditions
   f) Liquids by employing thin layer
   g) a composite wall.
2. Determination of coefficient of heat transfer for free/forced convection from the surface of
   a) Cylinder / plate when kept:
   b) Along the direction of flow
   c) Perpendicular to the direction of flow
   d) Inclined at an angle to the direction of flow
3. To plot the pool boiling curves for water and to determine its critical point
4. Determination of heat transfer coefficient for
   a) Film condensation
   b) Drop-wise condensation
5. Determination heat transfer coefficient by radiation and hence find the Stefan Boltzmann's constant using two plates/two cylinders of same size by making one of the plates/cylinders as a black body.
6. Determination of shape factor of a complex body by an analog technique.
7. To plot the temperature profile and to determine fin effectiveness and fin efficiency for
   i) A rod fin when its tip surface is superimposed by different boundary condition like.
      a) Insulated Tip
      b) Cooled Tip
      c) Temperature Controlled Tip
   ii) Straight triangular fins of various sizes and optimization of fin proportions
   iii) Circumferential fins of rectangular/triangular section

B. Each student is required to use Finite Difference Method for analysis of steady state one dimensional and two dimensional conduction problems (Minimum two problems one may be from the Lab. Project) such as conduction through plane / cylindrical / spherical wall with or without internal heat generation, heat transfer through fins, bodies with irregular boundaries subjected to different boundary conditions.

FLUID MACHINERY LAB.

Subject Code: BMEE1-633	**L T P C**
	0 0 2 1

1. Determination of various efficiencies of Hydraulic Ram.
2. To draw characteristics of Francis turbine.
3. To draw characteristics of Kaplan Turbine.

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4. To study the constructional features of reciprocating pump and to perform test on it for determination of pump performance.
5. To draw the characteristics of Pelton Turbine.
6. To draw the various characteristics of Centrifugal pump.
7. A visit to any Hydroelectric Power Station.

OPERATION MANAGEMENT

Subject Code: BMEE1 - 665 **L T P C** **Duration: 35 Hrs.**
3 0 0 3

UNIT-I

Need and Scope of Operation Management: Types of production system and their characteristics, productivity definition, types and measurements

Product Design and Development: Steps involved in product design and development, considerations of technical, ergonomic, aesthetic, economic and time factors. Use of concurrent engineering in product design and development.

UNIT-II

Planning and Forecasting: Role of market survey and market research in pre-planning, long medium and short range forecasting, objective and techniques of forecasting, smoothening and revision of forecast , PRODUCTION PLANNING: Production planning objective and functions, Bill of material, Capacity and man power requirement planning, operation analysis and process planning, long range planning, aggregate planning; Objective, Strategies, graphical and mathematical techniques of aggregate planning, master production scheduling, MRP and MRPII Systems.

UNIT-III

Production Control: Capacity control and priority control, production control functions; Routing, scheduling, dispatching, expediting and follow up. Techniques of production control in job shop production, batch production and mass production systems,

Material Management: Objectives, scope and functions of material management, planning, procurement, storing, ending and inventory control. Purpose of inventory, inventory cost, inventory control systems, Selective inventory control systems, Determination of EOQ, Lead time and reorder point. Methods of physical stock control.

UNIT-IV

Quality Control: Meaning of quality and quality control, quality of design, quality of conformance and quality of performance, functions of quality control. Introduction to statistical quality control-control charts and sampling plans

Management Information Systems: Introduction to MIS, steps in designing MIS, Role of Computers in MIS.

Learning Outcomes

The student will be able to:

1. Understand the fundamental theory of operation management.
2. Make forecasts in the manufacturing and service sectors using selected quantitative and Qualitative techniques.
3. Apply the principles and techniques for planning and control of the production and service systems to optimize/make best use of resources.
4. Understand the importance Quality in production.

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Recommended Books

1. Charry, 'Production and Operation Management', Tata-McGraw Hill.
2. J.G. Monks, 'Production/Operation Management', Tata-McGraw Hill.
3. R.N. Nauhria and Rajnish Prakash, 'Management of Systems', Wheeler Publishing, New Delhi.
4. E.L. Grant and R.S. Leaven Worth, 'Statistical Quality Control', McGraw Hill.

INDUSTRIAL TRIBOLOGY

Subject Code: BMEE1- 666 **L T P C** **Duration: 35 Hrs.**
3 0 0 3

UNIT-I

Introduction: Tribology in design, tribology in industry Viscosity, flow of fluids, viscosity and its variation -absolute and kinematic viscosity, temperature variation, viscosity index determination of viscosity, different viscometers, Tribological considerations Nature of surfaces and their contact; Physic-mechanical properties of surface layer, Geometrical properties of surfaces, methods of studying surfaces; Study of contact of smoothly and rough surfaces

Friction and Wear: Role of friction and laws of static friction, causes of friction, theories of friction, Laws of rolling friction; Friction of metals and non-metals; Friction measurements. 2.1 Definition of wear, mechanism of wear, types and measurement of wear, friction affecting wear, Theories of wear; Wear of metals and non-metals.

UNIT-II

Hydrostatic Lubrication: Principle of hydrostatic lubrication, General requirements of bearing materials, types of bearing materials., Hydrostatic step bearing, application to pivoted pad thrust bearing and other applications, Hydrostatic lifts, hydrostatic squeeze films and its application to journal bearing, optimum design of hydrostatic step bearing

Hydrodynamic theory of lubrication: Principle of hydrodynamic lubrication, Various theories of lubrication, Petroffs equation, Reynold's equation in two dimensions -Effects of side leakage - Reynolds equation in three dimensions, Friction in sliding bearing, hydro dynamic theory applied to journal bearing, minimum oil film thickness, oil whip and whirl, anti -friction bearing, hydrodynamic thrust bearing.

UNIT-III

Air/gas Lubricated Bearing: Advantages and disadvantages application to Hydrodynamic journal bearings, hydrodynamic thrust bearings. Hydrostatic thrust bearings. Hydrostatic bearing Analysis including compressibility effect.

Lubrication and Lubricants: Introduction, dry friction; Boundary lubrication; classic hydrodynamics, hydrostatic and elasto hydrodynamic lubrication, Functions of lubricants, Types of lubricants and their industrial uses; SAE classification, recycling, disposal of oils, properties of liquid and grease lubricants; lubricant additives, general properties and selection.

UNIT-IV

Special Topics: Selection of bearing and lubricant; bearing maintenance, diagnostic maintenance of Tribological components and considerations in IC engines and automobile parts, roller chains and wire rope, lubrication systems; Filters and filtration.

Learning Outcomes

The focus of Tribology & Lubrication is the fundamentals of interfacial contact, adhesion, friction, wear and lubrication. By the end of the course student should:

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1. Have a knowledge of surface topography and know how to model a rough engineering surface;
2. Have a clear overall picture about the basics of tribology and related sciences, theoretical background about processes in tribological system, mechanisms and forms of interaction of friction surfaces;
3. Understand Hertz contact and rough surface contact;
4. Be familiar with adhesion theories and the effect of adhesion on friction and wear;
5. Have a mastery of the friction/lubrication mechanisms and know how to apply them to the practical engineering problem;
6. Know the methods to reduce the friction for engineering surface

MECHATRONICS

Subject Code: BMEE1-668	**L T P C** **3 0 0 3**	**Duration: 36 Hrs.**

UNIT-I

Introduction: Definitions, trends, control systems, microprocessor / micro controller based controllers, PC based controllers, applications: SPM, robot, CNC machine, FMS, CIM.

Sensor Technology: Sensor and transducers, terminology, displacement, position, proximity - encoders, velocity – tacho generators, force - strain gauges, pressure, temperature-thermocouples, RTDs, thermistors, light sensors - photoelectric sensors, IR sensors, sensor selection.

Signal Conditioning: Introduction, the operational amplifier, protection, filtering, Wheatstone bridge, digital signals, multiplexers, data acquisition, digital signal processing, pulse-modulation.

UNIT-II

Precision Mechanical Actuation: Pneumatic actuation systems, electro-pneumatic actuation systems, hydraulic actuation systems, electro-hydraulic actuation systems, mechanical systems, types of motion, kinematics, inverse kinematics, timing belts, ball screw and nut, linear motion guides, linear bearings, harmonic transmission, bearings, motor / drive selection.

Electronic Devices and Circuits: Semiconductor devices, diodes and LEDS, zener diodes and voltage regulator, inductive kick, bandwidth, frequency %& response of a measurement system, bipolar transistor circuits, amplifiers.

UNIT-III

Electromechanical Drives: Relays and solenoids, stepper motors, DC brushed and brushless motors, DC servomotors, AC / DC motors for non-servo motion drives, braking methods, pulse width modulated, Bipolar driver, Mosfet drives, SCR drives, variable frequency drives

Digital Electronics: Digital logic, number systems, logic gates, Boolean algebra, Karnaughrnaps, sequential logic.

Microprocessors: Control, microcomputer structure, microcontrollers, digital interfacing, analog interfacing, DAC, ADC, applications.

UNIT-IV

Input / Output Systems: Interfacing, input / output ports, interface requirements, peripheral interface adapters, serial communication interface, direct memory access.

Control System: System transfer function, Laplace transformation and its applications, continuous and discrete processes, proportional control, integral control, differential control, PID

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control, digital controllers, control system performance, controller tuning, adaptive control, frequency response, PLC, PMC, introduction to fuzzy logic and neural networks.

Recommended Books

1. Kamm, 'Understanding Electro-Mechanical Engineering - An Introduction to Mechatronics' Prentice-Hall of India**.**
2. Koren, 'Computer Control of Manufacturing System', McGraw Hill.
3. Groover, 'Production Systems and CIM', Prentice Hall of India.
4. Maleki, 'Flexible Manufacturing Systems', Prentice Hall of India.
5. B.C. Kuo, 'Feedback Control Systems', Prentice Hall of India.
6. Sabri Cetinkunt, 'Mechatronics', Wiley Publications, **2006.**

Learning Objectives

1. To enable the student to understand the modern mechatronics components;
2. To present the underlying principles and alternatives for mechatronics systems design;
3. To provide the student with the opportunity for hands-on experience with the related components of the technology for diverse domains of application;
4. To develop the student's ability to evaluate appropriate technology and create and devise
5. realistic industrial systems.

The students will be able to understand the difference between Heat transfer and Thermodynamics and will also learn different modes of heat transfer. He will be able to solve the practical problems related to heat transfer in Cartesian, Cylindrical and Spherical co-ordinates. He will also learn how to increase the rate of heat flow by using the extended surfaces and also the heat transfers with phase change.

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SOLAR ENERGY

Subject Code: BMEE1 – 670	**L T P C** **3 0 0 3**	**Duration: 37 Hrs.**

Learning Objectives:

Upon successful completion of the course the students will be able to understand and apply
1. The characteristics and world distribution of solar radiation.
2. The solar radiation and measurement techniques.
3. The methods of calculation of solar radiation availability at a given location.
4. The fundamentals of thermal and direct conversion of solar energy to power.

UNIT-I

Energy Resources and Solar Spectrum: World energy resources - Indian energy scenario - Environmental aspects of energy utilization. Renewable energy resources and their importance – Global solar resources. Solar spectrum – Electromagnetic spectrum, basic laws of radiation. Physics of the Sun - Energy balance of the Earth, energy flux, solar constant for Earth, greenhouse effect

UNIT-II

Solar Radiation and Measurement: Solar radiation on the earth surface - Extraterrestrial radiation characteristics, Terrestrial radiation, solar isolation, spectral energy distribution of solar radiation. Depletion of solar radiation - Absorption, scattering. Beam radiation, diffuse and Global radiation. Measurement of solar radiation – Pyranometer, pyrheliometer, Sunshine recorder. Solar time - Local apparent time (LAT), equation of time (E)

UNIT-III

Solar Radiation Geometry and Calculations: Solar radiation geometry - Earth-Sun angles – Solar angles. Calculation of angle of incidence - Surface facing due south, horizontal, inclined surface and vertical surface. Solar day length – Sun path diagram – Shadow determination. Estimation of Sunshine hours at different places in India. Calculation of total solar radiation on horizontal and tilted surfaces. Prediction of solar radiation availability.

UNIT-IV

Solar Thermal Energy Conversion: Thermodynamic cycles – Carnot – Organic, reheat, regeneration and supercritical Rankine cycles - Brayton cycle – Sterling cycle – Binary cycles – Combined cycles. Solar thermal power plants - Parabolic trough system, distributed collector, hybrid solar-gas power plants, solar pond based electric power plant, central tower receiver power plant.

Solar Electrical Energy Conversion: Solar photovoltaic energy conversion - Principles - Physics and operation of solar cells. Classification of solar PV systems, Solar cell energy conversion efficiency, I-V characteristics, effect of variation of solar insolation and temperature, losses. Solar PV power plants.

Recommended Books

1. J.A**.** Duffie and W.A. Beckman, 'Solar Engineering of Thermal Processes', 3rd Edn., Wiley Publications, **2006.**
2. De Vos, 'Thermodynamics of Solar Energy Conversion', Wiley- VCH, **2008.**
3. H.P. Garg and J. Prakash, 'Solar Energy Fundamentals and Applications', Tata McGraw-Hill, **2005.**
4. S. Kalogirou, 'Solar Energy Engineering- Processes and Systems', Elsevier, **2009.**
5. R. Petela, 'Engineering Thermodynamics of Thermal Radiation for Solar Power', McGraw-Hill Co., **2010.**
6. D. Yogi Goswami, Frank Kreith, Jan F. Kreider, 'Principles of Solar Engineering', 2nd Edn., Taylor & Francis, **2003.**

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ENERGY CONSERVATION AND MANAGEMENT

Subject Code: BMEE1-671	**L T P C 3 0 0 3**	**Duration: 37 Hrs.**

UNIT-I

Introduction: Energy – Power – Past & Present scenario of World; National Energy Consumption Data – Environmental aspects associated with energy utilization –Energy Auditing: Need, Types, Methodology and Barriers. Role of Energy Managers. Instruments for energy auditing.

UNIT-II

ELECTRICAL SYSTEMS: Components of EB billing – HT and LT supply, Transformers, Cable Sizing, Concept of Capacitors, Power Factor Improvement, Harmonics, Electric Motors – Motor Efficiency Computation, Energy Efficient Motors, Illumination – Lux, Lumens, Types of lighting, Efficacy, LED Lighting and scope of Encon in Illumination.

UNIT-III

THERMAL SYSTEM: Stoichiometry, Boilers, Furnaces and Thermic Fluid Heaters – Efficiency computation and encon measures. Steam: Distribution &U sage: Steam Traps, Condensate Recovery, Flash Steam Utilization, Insulators & Refractories.

UNIT-IV

ENERGY CONSERVATION IN MAJOR UTILITIES: Pumps, Fans, Blowers, Compressed Air Systems, Refrigeration and Air Conditioning Systems – Cooling Towers – D.G. sets

ECONOMICS: Energy Economics – Discount Rate, Payback Period, Internal Rate of Return, Net Present Value, Life Cycle Costing –ESCO concept.

Recommended Books

1. L.C. Witte, P.S. Schmidt, D.R. Brown, 'Industrial Energy Management and Utilization', Hemisphere Publications, Washington, **1988**.
2. P.W. Callaghan, 'Design and Management for Energy Conservation', Pergamon Press, Oxford, **1981**.

REFRIGERATION AND AIRCONDITIONING

Subject Code: BMEE1- 734 **L T P C** **Duration: 42 Hrs.**

3 1 0 4

UNIT-I (12 Hrs.)

Basic Concepts: Definition of Refrigeration and Air conditioning; Difference between Refrigeration and cooling; Difference between Refrigeration and Air conditioning; Brief history of Refrigeration and Air conditioning; Natural and Mechanical Refrigeration; Applications of Refrigeration and Air conditioning; Definitions of refrigerant, cooling/ Refrigeration effect, cooling capacity, heating effect, heating capacity; Units of refrigeration; Coefficient of performance and Energy Efficient Ratio; COP of a refrigerator; and COP/EPR of a heat pump; Single Phase Reversed Carnot cycle and its limitations; Two Phase Reversed Carnot cycle and its limitations; Methods of Refrigeration; Numerical.

Gas Cycle Refrigeration and Aircraft Refrigeration & Air conditioning: Bell Coleman/Reversed Brayton / Reversed Joule Cycle and its analysis; Analysis of ideal thermodynamically coupled refrigerator and engine Numerical; Applications of Gas Cycle Refrigeration; Necessity of aircraft refrigeration and air conditioning; Classification of aircraft refrigeration and air conditioning systems; Simple/basic aircraft refrigeration and air conditioning system (with and without evaporative cooler); Need of evaporator cooler; Boot Strap aircraft refrigeration and air conditioning system (with and without evaporative cooler); Regenerative aircraft refrigeration and air conditioning system; Reduced Ambient aircraft refrigeration and air conditioning system; Performance of air-refrigeration systems; Dry Air Rated Temperature (DART); Comparison of different aircraft refrigeration and air conditioning systems; Numerical.

UNIT-II (11 Hrs.)

Vapour Compression Refrigeration Cycle: Vapour compression refrigeration system and its basic components; Representation of Simple/Theoretical vapour compression refrigeration cycle on h-s, T-s and P-h diagrams; C.O.P. from T-s diagram; Dry versus wet compression; expansion versus throttling of liquid refrigerant; Analysis of Simple/Theoretical vapour compression refrigeration cycle; Introduction of P-h diagram/chart and Refrigeration Tables; Optimum **C.O.P.:** Ewing analysis for maximum C.O.P.; Determination of properties of sub cooled, saturated and superheated refrigerant by using saturated properties & specific heat tables/saturated & superheated properties tables and P-h diagram; Compressor work and volumetric efficiency; Effect on performance and cooling capacity due to change in evaporator pressure, condenser pressure, sub cooling of liquid refrigerant, super heating of suction vapours,

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use of liquid - vapour regenerative heat exchanger; Effect on performance and cooling capacity due to heat exchange of vapours with compressor cylinder walls, pressure drop in suction (wire drawing) and discharge valves, pressure drop in evaporator and condenser; Actual vapour compression refrigeration cycle on T-s and P-h diagrams (No mathematical analysis); Numericals. Flash gas, its advantages and disadvantages, and its removal: flash chamber, liquid sub-cooler; Introduction to compound (multistage) compression, its advantages, schematic representation of these systems with use of flash chamber, water intercooler, flash intercooler, liquid sub-cooler (independent and combination of these); Introduction to multiple evaporator systems, schematic representation of these systems with use of individual and multiple expansion valves arrangements, with single and multiple (individual and compound) compressor. Numericals.

Vapour Absorption Refrigeration Cycle (No Mathematical Analysis): Principle and advantages of vapour absorption refrigeration system over compression system; basic components of the vapour absorption refrigeration system; Desirable properties of absorption system refrigerant and absorbent; Aqua - ammonia vapour absorption refrigeration system; Lithium Bromide - water absorption system (Single and double effect); Electrolux refrigeration system; comparison between vapour absorption and compression systems.

UNIT-III (11 Hrs.)

Refrigerants: Classification and nomenclature of refrigerants; Desirable thermodynamic, chemical and physical properties of refrigerants; comparative study of commonly used refrigerants and their fields of application; Azeotropes; Zeotropes; Effect of moisture and oil miscibility; Refrigerants dying agents and antifreeze solution; leak detection and charging of refrigerants; environmental aspects of conventional refrigerants; Eco friendly refrigerants and action plan to reduce ecological hazards.

Alternative Refrigeration Systems and Low Temperature Refrigeration: (No Mathematical Analysis) Principle, advantages, limitations and applications of Steam Jet Refrigeration; Mixed Refrigeration Systems; Vortex Tube Refrigeration, Thermoelectric cooling; Trans critical Carbon Dioxide Compression Refrigeration; Cascade Refrigeration System; Linde and Claude cycles, Liquefication of gases, cryogenics and its engineering applications.

UNIT-IV (12 Hrs.)

Air Conditioning Concepts and Applications: Classification of air-conditioning systems; Psychrometry; Dry Air; Moist Air; Basic laws obeyed by Dry Air and Moist Air; Psychrometric properties of air: Dry bulb, wet bulb and dew point temperatures, Relative and specific humidity, degree of saturation adiabatic saturation temperature, enthalpy of air and water vapours; Psychrometric chart and its use; Adiabatic mixing of moist air streams without condensation and with condensation; Numerical.

Human requirement of comforts; effective temperature and comfort charts; Industrial and comfort air conditioning.

Psychometric Processes: Basic psychrometric processes; Sensible heat process; Latent heat process; Total heat process; Sensible heat factor; Evaporative cooling; cooling with dehumidification; Heating with dehumidification; chemical dehumidification; By-pass factor; Contact factor; Psychrometric processes in air conditioning equipment: Cooling coils, Heating coils, cooling and dehumidification coils, Evaporative coolers, Adiabatic dehumidifiers, Steam injection, mixing of air streams, Air washer ; Summer, winter and year round air conditioning systems; Numerical.

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Calculations for Air Conditioning Load and for Rate and state of Supply Air: Sources of heat load; sensible and latent heat load; Cooling and heating load estimation; Apparatus dew point temperature; Rate and state of supply air for air conditioning of different types of premises; Numerical

Refrigeration and Air Conditioning Equipment: Brief description of compressors, condensers, evaporators and expansion devices; Cooling towers; Ducts; dampers; grills; air filters; fans; room air conditioners; split units; Package and central air conditioning plants. Thermal insulation for air conditioning systems.

Recommended Books

1. C.P. Arora, 'Refrigeration and Conditioning', Tata McGraw Hill.
2. Manohar Prasad, 'Refrigeration and Conditioning', Wiley Eastern Limited.
3. Jordan and Priester, 'Refrigeration and Conditioning', Prentice Hall of India.
4. W.F. Stoecker, 'Refrigeration and Conditioning', McGraw Hill.
5. Arora & Domkundwar, 'Refrigeration and Air conditioning', Dhanpat Rai.

REFRIGERATION AND AIRCONDITIONING LAB.

Subject Code: BMEE1-735 **L T P C**
0 0 2 1

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1. Study of various elements of a vapour compression refrigeration system through cut section models / actual apparatus.
2. Study of tools used in refrigeration and air conditioning.
3. Study and performance testing of domestic refrigerator.
4. Study the performance testing of Electrolux refrigerator.
5. Study and performance testing of an Ice plant.
6. Calculation/ Estimation of cooling load for a large building.
7. Visit to a central Air conditioning plant for study of processes for winter and summer air conditioning
8. Visit to a cold storage for study of its working.
9. Study and performance testing of window type room air conditioner.
10. Study and performance testing of water cooler.

MECHANICAL VIBRATIONS

Subject Code: BMEE1 -773 **L T P C** **Duration: 36 Hrs.**
3 0 0 3

UNIT-I

Introduction: Basic concepts, Types of vibration, Periodic & Harmonic vibrations, Degrees of freedom, Scope of vibrations, Vibration models, Equivalent springs and dashpot, beats, Methods of vibration analysis.

UNIT-II

Vibration of Single Degree of Freedom System: Undamped free vibrations, and, torsional system, Rolling of a ship, damped free vibrations, critical damping, logarithmic decrement, Modelling of stiffness and damping, Coulomb damping, Equivalent viscous damping, Structural damping, damped force vibration system, estimation of damping by decay plots, forcing due to unbalance, measurement of damping, vibration due to a constant force, vibration isolation transmissibility, Critical speeds or Whirling speeds, self-excited vibrations, coefficient of slip friction, vibration measuring instruments.

UNIT-III

Two degrees of Freedom Systems:

a) Principal modes of vibrations, natural frequencies, amplitude ratio, undamped free, damped free, forced harmonic vibration, semi-definite systems, torsional vibrations, combined rectilinear & angular modes; Lagrange's equation.

b) Application to un-damped and damped vibration absorbers: Vibration absorber – principle; centrifugal pendulum vibration absorber, dynamic vibration absorber, untuned dry friction and viscous vibration damper, torsional vibration absorber.

c) Generalized co-ordinates and co-ordinate coupling, geared system, Torsionally equivalent shaft, coupled pendulums.

UNIT-IV

Multi-degree of freedom systems: Undamped free vibrations, influence coefficients, Generalized coordinates, orthogonality principal, matrix methods, Rayleigh and Dunkerley, Holzer's, Stodola method, Mechanical impedance, Eigen values and Eigen vectors.

Continuous systems: Transverse vibrations of a string, longitudinal and harmonic vibrations of rods, transverse vibrations of beams, uniform beam and various boundary conditions, Euler's equation of motion for beam vibration, natural frequencies for various end conditions, torsional vibration of circular shafts.

Recommended Books

1. G.K. Grover, 'Mechanical Vibrations', Hem Chand and Bros.
2. K.K. Pujara, 'Mechanical Vibrations', Dhanpat Rai and Sons, Delhi.
3. V.P. Singh, 'Mechanical Vibrations', Dhanpat Rai and Sons, Delhi.
4. Debabrata Nag, 'Mechanical Vibration', John Wiley India.
5. Thomson, 'Mechanical Vibration', Prentice Hall.

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NON-TRADITIONAL MACHINING

Subject Code: BMEE1-774 **L T P C** **Duration: 38 Hrs.**
3 0 0 3

UNIT-I

Basics of Non Traditional Machining Processes: Need for non-traditional Machining-Classification on the basis of energy sources—Consideration in process selection, materials, and applications.

Mechanical Energy Processes: Ultra-sonic Machining – Elements of the process, mechanism of metal removal, process parameters, economic considerations, Benefits and Applications - Advantages and limitations, recent developments Abrasive Jet Machining, Water Jet Machining and abrasive flow machining: Basic principles, equipments, process variables, mechanism of material removal, applications and limitations

Unit-II

Electrical Energy Processes: Electro Chemical process: Fundamentals of Electro chemical machining, electro-chemical grinding, electro chemical honing and deburring process, metal removal rate in ECM, surface finish and accuracy, economic aspects of ECM simple problems for estimation of metal removal rate, applications and limitations, recent developments.

Chemical Energy Processes: Chemical Machining, Photochemical Machining: Basic principles equipment, process variables, mechanism of material removal, applications and limitations

UNIT-III

Thermo Electrical Energy Processes: General principles of Electrical discharge machining, Electrical discharge grinding and wire cut EDM process-power circuits for EDM, metal removal rate in EDM, process parameters, selection of tool electrode and dielectric fluids, surface finish and machining accuracy, characteristics of spark eroded surface and machine tool selection, recent developments.

UNIT-IV

Thermal Energy Processes: Electron beam machining, Plasma Arc Machining and Laser Beam Machining-Operating principles–Equipment and sub systems – Parameters influencing metal Removal-Benefits - Applications-Advantages and limitations, recent developments.

Hybrid Energy Processes: Concept, Classifications, applications, Advantages

Recommended Books

1. Pandey and Shan, 'Modern Manufacturing Process', Prentice Hall, New Jersey.
2. Vijay K Jain, 'Advanced Machining Processes", Allied Publishers, **2005.**
3. P.K. Mishra, 'Non-Conventional Machining', The Institution of Engineers (India), Text Book Series, New Delhi, **1997.**
4. G.F. Bennedict, 'Non-Traditional Machining Techniques', Marcel Decker, New York, **1990.**

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HEAT EXCHANGER DESIGN

Subject Code: BMEE1-775 **L T P C** **Duration: 36 Hrs.**
3 0 0 3

1. **Basic Design Methodologies:** Classification of heat exchanger, selection of heat exchanger, Thermal-Hydraulic fundamentals, Overall heat transfer coefficient, LMTD method for heat exchanger analysis for parallel, counter, multipass and cross flow heat exchanger, e-NTU method for heat exchanger analysis, Fouling, Rating and sizing problems, heat exchanger design methodology
2. **Fouling of Heat Exchangers:** Basic consideration, effect of fouling on heat transfer and pressure drop, cost of fouling, design of heat exchangers subject to fouling, fouling resistance, cleanliness factor, techniques to control fouling
3. **Design of Double Pipe Heat Exchangers:** Thermal and Hydraulic design of inner tube and annulus, hairpin heat exchanger with bare and finned inner tube, total pressure drop
4. **Design of Shell & Tube Heat Exchangers:** Basic components, basic design procedure of heat exchanger, TEMA code, J-factors, conventional design methods, Bell-Delaware method
5. **Design of Compact Heat Exchangers**: Heat transfer enhancement, plate fin heat exchanger, tube fin heat exchanger, heat transfer and pressure drop
6. **Condensers and Evaporators**
   Condenser: Shell and tube condenser, plate condenser, air cooled condenser, direct contact condenser, condenser for refrigeration and air-conditioning, thermal design of shell and tube condenser
   Evaporator: Evaporator for refrigeration and air-conditioning, thermal analysis of evaporator, standards for evaporators and condensers

7. **Heat Transfer Enhancement and Performance Evaluation:** Enhancement of heat transfer, Performance evaluation of Heat Transfer Enhancement technique. Introduction to pinch analysis

Recommended Books

1. Sadik, Kakac, 'Heat Exchanger Selection, Rating and Thermal Design', CRC Press.
2. Ramesh K. Shah, 'Fundamentals of Heat Exchanger Design', Wiley Publication.
3. V.A. Kays and A.L. London, 'Compact Heat Exchangers', McGraw Hill.
4. T. Kuppan, 'Heat Exchanger Design Handbook', Marcel Dekker, CRC Press.
5. E.U. Schunder, 'Heat Exchanger Design Hand Book', Hemisphere Pub.
6. Donald Q. Kern, 'Process Heat Transfer', McGraw Hill.

MAINTENANCE ENGINEERING

Subject Code: BMEE1 - 776	L T P C 3 0 0 3	Duration: 38 Hrs.

UNIT-I

Introduction: Evolution of maintenance, objective of maintenance, maintenance policies and philosophies, maintenance concept maintenance management & terotechnology, relationship with other functional areas, importance of maintenance, elements of good maintenance, economics of maintenance, training and safety aspects in maintenance.

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UNIT-II

Maintenance Strategies: Classification of maintenance programs, corrective, preventive and predictive maintenance, comparison of maintenance programs, preventive maintenance- concept functions, benefits, limitations. Condition Based Maintenance (CBM); Objectives, what to monitor, when to monitor, principles of CBM, condition based maintenance techniques, performance monitoring, vibration monitoring, current monitoring, oil debris/spectroscopy, thermography and corrosion monitoring, steps in implementation of CBM, benefits of CBM.

UNIT-III

Reliability Centered Maintenance (RCM): RCM logic, maintenance and RCM, benefits of RCM, total productive maintenance (TPM), introduction, key supporting elements of TPM, methodology, evaluation and benefits. Non-Destructive Testing (NDT): Purpose and challenges; Techniques, visual aids-borescopes, endoscopes, fibre optics scanners, magnetic particles inspection, liquid penetrants, eddy current, ultrasonic radiography, selection of NDT techniques, merits/demerits and applications of various techniques.

UNIT-IV

Maintenance Planning and Control: Basic ingredients, basic steps in maintenance management, maintenance planning and control system, documentation, maintenance productivity areas for improvement. Reliability, Maintenance & Availability: Techniques for improvement of operational reliability, safety and availability of machines and production systems, maintainability criteria, checklist to assess the maintainability of a system, maintainability programs, objectives, key issues in availability improvement program, fault diagnosis, pareto principle Ishikawa diagram.

Learning Outcomes

1. To enable the students to understand the principles, functions adapted in industry for the successful management of maintenance activities.
2. To understand the different types of maintenance strategies.

3. Understand the strategic role of Maintenance/Reliability engineering in asset life cycle optimization.
4. Apply analytical skills and problem-solving tools/techniques to the fault analysis of various machines and equipment.

Recommended Books

1. L.R. Higgin. 'Maintenance Planning and Control', McGraw Hill Book Company.
2. Kelley Anthony, 'Maintenance Planning and Control', East-West Press Pvt. Ltd.
3. B.S. Blanchard, E.E. Lowey, 'Maintainability: Principle and Practices', McGraw Hill.
4. B. Raj, T. Jayakumar, K. Thavasimutyi, 'Practical NDT', Narora Publishing House.
5. Niebel Benjamin W., 'Engineering Maintenance Management', Marcel Dekker.

NON-DESTRUCTIVE TESTING

Subject Code: BMEE1-777 **L T P C** **Duration: 38 Hrs.**
3 0 0 3

Learning Objectives

1. To understand the Need and Significance of Non Destructive Testing methods and fundamental concepts of Non-Destructive Testing**.**
2. To understand the nondestructive testing methods that is usually employed to locate defects. Advantages and disadvantages of ultrasonic inspection as compared to other methods for nondestructive inspection of metal parts.
3. To understand various magnetizing methods that may be used for practically any steel part in the magnetic particle method.
4. To understand the radiography and its practical applications, X-ray and Gamma –ray along with effect of variables on radiographs.

UNIT-I

Introduction: Scope and Classification of techniques of material testing, Need and Significance of Non Destructive Testing methods, Comparison with Destructive Testing, type of Non Destructive testing methods. Liquid penetrant testing, Principle, Equipment and procedure, Characteristics of Developers.

Magnetic Particle Testing: Basic principles, scope and applications, magnetic analysis of steel bars and tubing magnetization methods, equipment, inspection medium, Demagnetization. advantages and disadvantages of Magnetic particle testing.

Ultrasonic Testing: Basic principles, flaw detection in rails and tubes (Sperry Detector), Ultrasonic testing surface roughness, Detection of defects in ferrous and non-ferrous metals, plastics, ceramics, measurement of thickness, hardness, stiffness, sonic material analyzer, concrete test hammer.

Radiographic Examination: Radiant energy and radiography, practical applications, X-ray and Gamma –ray equipment, effect of variables on radiographs, requirement of a good radiograph, interpretation of radiograph, safety precautions, Xeroradiography.

LEARNING OUTCOMES:

CO1: To develop fundamental concepts of Non Destructive Testing methods and able to Select the appropriate technique for a given application.

CO2: The students will learn Basic principles, scope and applications, magnetic particle testing of steel bars and tubing.

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CO3: They will understand Detection of defects in ferrous and nonferrous metals, plastics, by using Basic principles of Ultrasonic testing.

CO4: Upon completion of the course, the students will be able to understand the interpretation of radiograph and safety precautions. Students expected to show ability to understand the difference in the different methods of nondestructive techniques, their advantages and disadvantages.

PROGRAMME OUTCOMES ADDRESSED IN THIS COURSE:

PO1: An ability to apply knowledge of Mechanical Engineering, applied mathematics, applied sciences and introductory engineering concepts.

PO5: An ability to create and apply the techniques, skills, and modern Mechanical engineering tools to complex engineering activities within constraints.

PO7: An ability to understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

LEARNING OUTCOMES- PROGRAMME OUTCOMES MAPPING TABLE

Course Outcomes	Programme Outcomes			Remarks
	PO1	PO5	PO7	Remarks
CO1	High	Medium	Medium	
CO2	High	Medium	High	
CO3	High	High	High	
CO4	High	High	High	
CO5	High	High	High	

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Recommended Books

1. H.E. Davies, G.E. Troxell and G.F.W. Hauck, 'The Testing of Engineering Materials', McGraw Hill.
2. W.H. Armstrong, Mechanical Inspection, McGraw Hill.
3. P.J. Shull, 'Nondestructive Evaluation - Theory, Techniques, and Applications', Marcel Decker Inc., **2002**.
4. D.E. Bray and R.K. Stanley, 'Non-destructive Evaluation - A Tool in Design, Manufacturing and Service', CRC Press, **1996**.
5. 'NDT Hand Books', Vol 1-17, ASNT Press, OH, USA, **2012**.
6. Baldev Raj, T. Jaya Kumar, 'Practical Non-destructive Testing', Woodhead Publishing Ltd., **2002**.
7. Paul E. Mix, 'Introduction to NDT: A Training Guide', John Wiley, **2005.**

AUTOMOTIVE CONTROL

Subject Code: BMEE1-778 **L T P C** **Duration: 38 Hrs.**
3 0 0 3

1. **Introduction of Common Technology**: Engine related systems. Ignition system, computer controlled petrol fueling injection systems, Engine management systems, Anti-lock braking systems, Traction control system, Stability Control system, air conditioning, computer controlled diesel engine system.

2. **Computer ECM**: Fundamental parts of computer, Principles of operation, Computer data, Computer interfaces, Computer memories, Adaptive operating strategy of the ECM.
3. **Digital Electronics:** Logic gates, truth tables, Application of Logic gates, Flip-Flop, Analogue to Digital Conversion, Digital to Analogue conversion, Digital Displays (LED Display and Liquid crystal displays).
4. **Sensors:** Introduction of sensors and transducers Electromagnetic Sensors, Optical sensors, variable resistance type sensors, temperature sensors, Pressure sensors, variable capacitance sensors, Flow sensors, Piezoelectric sensors, Oxygen Sensor, Practical Importance of sensors.
5. **Actuators:** Introduction of Actuators, Actuators operation, Injectors, Exhaust gas recirculation actuators, motors, Solenoids, ABS actuators.
6. **Additional Technology:** Computer performance, Supplementary restraint systems(SRS), Coded ignition key, Fault tracing, Precautions when working with computer controlled system.

Recommended Books

1. Allan W.M. Bonnick, 'Automotive Computer Controlled Systems', Butterworth-Heinemann: A Division of Reed Educational and Professional Publishing Ltd.
2. Willium B. Ribbens, Willium B. Ribbens, 'Understanding Automotive Electronics', Elsevier Science, **2003.**
3. Ronald K. Jurgen, 'Sensors and Transducers', SAE, **2003.**
4. Jack Erjavec, 'Automotive Technology' Robert Scharff Delmar Publications Inc., **1992.**

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CAD/CAM

Subject code: BMEE1-838 **L T P C** **Duration: 36 Hrs.**
3 0 0 3

UNIT-I

Fundamentals of CAD: Design process with and without computer; CAD/CAM system and its evaluation criteria, brief treatment of input and output devices, display devices; Functions of a graphics package and Graphics standard GKS, IGES and STEP; Modeling and viewing; Application areas of CAD.

Geometric Transformations: Mathematics preliminaries, matrix representation of 2 and 3 dimensional transformations: Concatenation of transformation matrices. Application of geometric transformations

UNIT-II

Geometric Modeling: Wireframe model: solid modeling: Boundary Representation (B-rep), Constructive Solid Geometry (CSG), Parametric Modeling Technique; Mass, volumetric properties calculations; surface modeling, concepts of hidden-line removal and shading: Mechanical Assembly Kinematics analysis and simulation.

Representation of Curves and Surfaces: Non-parametric and parametric representation of curves. Parametric representation of Hermite Cubic, Beizer and B-spline curves; Surface and its analysis. Representation of Analytical and synthetic surfaces.

Overview of FEM, Advantages and applications, recent advance in FEM, FEA software Basic principles and general procedure of FEM.

UNIT-III

NC/CNC Machine Tools: NC machine tools- basic components, coordinate systems; features of NC machine tools.

Computerized Numerical Control (CNC): Tooling for NC machines - tool presetting equipment, flexible tooling, tool length compensation, tool path graphics; NC motion control system; Manual part programming, fixed/floating zero. Block format and codes: Computer assisted part programming. DNC and Adaptive Control: Direct numerical control: Adaptive control in machining system; Combined DNC/CNC system.

Group Technology (GT): Part families; part classification and coding system: Group technology machine cells: Advantages of GT.

UNIT-IV

Computer Aided Process Planning: Introduction and benefits of CAPP. Types of CAPP systems, machinability, data selection systems in CAPP.

Computer Integrated Manufacturing Systems: Basic Concepts of CIM: CIM Definition, The meaning of Manufacturing, Types of Manufacturing systems; Need, Elements, Evolution of CIM; Benefits of CIM; Flexible Manufacturing Systems: Physical Components of an FMS. Types of Flexibility, Layout Considerations; FMS benefits

Recommended Books

1. Mikell P. Groover and Emory W. Zimmers,' CAD/CAM', PHI.
2. D.D. Bedworth, M.R Henderson & P.M. Wolfe, 'Computer Integrated Design and Manufacturing', Tata McGraw Hill.
3. Zeid Ibraham, 'CAD/CAM - Theory and Practice', Tata McGraw Hill.
4. P.N. Rao, 'CAD/CAM', Tata McGraw Hill.
5. C. Elanchezhian, G. Shanmuga Sundar, 'Computer Aided Manufacturing (CAM)', Firewall Media.

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OPERATION RESEARCH

Subject Code: BMEE1 - 839	L T P C 3 1 0 4	Duration: 45 Hrs.

UNIT-I

Introduction: Introduction to Operations Research: Basics definition, scope, objectives, phases, models and limitations of Operations Research.

Linear Programming Problem – Formulation of LPP, Graphical solution of LPP. Simplex Method, Artificial variables, Big-M method, two-phase method, degeneracy and unbound solutions.

UNIT-II

Transportation Problem: Formulation, solution, unbalanced Transportation problem. Finding basic feasible solutions – Northwest corner rule, least cost method and Vogel's approximation method. Optimality test: the stepping stone method and MODI method.

Assignment Model: Formulation. Hungarian method for optimal solution. Solving unbalanced problem. Traveling salesman problem and assignment problem.

Sequencing Models: Solution of Sequencing Problem – Processing n Jobs through 2 Machines – Processing n Jobs through 3 Machines – Processing 2 Jobs through m machines– Processing n Jobs through m Machines.

UNIT-III

Dynamic Programming: Characteristics of dynamic programming. Dynamic programming approach for Priority Management employment smoothening, capital budgeting, Stage Coach/Shortest Path, cargo loading and Reliability problems,

Game Theory: Competitive games, rectangular games, saddle point, minimax (maxim in) method of optimal strategies, value of the game. Solution of games with saddle points, dominance principle. Rectangular games without saddle point – mixed strategy for 2 X 2 games.

UNIT-IV

Replacement Models: Replacement of Items that Deteriorate whose maintenance costs increase with time without change in the money value. Replacement of items that fail suddenly: individual replacement policy, group replacement policy.

Inventory Models: Inventory costs. Models with deterministic demand – model (a) demand rate uniform and production rate infinite, model (b) demand rate non-uniform and production rate infinite, model (c) demand rate uniform and production rate finite.

Learning Outcomes:

After The course the student will be able to

1. Solve simple and complex optimization models and implement in software.
2. Formulate and solve transportation problems for cost minimization.
3. Formulate and solve different inventory model problems for the different type of industries.
4. Will be able to carry out economical replacement analysis for obsolete /worn out industrial equipment.
5. Will be able to solve job sequencing problems for 2/3 machines for minimum cost/time models.

Recommended Books

1. P. Sankara Iyer, 'Operations Research', Tata McGraw-Hill.
2. A.M. Natarajan, P. Balasubramani, A. Tamilarasi, 'Operations Research', Pearson Education.
3. J.K. Sharma, 'Operations Research Theory & Applications,' Macmillan India Ltd.
4. P.K. Gupta and D.S. Hira, 'Operations Research', S. Chand & Co.
5. J.K. Sharma., 'Operations Research, Problems and Solutions', 3rd Edn., Macmillan India Ltd.

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OPTIMIZATION TECHNIQUES

Subject Code: BMEE1-879 **L T P C** **Duration: 37 Hrs.**

3 0 0 3

UNIT-I

Introduction: Historical Development; Engineering applications of Optimization; Optimization techniques – classical and advanced techniques. Art of Modeling Origin of OR and its role in solving industrial problems: General approach for solving OR problems. Classification of mathematical models: various decision making environments.

UNIT-II

Linear Programming: Formulation of linear mathematical models: Graphical and simplex techniques for solution of linear programming problems, Motivation of simplex method, Simplex algorithm and construction of simplex tableau; Simplex criterion; Minimization versus maximization problems, Big-M method and two phase method, Introduction to duality theory and sensitivity analysis.

UNIT-III

Transportation and Assignment Models: Various initial basic feasible solutions methods, Optimization of transportation and assignment using different methods considering the concept of time and cost function.

Dynamic Programming: Characteristics of dynamic programming problems, deterministic dynamic programming, and probabilistic dynamic programming.

Queuing Theory: Basic structure of queuing model, Types of queuing situation: Queuing models with Poisson's input and exponential service, their application to simple situations.

UNIT-IV

Network Models: Shortest route and traveling sales man problems, PERT & CPM, analysis of time bound project situations, construction of networks, identification of critical path, slack and float, crashing of network for cost reduction.

Non-linear Programming Models: Graphical illustration to non-linear programming problems, introduction to different types of non-linear programming problems. Problems related to the topic.

RECOMMENDED BOOKS:

1. H.A. Taha, Operations Research, Prentice Hall of India, New Delhi.
2. H.M Wagner, Principles of Operations Research, Prentice Hall.
3. P.K. Gupta and D.S. Hira, Operations Research, S. Chand & Co.
4. F.S. Hiller and G.I. Libermann, Introduction to Operation Research, Holden Ray.
5. A Management Guide to PERT/CPM Wiest & Levy Prentice Hall

LEAN MANUFACTURING

Subject Code: BMEE1-880 **L T P C** **Duration: 38 Hrs.**
3 0 0 3

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UNIT-I

Lean Production: Introduction, background, and lean thinking, importance of philosophy, strategy, culture, alignment, focus and systems view. Discussion of Toyota Production System. Lean Production Preparation: System assessment, process and Value-stream mapping, sources of waste.

UNIT-II

Lean Production Processes, Approaches and Techniques: Importance of focusing upon flow. Tools include: Workplace organization – 5S, Stability, Just-In-Time – One-piece flow – Pull, Cellular systems, Quick change and set-up reduction methods, Total productive maintenance, Poka-Yoke– mistake proofing, quality improvement, Standards, Leveling and Visual management, Six Sigma.

UNIT-III

SMED Single minute exchange of dies – theory and practice of the SMED system, the structure of production, Set-up operations, Fundamentals of SMED, Techniques for applying SMED, Basic examples of SMED.

UNIT-IV

Employee Involvement: Teams, Training, Supporting and encouraging involvement – Involving people in the change process; communication; importance of culture. Concurrent Engineering: Obeya in Toyota's new product development process, cross functional teams, use of computer technology, information management for simultaneous engineering.

Learning Outcomes

The students will be able to

1. Identify and understand the key requirements and concepts in lean manufacturing to initiate a continuous improvement change program in a manufacturing organization.

2. Apply the tools in lean manufacturing to analyze a manufacturing system and plan for its improvements.

Recommended Books

1. D. Womack and D. Jones, 'Lean Thinking', Free Press, **2003.**
2. J. Womack, D. Jones and D. Roos, 'The Machine that Changed the World', Rawson Associates, **1990.**
3. P. Dennis, 'Lean Production Simplified', Productivity Press, **2007.**
4. S. Shingo, 'A Revolution in Manufacturing: The SMED System', Productivity Press, **1985.**
5. J. Liker, 'The Toyota Way', McGraw-Hill, **2004.**
6. J. Liker and D. Meier, 'The Toyota Way', Field book, McGraw Hill, **2006.**

STATISTICAL QUALITY CONTROL

Subject Code: BMEE1 - 882 **L T P C** **Duration: 38 Hrs.**
3 0 0 3

UNIT-I

Introduction: Definition and Need of quality, Aspects of quality, Quality characteristic, Quality specification, Quality function, Economics of quality. Inspection, Its objectives and types, Inspection versus Quality Control, Statistical Quality Control, its Tools, Advantages, limitations and Applications.

Probability & Statistics: Definition, Laws, Probability Distributions (Normal Binomial, Poisson, Exponential) & related problems. Measures of Central tendency & Dispersion, Concept of Variation, Variable and attribute data, Frequency distribution.

UNIT-II

Control Charts: Concept of variability, Assignable and chance causes, Concept of specifications and tolerances, Definition and objectives of control charts, Control charts for variables and attributes and related problems, Variable charts vs attribute charts, Patterns on control charts, Type–I & Type-II Errors, Process capability and its methods of determination.

UNIT-III

Acceptance Sampling: Definition, Advantages over 100% inspection, Methods of taking samples, Operating characteristics curve & its characteristics. Single, Double and Multiple, Sequential Sampling Plan & Related problems.

Quality Assurance: Need, Principles, Essentials and Advantages of Quality Assurance System, Quality Manual, Field complaints, Quality Audit & its types, Quality Assurance Methods, Quality Control vs. Quality Assurance.

UNIT-IV

Quality Systems: Description of ISO: 9000 series of standards, ISO: 9001–2000 Systems. Description of TQM, Concept of Quality Circles, JIT System, Taguchi's Concept of Quality, Zero Defect Concept, 6s Concept and 5S.

Learning Outcomes

The student will learn

1. Concepts of quality control.
2. Principles and techniques of quality control.
3. Implementation of quality control.
4. Standards used for quality control.

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Recommended Books

1. M. Mahajan, 'Statistical Quality Control', Dhanpat Rai & Co.
2. Amitav Mitra, 'Fundamentals of Quality Control', Pearson Education.
3. E.L. Grant & R.S. Leavenworth, 'Statistical Quality Control', McGraw Hill & Co.
4. Feigenbaum, 'Total Quality Control', McGraw Hill & Co.
5. D.C. Montgomery DC, 'Introduction to Statistical Quality Control', John Wiley & Sons Inc.
6. Stephan B. Vardeman, J. Marcus Jobe, 'Statistical QA Methods for Engineers', John Wiley & Sons Inc.
7. J.R. Taylor, 'Quality Control systems', McGraw Hill Int. Education.

ADDITIVE MANUFACTURING

Subject Code: BMEE1-883 **L T P C** **Duration: 38 Hrs.**

3 0 0 3

UNIT-I

Introduction to Rapid Prototyping: Classification of Manufacturing Processes, Introduction to Rapid Prototyping and Additive Manufacturing, History of development of RP, Engineering design process, Rapid Prototyping and its Impact, Product development, Product Prototyping and Product Development

Product Prototyping: Need of Product Prototyping, Prototype Planning and Management, Product and Prototype Cost Estimation, Prototype Design Methods and tools

UNIT-II

CAD Modeling: Geometrical Modelling Techniques, Wireframe Modelling, Surface Modelling and solid modeling, Slicing methods and software

UNIT-III

Rapid Prototyping Processes: Rapid Prototyping Overview, Rapid Prototyping Procedure, Liquid-Based RP Processes, Solid-Based RP Processes, Powder-Based RP Processes, Prototyping Materials, Modeling of Material Properties, Modeling and Design of Materials and Structures.

Direct Digital Prototyping and Manufacturing: Solid Models and Prototype Representation, Reverse Engineering for Digital Representation, Prototyping and Manufacturing Using CNC Machining, Fully Automated Digital Prototyping and Manufacturing.

UNIT-IV

Direct Methods for Rapid Tool Production: Classification of Direct Rapid Tool Methods, Direct ACESTM Injection Moulds, Laminated Object Manufactured (LaM) Tools, DTM Rapid Tool, Sand Form, EOS Direct Tool Process, Direct Metal Tooling using 3Dp.

Applications of Rapid Prototyping: Functional Models, Rapid Tooling, Rapid Manufacturing, Engineering Applications, Medical Model, and Art Models, Engineering Analysis Models.

Indirect Methods for Rapid Tool Production: Metal Deposition Tools, RTV Tools, Epoxy Tools, Ceramic Tools, Cast Metal Tools, Investment Casting, Fusible Metallic Core, Sand Casting, Keltool Process.

Recommended Books

1. Frank W. Liou, 'Rapid Prototyping and engineering Applications', CRC Press, **2007.**
2. D.T. Pham and S.S. Dimov, 'Rapid Manufacturing', Springer.
3. Kevin Otto, Kristin Wood, 'Product Design', Pearson.

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INDUSTRIAL SAFETY AND ENVIOREMENT

Subject Code: BMEE0 –F91 **L T P C 3 0 0 3** **Duration: 38 Hrs.**

UNIT-I

Meaning & Need for Safety: Relationship of safety with plant design, equipment design and work environment. Industrial accidents, their nature, types and causes. Assessment of accident costs; prevention of accidents. Industrial hazards, Hazard identification techniques, Accident investigation, reporting and analysis.

UNIT-II

Planning for Safety & its Measures: Definition, purpose, nature, scope and procedure. Range of planning, variety of plans. Policy formulation and implementation of safety policies. Safety measures in a manufacturing organization, safety and economics, safety and productivity. Employees participation in safety. Safety standards and legislation.

UNIT-III

Meaning of Environment and Need for Environmental Control: Environmental factors in industry. Effect of temperature, Illumination, humidity noise and vibrations on human body and mind. Measurement and mitigation of physical and mental "fatigue" Basics of environment design for improved efficiency and accuracy at work. Environment Standards: Introduction to ISO 14000; Environment standards for representative industries.

UNIT-IV

Ventilation and heat Control Purpose of ventilation, Lighting, Noise & Vibrations: Physiology of heat regulation. Thermal environment and its measurement. Thermal comfort. Indices of heat stress. Thermal limits for comfort, efficiency and freedom from health risk. Natural ventilation. Mechanical ventilation. Air conditioning Process ventilation. Control of heat exposures: control at source, insulation, and local exhaust ventilation. Control of radiant heat, dilution ventilation. Local relief. Industrial Lighting: Purpose of lighting, benefits of good illumination. Phenomenon of lighting and safety. Lighting and the work. Sources and types of artificial lighting. Principles of good illumination. Recommended optimum standards of illumination. Design of lighting installation. Maintenance standards relating to lighting and colour. Noise & Vibrations: Continuous and impulse noise. The effect of noise on man. Noise measurement and evaluation of noise. Noise isolation. Noise absorption techniques. Silencers vibrations: Effect, measurement and control measures.

Learning Outcomes

1. Understand importance of safety at work
2. Understand various safety measures and how it leads to increasing plant productivity.
3. Understand basics of environmental design
4. Understand the control of Ventilation and heat etc.

Recommended Books

1. H.W. Heinrich, ‘Industrial Accident Prevention’, McGraw Hill.
2. Beranek, ‘Noise Reduction’, McGraw Hill.
3. D.C. Reamer, ‘Modern Safety and Health Technology’, R. Wiley.

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B.TECH. ELECTRICAL AND ELECTRONICS ENGG. (3rd SEMESTER)

TOTAL CONTACT HRS. = 28, TOTAL CREDITS = 23

Code	Name	L	T	P	Int.	Ext.	Total	
BMAT0-F91	Mathematics-III	3	1	0	40	60	100	4
BEEE1-301	Circuit Theory	3	1	0	40	60	100	4
BEEE1-302	Electrical Measurement & Instrumentation	3	1	0	40	60	100	4
BEEE1-303	Electrical Machines-I	3	1	0	40	60	100	4
BEEE1-304	Electronic Devices and Circuits	3	1	0	40	60	100	4
BEEE1-305	Electrical Measurement & Instrumentation Laboratory	0	0	2	60	40	100	1
BEEE1-306	Electrical Machines-I Laboratory	0	0	2	60	40	100	1
BEEE1-307	Electronic Devices and Circuits Laboratory	0	0	2	60	40	100	1
BPRS0-F91	Professional skills-I	0	0	2	60	40	100	1
BEEE1-308	Training-I	-	-	-	60	40	100	2
Total 5 Theory & 4 Lab. Courses		**15**	**5**	**08**	**500**	**500**	**1000**	**26**

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B.TECH. ELECTRICAL AND ELECTRONICS ENGG. (4TH SEMESTER)

TOTAL CONTACT HRS. = 26, TOTAL CREDITS = 23

Course		Contact Hrs.			Marks			Credits
Code	**Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
BEEE1-409	Electrical Machines-II	3	1	0	40	60	100	4
BEEE1-410	Linear Control System	3	1	0	40	60	100	4
BEEE1-411	Digital Electronics	3	1	0	40	60	100	4
BEEE1-412	Power System-I	3	1	0	40	60	100	4
BEEE1-413	Electromagnetic Field Theory	3	1	0	40	60	100	4
BEEE1-414	Linear Control System Laboratory	0	0	2	60	40	100	1
BEEE1-415	Digital Electronics Laboratory	0	0	2	60	40	100	1
BPRS0-F92	Professional skills- II	0	0	2	60	40	100	1
Total 5 Theory & 3 Lab. Courses		**15**	**5**	**6**	**380**	**420**	**800**	**23**

B.TECH. ELECTRICAL AND ELECTRONICS ENGG. (5TH SEMESTER)

TOTAL CONTACT HRS. = 23, TOTAL CREDITS = 23

Course		Contact Hrs.			Marks			Credits
Code	**Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
BEEE1-516	Signals & Systems	3	1	0	40	60	100	4
BEEE1-517	Power Electronics & Utilization	3	1	0	40	60	100	4
BEEE1-518	Microprocessors	3	1	0	40	60	100	4
BEEE1-51XX	**Open Elective-I**	3	0	0	40	60	100	3
Departmental Elective-I (Choose any one)		3	1	0	40	60	100	4
BEEE1-556	Sensors & Transducers							
BEEE1-556	Electrical Engineering Materials							
BEEE1-556	Power Generation System							
BEEE1-556	Modern Optimization Techniques							
BEEE1-519	Microprocessors Lab	0	0	2	60	40	100	1
BPRS0-F93	Professional Skill-III	0	0	2	60	40	100	1
BEEE1-520	Training-II	--	-	--	60	40	100	2
Total 5 Theory & 2 Lab. Courses		**15**	**4**	**04**	**380**	**420**	**800**	**23**

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B.TECH. ELECTRICAL AND ELECTRONICS ENGG. (6TH SEMESTER)

TOTAL CONTACT HRS. = 25, TOTAL CREDITS = 22

Course		Contact Hrs.			Marks			Credits
Code	**Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
BEEE1-621	Non Linear & Digital Control Systems	3	1	0	40	60	100	4
BEEE1-622	Power System-II	3	1	0	40	60	100	4
Departmental Elective-II		3	1	0	40	60	100	4
BEEE1-660	Fuzzy logic & Neural Networks							
BEEE1-661	VLSI Design							
BEEE1-662	Energy auditing & Management							
BEEE1-663	Microcontroller & PLC							
Departmental Elective-III		3	1	0	40	60	100	4
BEEE-664	Digital Signal Processing							
BEEE-665	Remote control & Telemetry							
BEEE-666	Non-Conventional Energy Resources							
BEEE-667	Artificial Intelligent Systems							
BEEE-162XX	**Open Elective-II**	3	0	0	40	60	100	3
BEEE1-623	Power System-II Lab	0	0	2	60	40	100	1
BEEE1-624	Power Electronics Lab	0	0	2	60	40	100	1
BPRS0-F94	Professional Skills -IV	0	0	2	60	40	100	1
Total 5 Theory & 5 Lab. Courses		**15**	**4**	**6**	**380**	**420**	**800**	**22**

B.TECH. ELECTRICAL AND ELECTRONICS ENGG. (7TH SEMESTER)

TOTAL CONTACT HRS. = 19, TOTAL CREDITS = 25

Course		Contact Hrs.			Marks			Credits
Code	**Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
BEEE1-725	Computer Applications in Power System Analysis	3	1	0	40	60	100	4
BEEE1-726	Communication System	3	1	0	40	60	100	4
BEEE1-73XX	**Open Elective-III**	3	0	0	40	60	100	3
Departmental Elective-IV		3	1	0	40	60	100	4
BEEE1-768	Telemetry & SCADA System							
BEEE1-769	Image Processing							
BEEE1-770	High Voltage Engineering							
BEEE1-771	HVDC & EHVAC Systems							
BEEE1-727	Computer Applications in Power System Analysis Laboratory	0	0	2	60	40	100	1
BEEE1-728	Communication System Laboratory	0	0	2	60	40	100	1
BEEE1-729	Industrial Training & Project-I	--	-	--	60	40	100	8
Total 4 Theory & 2 Lab. Courses		**12**	**3**	**04**	**340**	**360**	**700**	**25**

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B.TECH. ELECTRICAL AND ELECTRONICS ENGG. (8TH SEMESTER)

TOTAL CONTACT HRS. = 10, TOTAL CREDITS = 16

Course		Contact Hrs.			Marks			Credits
Code	**Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
BEEE1-830	Pulse Wave shaping & switching	3	1	0	40	60	100	4
BEEE1-831	Software Laboratory	0	0	2	60	40	100	2
Departmental Elective-V		3	1	0	40	60	100	4
BEEE1-872	Electrical Machine Design							
BEEE1-873	Biomedical Instrumentation							
BEEE1-874	Flexible AC Transmission Systems							
BEEE1-875	Special Electrical Machines							
BEEE1-832	Project-II	--	-	--	60	40	100	6
Total 2 Theory & 1 Lab. Courses		**6**	**2**	**2**	**180**	**220**	**400**	**16**

List of Open Electives offered by Department of Electrical and Electronics Engineering to Students of other Departments Subjects

Open Elective-I

BEEE-151XX	Subject Name
BEEE-15191	Power Plant Engineering
BEEE-15192	Analog & Digital Circuit Analysis
BEEE-15193	Digital Signal Processing

Open Elective-II

BEEE-162XX	Subject Name
BEEE-16294	Renewable Energy Resources
BEEE-16295	High Voltage Engineering
BEEE-16296	Substation Equipment & Design

Open Elective-III

BEEE-173XX	Subject Name
BEEE-17397	Electrical Machine Design
BEEE-17398	Soft Computing
BEEE-17399	Image Processing

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ENGINEERING MATHEMATICS-III

Subject Code: BMAT0-F91 **L T P C** **Contact Hrs.- 45**
3 1 0 4

UNIT-I (13 Hrs.)

Fourier Series: Periodic function, Fourier Seies, Dirichlet's conditions, Fourier series for even and odd functions, Change of interval, Half range Fourier series, Other forms of Fourier series.
Fourier Transforms: Dirichlet's conditions, Fourier integral formula (without proof), Fourier transform, Inverse Theorem for Fourier transform, Fourier sine and cosine transforms and their inversion formulae. Properties of Fourier transform, Convolution theorem of Fourier transforms, Parseval's identity.

UNIT-II (10 Hrs.)

Laplace Transforms: Laplace transforms of various standard functions (Exponential, Algebraic, Sine, Cosine), Properties of Laplace transforms, inverse Laplace transforms, transform of derivatives and integrals, Laplace transform of unit step function, impulse function,
Application of Laplace Transforms: Solution of ordinary linear differential equations with constant coefficients, and simultaneous differential equations.

UNIT-III (12 Hrs.)

Partial Differential Equations: Formation of partial differential equations, Linear partial differential equations, homogeneous partial differential equations with constant coefficients. Classification of partial differential equation.
Applications of PDEs: Wave equation and Heat conduction equation in one dimension. Two dimensional Laplace equation in Cartesian Coordinates, solution by the method of separation of variables.

UNIT-IV (10 Hrs.)

Functions of Complex Variable: Limits, continuity and derivative of the function of complex variable, Analytic function, Cauchy-Riemann equations, conjugate functions, harmonic functions; Conformal Mapping: Definition, standard transformations, translation, rotation, inversion, bilinear. Complex Integration: Line integrals in the complex plane, Cauchy's theorem, Cauchy's integral formula and derivatives of analytic function. Taylor's and Laurent's expansions (without proofs), singular points, poles, residue, Integration of function of complex variables using the method of residues(Integration Of type $\int_0^{2\pi} F(Cos\theta, Sin\theta)d\theta,\ \ \int_{-\infty}^{\infty} \frac{f(x)}{F(X)}dx$)

Recommended Books:

1. E. Kreyszing, 'Advanced Engineering Mathematics', 8th Edn., John Wiley, New Delhi.
2. B.S. Grewal, 'Higher Engineering Mathematics', Khanna Publishers, New Delhi.
3. Ian N. Sneedon, 'Elements of Partial Differential Equations', McGraw- Hill, Singapore, **1957**.
4. Peter. V. O'Nil, 'Advanced Engineering Mathematics', Wadsworth Publishing Company.
5. H.C. Taneja, 'Engineering Mathematics', Volume-I & II, I.K. Publisher.

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CIRCUIT THEORY

Subject Code: BEEE1-301	**L T P C** **3 1 0 4**	**Contact Hrs.: 48**

Learning Objectives:

- To aware the students about the basics of networks.
- To provide them basic concepts of different types of network theorems & their applications.
- To impart knowledge about different circuits, analysing and synthesizing methods of circuits.

Learning Outcomes:

- After the completion of course, students will be having skills to design, analyse and synthesize the circuits.
- Knowledge of mathematical forms such as Laplace transforms & designing of filters and circuits.

Contents

Unit-1 (12 Hrs)

CIRCUITS CONCEPTS: Independent and dependent sources, Signals and wave forms: Periodic and singularity voltages, step, ramp, impulse, doublet, loop currents and loop equations, node voltage and node equations, Network Theorems: Superposition, Thevenin's, Norton's, Maximum Power Transfer, and Reciprocity.

Unit-2 (12 Hrs)

TIME AND FREQUENCY DOMAIN ANALYSIS: Representation of basic circuits in terms of generalized frequency and their response, Laplace transform of shifted functions, transient and steady response, Time domain behaviours from poles and zeros, Convolution Theorem.

Unit-3 (12 Hrs)

NETWORK SYNTHESIS: Network functions, Impedance and admittance function, Transfer functions, Relationship between transfer and impulse response, poles & zeros and restrictions, Network function for two terminal pair network, Sinusoidal network in terms of poles & zeros, Real liability condition for impedance synthesis of RL & RC circuits, Network synthesis techniques for 2-terminal network, Foster and Cauer forms.

Unit-4 (12 Hrs)

FILTERS SYNTHESIS: Classification of filters, characteristics impedance and propagation constant of pure reactive network, Ladder network, T-section, π-section, terminating half section, pass bands and stop bands, Design of Constant-K, m-derived filters, Composite filters.

Recommended Books

1. Abhijit Chakraborty, ‘Circuit Theory’, 2nd Edn., Dhanpat Rai, **2001**.
2. D. Roy Chaudhury, ‘Networks & Synthesis’, New Age International, **2001.**
3. J.A. Edminister, ‘Electric Circuits’, 4th Edn., Tata McGraw Hill, **2002**.
4. T.S.K.V. Iyer, ‘Circuit Theory’, Tata McGraw Hill, **2006**.
5. Mohan, Sudhakar Sham, ‘Circuits & Networks Analysis and Synthesis’, 2nd Edn., Tata Mc Graw Hill, **2005**.
6. M.E. Van Valkenberg, ‘Network Analysis & Synthesis’, PHI Learning, **2009**.
7. M.E. Van Valkenberg, ‘Network Analysis & Synthesis’, 3rd Edn., Pearson Education, **2006.**

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ELECTRICAL MEASUREMENTS & INSTRUMENTATION

Subject Code: BEEE1-302 **L T P C** **Contact Hrs.: 48**
3 1 0 3

Learning Objectives:

- To aware the students about the basics of Measurements and Instrumentation systems.
- To impart knowledge about different instruments for electrical parameters.
- To provide them basic concepts of different types of sensors and transducers.

Learning Outcomes:

- After the completion of course, students will be having skills to design, analyse and instruments.
- Gain the skill knowledge of bridges and CRO operations.

Contents

UNIT I (12 Hrs)

Measuring Instruments: Introduction to measuring techniques, Necessity of measurements, block diagram of measurement system, Types of instruments, classification of standards, Fundamental Unit and Derived units. Instrument Characteristics; accuracy and precision, indications of precision, repeatability, Threshold, Sensitivity and span. Different types of errors in measurement, statistical analysis of data, arithmetic mean, deviation, average and standard deviation, probable error. Principle of operation and Constructional Features; D'Arsonval Galvanometer, Moving Coil PMMC & Moving Iron instrument (Repulsion and Attraction type), Electrodynamics instruments, Electrostatic instruments and Thermoelectric Instruments Range Extension of Voltmeter and Ammeter.

UNIT II (12 Hrs)

Measurement of Resistance: Low, Medium and High resistance using Kelvin Double Bridge, Ammeter-Voltmeter method, substitution method, Wheat Stone Bridge, Loss of Charge and Megger.

Measurement of Inductance and Capacitance: Maxwell Inductance, Hay's, Anderson and Schering Bridges. Measurement of frequency by Wein bridge method.

UNIT III (12 Hrs)

Oscilloscope: Basic principle & construction of Analog CRO, sweep modes, applications in measurement of voltage, frequency (Lissajous pattern), Introduction to Dual Trace Oscilloscope, Digital Storage Oscilloscope, sampling oscilloscope. Comparison between analog and digital oscilloscope

Recorders: Strip Chart Recorders, X-Y Recorders, Ultraviolet Recorders, Magnetic Tape Recorders.

Display Devices: Digital display methods, Seven Segment LED display, Dot Matrix display and LCD Display.

UNIT IV (12 Hrs)

Basic Concept of measurement system, Transducer and its classifications, basic requirements of Transducer/Sensors. Displacement Transducers: LVDT, RVDT and Piezo Electric. Resistance Thermometer, Thermistors, Thermocouples and Strain Gauge Transducer: Basic principle of operation of Resistance strain gauge.

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Recommended Books

1. Cooper Halfrick, 'Modern Electronic Instrumentation and Measurement Techniques', PHI, **1990**.
2. A.K. Sawhney, 'Electronic Instrumentation & Measurement', 19th Edn., Dhanpat Rai & Sons., **2011**.
3. Jones & Chin, 'Electronic Instruments and Measurement', 2nd Edn., **2010**.
4. J. Toppin, 'Theory of Errors', Wessely Publishing, 4th Edn., **2000.**

ELECTRICAL MACHINES-I

Subject Code: BEEE1-303 **L T P C** **Contact Hrs.: 48 Hours**
3 1 0 4

Learning Objectives:

- To aware the students about the basics of electromechanical energy conversion.
- To impart knowledge about different construction operation of Transformers.
- To study characteristics speed control methods and testing of different types of DC Generators and motors.

Learning Outcomes:

- After the completion of course, students will be having skills to analyse the transformer.
- Gain the skill knowledge of experimental performance and testing of Electrical DC Machines.

Contents

UNIT-1 (15 Hrs)

Single Phase Transformer: Construction, Theory and operation, E.M.F. equation, phasor diagram, rating of transformers, equivalent circuit, open and short circuit tests, back to back test, parallel operation of single phase transformer, Scott connection, voltage regulation and efficiency, Ideal Transformer.

Auto-Transformers: Construction, Theory and operation, phasor diagram, equivalent circuit.

Three Phase Transformer: Three winding transformer, parallel operation of three phase transformers, three phase transformer connections, phasor groups, three phase to two phase and six phase conversion, Harmonics and excitation phenomenon, inrush current phenomenon.

UNIT-2 (10 Hrs)

Basics of DC Machines: Review of construction, types of armature winding, physical concepts of winding pitches, derivation of EMF equation & types of excitation. Armature reaction and its effect on the performance, methods adopted for compensation of armature reaction.

UNIT-3 (10 Hrs)

Excitation and Commutation of DC Generator: characteristics of separately excited, shunt, series and compound generators, Compensating winding, Commutation and function of commutators, Improvement of commutation: Brush shift and interpoles.

UNIT-4 (13 Hrs)

Control of DC Machines: Types of DC motors. Torque equation, speed torque characteristics: shunt, series and compound motors. Starting & speed control of DC motors. 3- point starter & its step calculation. Speed control by controlling armature resistance, field excitation and armature voltage, Ward- Leonard method of speed control, Losses & efficiency of DC machines, Hopkinson's & Swinburne's test.

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Recommended Books

1. P.S. Bhimra, 'Electrical Machinery', 6th Edn., Khanna Publisher, **2014**.
2. I.J. Nagrath & D.P. Kothari, 'Electric Machines', 3rd Edn., TMH, **2004**.
3. P.K. Mukherjee & S. Chakrabarty, 'Electrical Machines', 4th Edn., Dhanpat Rai Pub., **2007**.
4. S.K. Sen, 'Electrical Machinery', 3rd Edn., Khanna Publishers, **1998.**

ELECTRONIC DEVICES & CIRCUITS

Subject Code: BEEE1-304 **L T P C** **Contact Hrs.: 48**

3 1 0 4

Learning Objectives:

- To aware the students about basic electronic components.
- To update the knowledge about amplification circuits to amplify the signal.
- Various types of circuits to generate signals.
- How electronic components are specified and selected for industrial applications.

Learning Outcomes:

- After the completion of the course, the students could have skills about the basic Electronic Circuits, their operational characteristics and their applications.
- An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

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CONTENTS

UNIT I (12 Hrs)

Transistors Theory: Introduction to semiconductors, diodes, Bipolar Junction Transistor. Working action of NPN and PNP. CE, CB & CC configurations. Current components, Concept of D.C. and A.C. load line and operating point, Q point selection, bias stability, various biasing circuits- fixed bias, collector to base bias, emitter bias, voltage divider. Stability factors.

UNIT II (13 Hrs)

Transistor h-Parameter Equivalent Circuits: Analysis of transistor amplifier using h-parameters in CB, CE and CC configuration, The high frequency T- model, hybrid pi CE transistor model, hybrid pi conductance in terms of low frequency h parameters. Multistage amplifiers, RC coupled amplifier, its frequency response.

UNIT III (12 Hrs)

Power Amplifiers: its classifications according to mode of operation and driving output. Class A direct coupled with resistive load, operation of class- B power amplifier, Push-Pull Amplifiers, phase inverter, complementary- symmetry amplifier. Concept of feedback in amplifiers; Positive & Negative Feedback, effect of Negative Feedback on voltage gain, input & output resistance **Oscillators:** Principle of operation of different oscillator's circuits- RC Phase Shift, Wien Bridge, Hartley, Colpitts and Crystal

UNIT IV (13 Hrs)

Field Effect Transistors: Theory of FET construction & working P-channel & N-channel. Comparison with BJT. Its Characteristics JFET parameter- ac drain resistance, trans-conductance, amplification factor, dc drain resistance. Construction & working of MOSFET.

Recommended Books

1. Boylstad & Nashelsky. 'Electronic Devices & Circuits', 9th Edn., Prentice Hall Pub., **2010**.
2. Millman & Halkias, 'Integrated Electronics', Mc-Graw Hill Pub., 2nd Edn., **2001**.

3. Malvino, 'Electronic Principles', 7th Edn., Mc-Graw Hill Pub., **2007**.
4. V.K. Mehta, 'Principles of Electronics', 10th Edn., S. Chand., **2006**.
5. Donald L. Shilling & Charles Belowl, 'Electronic Circuits', 3rd Edn., TMH, **2009**.

ELECTRICAL MEASUREMENT & INSTRUMENTATION LAB

Subject Code: BEEE1-305 **L T P C**
0 0 2 1

Learning Objectives:

- To understand the working principal and construction of the measuring instruments and recorders.
- To measuring various electrical parameters using meters and transducers.
- To calibrate the measuring devices such as meters and transducers.

Learning Outcomes:

- After the completion of the course, the students could have skills about the basic measurement circuits, their operational characteristics and their applications.
- An ability to use the techniques and skills to CRO.

LIST OF EXPERIMENTS

1. Study of principle of operation of various types of electromechanical measuring instruments.
2. To measure high value of DC current and voltage using shunt and Multiplier.
3. To measurement of low resistance using wheat stone bridge.
4. To measure active and reactive power in 3-phase balanced load by one wattmeter method.
5. To measure the active power in 3-phase balanced and unbalanced load by two wattmeter method and observe the effect of power factor variation on wattmeter reading.
6. To study and calibrate Energy Meter.
7. Measurement of resistance using Kelvin's Bridge.
8. Measurement of self-inductance using Anderson's Bridge.
9. Measurement of capacitance using Schering Bridge.
10. Plotting of Hysteresis loop for a magnetic material using flux meter.
11. Measurement of frequency using Wein's Bridge.
12. To study the connections and use of Current and Potential transformers and to find out ratio error.
13. Determination of frequency and phase angle using CRO.
14. Measurement of unknown voltage using potentiometer.
15. To find 'Q' of an inductance coil and verify its value using Q-meter.

Note: Atleast ten experiments should be performed in semester

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ELECTRICAL MACHINES-I LAB

Subject Code: BEEE1-306 **L T P C**
0 0 2 1

Learning Objectives:

- To understand the working principal and construction of the Transformer.
- To carry out laboratory experiments on electrical DC machines to find out parameters.

- To perform the experiments to draw the characteristics of DC machines.

Learning Outcomes:

- After the completion of the course, the students could have skills about the basics of testing of Transformer and DC machines.
- An ability to analyse possible causes of discrepancy in comparison to theory.

LIST OF EXPERIMENTS

1. To study cut section model and sketches of DC machine
2. To study cut section model and sketches of Transformer.
3. To perform load test on a single phase transformer.
4. To perform Open circuit and short circuit tests on a single phase transformer to determine equivalent circuit, voltage regulation and efficiency.
5. To find the efficiency and voltage regulation of single phase transformer under different loading conditions.
6. To perform parallel operation of two single phase transformers.
7. To study the various connections of three phase transformer.
8. To perform Scott connections on three phase transformer.
9. To measure armature and field resistance of DC shunt machine to obtain its open circuit characteristics.
10. To obtain load characteristics of DC shunt/series/compound generator.
11. To draw speed-torque characteristics of DC shunt/series/compound generator.
12. To study different types of DC motor starters.
13. To perform Swinburne's test on DC shunts motor.
14. To perform no load and blocked rotor test on DC shunt motor.

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ELECTRONIC DEVICES & CIRCUITS LAB

Subject Code: BEEE1-307 **L T P C**

0 0 2 1

Learning Objectives:

- To understand the Characteristics of various semiconductor devices and construction of different electronic circuits using the above devices.
- To introduce variety of sources to obtain specifications of electronic devices & to impart knowledge about write technical reports related to basic electronic circuits using correct technical vocabulary.
- Able to understand identification and selection of various electronic components.

Learning Outcomes:

- An ability to understand all types of electronics devices and circuits
- An ability to design and conduct experiments, as well as to analyse and interpret data

LIST OF PRACTICALS

1. To analyse the response of Zener diode as regulator
2. To analyse the response of Half wave, full wave & Bridge rectifiers.
3. To plot the input and output characteristics of CE configuration.
4. To examine the characteristics of a Class- A amplifier.
5. To examine the characteristics of Class- B amplifier.

6. To analyse the characteristics of Class- B push-pull amplifier.
7. To analyse the characteristics of complementary symmetry amplifier.
8. To discuss the response of RC phase shift oscillator and determine frequency of oscillation.
9. To discuss the response of Hartley oscillator and determine frequency of oscillation.
10. To analyse the response of Colpitt's oscillator and determine frequency of oscillation.
11. To analyse the response of Wien Bridge oscillator and determine frequency of oscillation

Note: At least ten experiments should be performed in semester.

ELECTRICAL MACHINES-II

Subject Code: BEEE1-409	**L T P C** **3 1 0 4**	**Contact Hrs.: 48**

Learning Objectives:

- To aware the students about basics of working principles of machines.
- To update the knowledge about illustrate starting and control of induction motors.
- To analyse the performance of induction motors

Course outcomes:

- The students will gain teaching skills in this domain.
- An ability to use the speed control schemes of machines.

CONTENTS

UNIT-I (9 Hrs)

Basic Concept of Electrical Machines: winding factors, generated E.M.F. and M.M.F, distributed winding, production of rotating magnetic field.

UNIT-II (14 Hrs)

Induction Machines: Constructional features, production of torque, equivalent circuit, phasor diagram, torque slip characteristics, Testing running light and blocked rotor test, load test, Effect of rotor resistance, double cage induction motor, Generator operation, starting methods of squirrel cage and wound rotor induction motor, Effect of space harmonics.

UNIT-III (9 Hrs)

Signal Phase Induction Motors: - Constructional features, double revolving field theory, Equivalent circuit, determination of parameters, different types of single phase induction motor and their starting methods & applications.

UNIT-IV (14 Hrs)

Synchronous Machines: Constructional features, salient and non-salient rotor.

Synchronous Generator – Generated emf, circuit model and phasor diagram, armature reaction, synchronous impedance, determination of voltage regulation by different methods, Parallel operation of alternators: - Synchronisation and load sharing.

Synchronous Motor – Operating principle, circuit model, phasor diagram, effect of load, operating characteristics of synchronous motor, V-curves and inverted V-curves, starting methods of synchronous motors, Two reaction theory, analysis of phasor diagram, power angle characteristics, determination of X_d and X_q.

Recommended Books

1. P.S. Bhimbra, 'Electric Machinery', 4th Edn., Khanna Publishers, **2011.**
2. Nagrath & Kothari, 'Electric Machines', 5th Edn., TMH, **2010**.
3. Fitzerald & Kingsley, 'Electric Machinery', 3rd Edn., MGH, **2007.**

MRSPTU

LINEAR CONTROL SYSTEM

Subject Code: BEEE1-410 **L T P C 3 1 0 4** **Contact Hrs.: 48**

Learning Objectives:

- To obtained transfer functions for electrical circuits, translational/rotational mechanical systems and electromechanical systems.
- To learn basic goals of control systems in terms of transient/steady state time response behaviour.
- To update the knowledge about control components.

Learning Outcomes:

- After the completion of the course, the students could have skills about the basics to model the control systems.
- An ability to analyse the stability of designed systems.

CONTENTS

UNIT-I (10 Hrs)

Introductory Concepts: Plant, Systems, Servomechanism, regulating systems, disturbances, Open loop control system, closed loop control systems, stability, linear and non-linear systems, time variant and invariant, pole-zero location, Block diagrams, some illustrative examples.

UNIT-II (14 Hrs)

Modelling: Force voltage analogy, force current analogy, Laplace transforms, Transfer function, Block diagram representation, signal flow graphs and associated algebra, characteristics equation.

Time Domain Analysis: Testing signals, Transient response of the first and second order systems, Time domain specifications, Steady state error and coefficients, PID controller, Absolute & relative stability, Routh-Hurwitz Criterion.

UNIT-III (14 Hrs)

Stability Analysis: Root locus technique, The extreme points of the root loci for positive gain. Asymptotes to the loci, Breakaway points, intersection with imaginary axis, location of roots with given gain and sketch of the root locus plot., Frequency domain analysis: Closed loop frequency response, bode plots, stability and loop transfer function, Frequency response specifications, Relative stability, Relation between time and frequency response for second order systems. Log. Magnitude versus Phase angle plot, Nyquist criterion for stability.

UNIT-IV (10 Hrs)

State Space Analysis: state space representations, transfer function, state transition matrix, controllability, observability.

Control Components: Error detectors – potentiometers and synchros, servo motors, A.C. and D.C. techno generators, Magnetic amplifiers.

Recommended Books

1. Dorf Richard C. and Bishop Robert H., Modern Control System, Addison –Wesley, Pearson New Delhi 12th Ed., 2014
2. Ogata K., Modern Control Engineering", Prentice Hall,5th Ed., 2008
3. Kuo B. C., Automatic Control System", Prentice Hall,6th Ed., 2010
4. Nagrath I.J. and Gopal M., Control System Engineering, Wiley Eastern Ltd.2nd Ed.,2004
5. B. S. Manke, Linear Control Systems,7th Ed., 2009

MRSPTU

DIGITAL ELECTRONICS

Subject Code: BEEE1-411 **L T P C** **Contact Hrs.: 48**
3 1 0 4

Learning Objectives:

- To provide knowledge about basics of digital electronics.
- To impart knowledge about designing of digital circuits.
- Students will use schematics and symbolic algebra to represent digital gates in the creation of solutions to design problems

Learning Outcomes:

- An ability to understand all types of combinational & sequential digital circuits and their designing.
- Students will have skills to simplify a digital design problem as part of the systematic approach to solving a problem.

CONTENTS

UNIT I (14 hrs)

Number System and Binary Code: Introduction, Binary, decimal, Octal, hexadecimal, BCD number system, Signed and unsigned number, binary operations - Addition, Subtraction. Multiplication and division. Subtractions using 1's and 2's compliment; ASCII code. Excess 3 codes and Gray code. Minimization of logic function:-OR, AND, NOT, NOR, NAND, Ex-OR gates, Basic theorem of Boolean Algebra sum of products and product of sums. Minimisation using theorems, minimisation using K-map up to 4 variables

UNIT II (12 hrs)

Combinational logic circuits: Combinational circuit design, multiplexer, demultiplexer, encoders, decoders, adders (Half adder, full adder), substracters and code converters, parity checker, BCD display drive, magnitude comparators.

UNIT III (13 hrs)

Sequential circuits: Flip Flop fundamentals, different flip flop configurations; SR, JK, D, T. Edge triggered and clocked flip flop, Registers; Types of Registers; series & parallel shift, circuit diagram, timing wave form and operations, counter, synchronous & asynchronous, Johnson counter.

UNIT IV (13 hrs)

D/A and A/D Converters: Introduction, Weighted register D/A converter, binary ladder D/A converter, D/A accuracy and resolution, parallel A/D converter Counter type A/D converter, Successive approximation A/D converter, Single and dual slope A./D converter, A/D accuracy and resolution.

Logic Families: Introduction; RTL, DTL & TTlL.

Recommended Books

1. R.P. Jain, 'Modern Digital Electronics', 4th Edn., TMH, **2011**.
2. Malvino & Leach, 'Digital Principals & Applications', 4th Edn., TMH, **1991**.
3. Fletcher, 'An Engg. Approach to Digital Design', PHI, Indian Edn., **2011**.
4. Sanjay Sharma, 'Digital Electronics', 1st Edn., Kataria Sons, **2011**.

MRSPTU

POWER SYSTEM-I

Subject Code: BEEE1-412 **L T P C** **Contact Hrs.: 48**
3 1 0 4

Learning Objectives:

- To provide knowledge about basics of transmission systems.
- To impart knowledge about representation of different power system components and loading capability of a generator
- Students will learn the basic concepts of mechanical and electrical design of transmission lines HVDC/EHVAC systems

Learning Outcomes:

- An ability to understand all types of different power system components
- Students will have skills to differentiate transmission and distribution systems

CONTENTS

UNIT-I (10 Hrs)

Generation of Electric Power: Brief description of Thermal, hydro nuclear and gas power plants & other non- conventional power plants. Legal aspects of electricity supply- Electricity acts, rules and codes, Standards followed in power supply, environmental and safety measures.

UNIT-II (12 Hrs)

Transmission and Distribution Systems: DC 2–wire and 3–wire systems, AC single phase, three phase and 4-wire systems, and comparison of copper efficiency.

Distribution Systems: primary and secondary distribution systems, concentrated & uniformly distributed loads on distributors fed one and both ends, ring distribution, sub mains and tapered mains, voltage drop and power loss calculations, voltage regulation.

UNIT-III (14 Hrs)

Overhead Transmission Lines and Cables: Types of Conductors, Line parameters; calculation of inductance and capacitance of single and double circuit transmission lines, three phase lines with stranded and bundle conductors, Generalized ABCD constants and equivalent circuits of short, medium & long lines, Ferranti and proximity effect.

Line Performance: regulation and efficiency of short, medium and long lines, Series and shunt compensation, Calculations of capacity of cables, charging current, stress, grading, heating of cables, Construction and characteristics of HV & EHV cable.

UNIT-IV (12 Hrs)

Overhead Line Insulators and Mechanical Design of Transmission Lines: Type, string efficiency, voltage distribution in string of suspended insulators, grading ring, preventive maintenance, Different types of tower, sag-tension calculations, sag-template, stringing charts, Corona-losses, Brief description of EHV/HVDC transmission.

Recommended Books

1. J. Grainger John and Jr. W.D. Stevenson, ‘Power System Analysis’, McGraw Hill, **1994**.
2. Harder Edwin.I, ‘Fundamentals of Energy Production’, John Wiley and Sons, **1982**.
3. J. Burke James, ‘Power Distribution Engineering; Fundamentals and Applications’, Marcel Dekk., **1996**.
4. C.L. Wadhwa, ‘Electric Power Systems’, 2nd Edn., Wiley Eastern Limited, **1985**.
5. I.J. Nagrath and D.P. Kothari, ‘Power System Engineering’, Tata McGraw Hill, **1995**.

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ELECTROMAGNETIC FIELD THEORY

Subject Code: BEEE1-413	L T P C 3 1 0 4	Contact Hrs.: 48

Learning Objectives:

- To provide knowledge about the propagation of electromagnetic wave along different mediums like guided, unguided Medias and in space with basic understanding of transmission lines and the method of solving different problems related to it.
- Study of physical concept and all the important fundamental parameters of transmission lines and waveguides.

Learning Outcomes:

- After the completion of the course, the students will be familiar with the concepts of electromagnetic field theory and fundamental equations fields.
- The students will have skills to identify, formulates, and solves engineering problems

CONTENTS

UNIT-I (10 Hrs)

INTRODUCTION: Fundamentals of Electrostatic and Magnetostatics. Time Varying Fields, Maxwell's equations in differential and integral forms concept of displacement current. Boundary conditions. Wave equation and its solution in different media, plane wave, Sinusoidal time variation, polarization.

UNIT-II (12 Hrs)

ELECTROMAGNETIC WAVES: Reflection of waves by perfect dielectrics and by perfect insulators. Surface impedance, Poynting theorem and Poynting vector. Guided Waves: Waves between parallel planes. TE and TM waves and their characteristics. TEM waves, velocities of propagation, Attenuation in parallel plane guides, wave impedance.

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UNIT-III (12 Hrs)

TRANSMISSION LINES: Circuit representation of parallel plane transmission lines. Parallel plane transmission line with losses. Law loss RF and UHF transmission lines. Distortion less condition. Transmission line charts-impedance matching.

UNIT-IV (14 Hrs)

WAVE GUIDES: Rectangular and circular wave guides. TE and TM waves in rectangular wave guides. Impossibility of TEM wave in wave guides. Wave impedance and characteristics impedances. Transmission line analogy for wave guides. Attenuation and factor of wave guides. Dielectric slab wave guides.

Recommended Books

1. Jordan and Balmain, ‘Electromagnetic Wave, PHI and Radiation System’, **1998.**
2. Kraus, ‘Electromagnetics’, T.M.H., **2005.**
3. W.H. Hayt and J.A. Buck, ‘Problem and Solutions in Electromagnetics’, Tata McGraw Hill, **1997.**
4. W.H. Hayt, ‘Engineering Electromagnetic’, T.M.H., **1997.**

LINEAR CONTROL SYSTEM LAB

Subject Code: BEEE1-414 **L T P C**
0 0 2 1

Learning Objectives:

- To understand the basics of MATLAB software.
- To introduce variety of control system strategies.
- To comment about the stability of designed systems.

Learning Outcomes:

- To acquire skills to understand all types of control components
- An ability to analyse the stability of control systems

LIST OF EXPERIMENTS

1. Familiarization with MATLAB control system toolbox, MATLAB Simulink toolbox & PSPICE.
2. Determination of step response for first order & second order system with unity feedback and their display on CRO. Calculation and verification of time constant, peak overshoot, setting time etc. from the response.
3. Simulation of step response&impulseresponsefortype-0, type-1& type-2 systems with unity feedback using MATLAB &PSPICE.
4. Determination of Root Locus, Bode-Plot, Nyquist Plot using MATLAB-Control system toolbox for 2nd order system. Determination of different control system performance indices from the plots.
5. Determination of PI, PD, PID controller action of first order simulated process.
6. Experimental determination of approximate transfer function from Bode plot.
7. Evaluation of steady state error, setting time, percentage peak overshoot, gain margin, phase margin, with addition of lead compensator & by compensator in forward path transfer function for unity feedback control system using PSPICE.
8. Determination of control system specifications for variations of system parameters in practical position control system.
9. Design of a second order linear time invariant control system and study of system response with unit step input.
10. To study the characteristics of potentiometers and to use 2- potentiometers as an error detector in a control system.
11. To study the synchro Transmitter-Receiver set and to use it as an error detector
12. To study the Speed – Torque characteristics of an AC Servo Motor and to explore its applications.
13. To study the Speed – Torque characteristics of a DC Servo Motor and explore its applications.
14. To study various electro-mechanical transducers i.e. resistive, capacitive and inductive transducers
15. To study a LVDT (AC-AC, DC-DC) as a transducer and its processing circuits
16. To obtain the transfer function of a D.C. motor – D.C. Generator set using Transfer Function Trainer
17. To study the speed control of an A.C. Servo Motor using a closed loop and an open loop system

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18. (i) To study the operation of a position sensor and study the conversion of position in to corresponding voltage (ii) To study an PI control action and show its usefulness for minimizing steady state error of time response.

At least ten experiments should be performed in a semester

DIGITAL Electronics Lab

Subject Code: BEEE1-415 **L T P C**

0 0 2 1

Learning objectives:

- To give students a practical knowledge about all types of digital circuits.
- To give students a working knowledge to connect digital circuits and verify their truth tables.
- To give students a knowledge about integrated circuits of different combinational and sequential circuits.

Learning Outcomes:

- An ability to test and verify working and truth tables of combinational and sequential circuits
- Working knowledge to study input output waveforms on digital storage oscilloscope
- Understand and commit to professional, ethics, responsibilities and norms of engineering practice.

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LIST OF EXPERIMENTS

1. To Study of Logic Gates: Truth-table verification of OR, AND, NOT, XOR, NAND and NOR gates and their Realization of OR, AND, NOT and XOR functions using universal gates.
2. To Realize of Half Adder using Logic gates.
3. To Realize of Full Adder using Logic gates.
4. To Realize of Half Subtractor using Logic gates
5. To Realize of Full Subtractor using Logic gates
6. To Design 4-Bit Binary-to-Gray Code Converter.
7. To Design 4-Bit Gray-to-Binary Code Converter.
8. To study and design 4-Bit magnitude comparator using logic gates.
9. To study and design multiplexer Truth-table and their verification.
10. Realization of Half adder and Full adder using MUX.
11. To study and design Demultiplexer Truth table and their verification
12. Realization of Half subtractor and Full subtractor using DEMUX.
13. To study and verify Truth-table of RS, JK, D, JK Master Slave Flip Flops.
14. To design MOD-7 Synchronous up-counter using JK/RS/D Flip Flops.
15. To Study different shift registers, viz. SIPO, SISO, PIPO, PISO.
16. To Study digital logic families.

At-least ten experiments should be performed.

B. TECH. ELECTRICAL ENGINEERING
(2nd Year)

Total Contact Hours = 30 Total Marks = 900 Total Credits = 25

SEMESTER 3rd		Contact Hrs			Marks			Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
BELE1-301	Transformers	3	1	0	40	60	100	4
BELE1-302	Network Analysis and Synthesis	3	1	0	40	60	100	4
BELE1-303	Electronics Devices & Circuits	3	1	0	40	60	100	4
BELE1-304	Electrical Measurement & Measuring Instruments	3	1	0	40	60	100	4
BMAT0-F91	Mathematics -III	3	1	0	40	60	100	4
BSOS0-F91	Soft Skills-I	0	0	2	60	40	100	1
BELE1-305	Instrumentation & Measurement Laboratory	0	0	2	60	40	100	1
BELE1-306	Electronics Devices & Circuit Laboratory	0	0	2	60	40	100	1
BELE1-307	Industrial Training Report	0	0	4	100	---	100	2
Total		**15**	**5**	**10**	**480**	**420**	**900**	**25**

Total Contact Hours = 28 Total Marks = 900 Total Credits = 24

SEMESTER 4th		Contact Hrs			Marks			Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
BELE1-408	DC Machines	3	1	0	40	60	100	4
BELE1-409	Digital Electronics	3	1	0	40	60	100	4
BELE1-410	Electrical Engineering Materials	3	1	0	40	60	100	4
BELE1-411	Linear Control System	3	1	0	40	60	100	4
BELE1-412	Electromagnetic Field Theory	3	1	0	40	60	100	4
BSOS0-F92	Soft Skills-II	0	0	2	60	40	100	1
BELE1-413	Electrical Machine - I Laboratory	0	0	2	60	40	100	1
BELE1-414	Control System Laboratory	0	0	2	60	40	100	1
BELE1-415	Digital Electronics Laboratory	0	0	2	60	40	100	1
Total		**15**	**5**	**8**	**440**	**460**	**900**	**24**

After 2nd year student will go for 4 Weeks- 6 Weeks Institutional / Industrial Training in which he/she should cover complete knowledge of at least one of the following software: MATLAB/LabVIEW/C/C++/Automation/AutoCAD (Electrical)/Data Analysis using Excel.

Total Contact Hours = 24 Total Marks = 900 Total Credits = 24

SEMESTER 5th		Contact Hrs			Marks			Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
BELE1-516	Asynchronous Machines	3	1	0	40	60	100	4
BELE1-517	Power Electronics & Drives	3	1	0	40	60	100	4
BELE1-518	Generation and Economics of Electric Power	3	1	0	40	60	100	4
BSOS0-F93	Soft Skills-III	0	0	2	60	40	100	1
BELE1-519	Power Electronics Laboratory	0	0	2	60	40	100	1
BELE1-520	Electrical Machines-II Laboratory	0	0	2	60	40	100	1
BELE1-521	Industrial Training	---	---	---	60	40	100	3
Department Elective – I (Select any one)		3	0	0	40	60	100	3
BELE1-556	Power Plant Engineering							
BELE1-557	Signals and Systems							
BELE1-558	Microprocessors and Microcontroller							
BELE1-559	Instrumentation Engineering							
Open Elective – I (Select any one)		3	0	0	40	60	100	3
Total		**15**	**3**	**6**	**440**	**460**	**900**	**24**

Total Contact Hours = 25 Total Marks = 800 Total Credits = 22

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SEMESTER 6th		Contact Hrs			Marks			Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
BELE1-622	Synchronous Machines	3	1	0	40	60	100	4
BELE1-623	Power System-I (Transmission and Distribution)	3	1	0	40	60	100	4
	Professional Skills	0	0	2	60	40	100	1
BELE1-624	Electrical: Estimation & Costing Laboratory	0	0	2	60	40	100	1
BELE1-625	Programming in MATLAB	0	0	2	60	40	100	1
Department Elective – II (Select any one)		3	1	0	40	60	100	4
BELE1-660	Electrical Power Utilization							
BELE1-661	Energy Auditing & Management							
BELE1-662	Substation Equipment & Design							
BELE1-663	Digital Control System							
Departmental Elective – III (Select any one)		3	1	0	40	60	100	4
BELE1-664	Energy Efficient Machines							
BELE1-665	Virtual Instrumentation							
BELE1-666	Flexible AC Transmission System Devices							
BELE1-667	Non-conventional Energy Sources							
Open Elective – II (Select any one)		3	0	0	40	60	100	3
Total		**15**	**4**	**6**	**380**	**420**	**800**	**22**

Total Contact Hours = 31 Total Marks = 800 Total Credits = 23

SEMESTER 7th		**Contact Hrs**			**Marks**			**Credits**
Subject Code	**Subject Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
BELE1-726	Non-linear and Digital Control System	3	1	0	40	60	100	4
BELE1-727	Power System-II (Switchgear and Protection)	3	1	0	40	60	100	4
BSOS0-IV	Professional Skills-IV	0	0	2	60	40	100	1
BELE1-728	Project - I	0	0	4	60	40	100	2
BELE1-729	Software Laboratory	0	0	2	60	40	100	1
BELE1-730	Power System-II Laboratory	0	0	2	60	40	100	1
BELE1-731	Industrial Training Report	0	0	6				3
Department Elective – IV (Select any one)		3	1	0	40	60	100	4
BELE1-768	Industrial Automation and PLCs							
BELE1-769	System Engineering and Reliability							
BELE1-770	Digital Signal Processing							
BELE1-771	EHVAC Transmission							
Open Elective – III (Select any one)		3	0	0	40	60	100	3
Total		**12**	**3**	**16**	**400**	**400**	**800**	**23**

Total Contact Hours = 24 Total Marks = 500 Total Credits = 18

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SEMESTER 8th		**Contact Hrs**			**Marks**			**Credits**
Subject Code	**Subject Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
BELE1-832	Power System Analysis and Design	3	1	0	40	60	100	4
BELE1-833	High Voltage Engg.	3	1	0	40	60	100	4
	Professional Skills	0	0	2	60	40	100	1
BELE1-834	Power System Analysis Laboratory	0	0	2	60	40	100	1
BELE1-835	Project -II	0	0	8				4
Department Elective – V (Select any one)		3	1	0	40	60	100	4
BELE1-872	Electrical Machine Design							
BELE1-873	HVDC Transmission							
BELE1-874	Fuzzy Logics & Systems							
BELE1-875	Neural Networks							
Total		**9**	**3**	**12**	**240**	**260**	**500**	**18**

TRANSFORMERS

Subject Code: BELE1-301 **L T P C** **Duration: 45 Hrs**
3 1 0 4

Learning Objectives

- To aware the students about the basics of Transformer.
- To provide basic concepts of different types of Transformer connections & their applications.
- To impart knowledge of single phase transformer, auto transformer and three phase transformer
- To impart knowledge about analysis of different transformer connections

Learning Outcomes

- After the completion of course, students will be having skills to analyze transformer connections.
- Knowledge of different types of transformer operations & applications.

UNIT-I (12 Hrs)

Single Phase Transformer: Construction, working principle of operation, E.M.F. equation, phasor diagram under loaded and unloaded condition, rating of transformers, Losses in transformer, Transformer testing, open and short circuit tests, back to back test, voltage regulation and efficiency, condition for maximum efficiency, equivalent circuit, Ideal Transformer, Parallel operation of single phase transformer, applications of transformers.

UNIT-II (11 Hrs)

Auto-Transformers: Construction, working principle of operation, phasor diagram, saving of conductor material, Comparison of auto transformer and two winding transformer, advantages, disadvantages and applications, equivalent circuit.

UNIT-III (12 Hrs)

Three Phase Transformer: Three winding transformer, construction of three Phase Transformer, three phase transformer connections: Star-star connection, delta-delta connection, delta-star connection, star-delta connection, phasor groups, three phase to two phase and six phase conversion, Scott connection three phase to two phase conversion, phase shifting from primary to secondary windings, Parallel operations of three phase transformers, Harmonics and excitation phenomenon, inrush current phenomenon.

UNIT-IV (10 Hrs)

Transformer Materials: Different types of insulting material for transformer core, winding, insulation, need for bushings, various cooling techniques, effect of temperature on the performance of transformer.

Recommended Books

1. P.S. Bhimbra, ‘Electrical Machinery’, 7th Edn. Khanna Publishers, Delhi, **2004.**
2. A.E. Fitzerald, C. Kingsley and S.D. Umans, ‘Electric Machinery’, Tata McGraw Hill, **2002.**
3. A.S. Langsdorf, ‘Theory of AC Machinery’, 2nd Edn., Tata McGraw Hill, **1955.**
4. Ashfaq Hussian, ‘Electrical Machines’, Dhanpat Rai & Company, **2002.**
5. S.J. Chapman, ‘Electrical Machinery Fundamentals’, McGraw Hill,New York, **1991.**

NETWORK ANALYSIS AND SYNTHESIS

Subject Code: BELE1-302 **L T P C** **Duration: 45 Hrs**
3 1 0 4

Learning Objectives

- To aware the students about the basics of networks.

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- To provide them basic concepts of different types of network theorems & their applications.
- To impart knowledge about different circuits, analyzing and synthesizing methods of circuits.

Learning Outcomes

- After the completion of course, students will be having skills to design, analyze and synthesize the circuits.
- Knowledge of mathematical forms such as Laplace transforms & designing of filters and circuits.

UNIT-I (12 Hrs)

Circuits Concepts: Independent and dependent sources, Signals and wave forms: Periodic and singularity voltages, step, ramp, impulse, doublet, loop currents and loop equations, node voltage and node equations, Network Theorems: Superposition, Thevenin's, Norton's, Maximum Power Transfer, and Reciprocity.

UNIT-II (12 Hrs)

Time and Frequency Domain Analysis: Representation of basic circuits in terms of generalized frequency and their response, Laplace transform of shifted functions, transient and steady response, Time domain behaviors from poles and zeros, Convolution Theorem.

UNIT-III (12 Hrs)

Network Synthesis: Network functions, Impedance and admittance function, Transfer functions, Relationship between transfer and impulse response, poles & zeros and restrictions, Network function for two terminal pair network, Sinusoidal network in terms of poles & zeros, Real liability condition for impedance synthesis of RL & RC circuits, Network synthesis techniques for 2-terminal network, Foster and Cauer forms.

UNIT-IV (12 Hrs)

Filters Synthesis: Classification of filters, characteristics impedance and propagation constant of pure reactive network, Ladder network, T-section, π-section, terminating half section, pass bands and stop bands, Design of Constant-K, m-derived filters, Composite filters.

Recommended Books

1. John Bird, ‘Electrical Circuit Theory and Technology’, 2nd Edn., Newnes, **2003.**
2. Abhijit Chakraborty, ‘Circuit Theory’, 2nd Edn., Dhanpat Rai, **2001.**
3. Chaudhury D. Roy, ‘Networks & Synthesis’, New Age International.
4. J.A. Edminister, ‘Electric Circuits’, 4th Edn., Tata McGraw Hill, **2002.**
5. T.S.K.V. Iyer, ‘Circuit Theory’, Tata McGraw Hill, **2006.**
6. Van Valkenberg, M.E., ‘Network Analysis & Synthesis’, PHI Learning, **2009.**

ELECTRONICS DEVICES & CIRCUITS

Subject Code: BELE1-303	**L T P C** **3 1 0 4**	**Duration: 45 Hrs**

Learning Objectives

- To aware the students about basic electronic components.
- To update the knowledge about amplification circuits to amplify the signal.
- Various types of circuits to generate signals.
- How electronic components are specified and selected for industrial applications.

Learning Outcomes

- After the completion of the course, the students could have skills about the basic Electronic Circuits, their operational characteristics and their applications.

- Ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

UNIT-I (10 Hrs)

Introduction: Introduction to semiconductors theory, P type and N-Type semiconductors, diodes, Drift current, diffusion current. Rectifiers.

UNIT-II (11 Hrs)

Bipolar Junction Transistor: Working action of NPN and PNP. CE, CB & CC configurations, Current components, Concept of D.C. and A.C. load line and operating point, Q point selection, bias stability, various biasing circuits- fixed bias, collector to base bias, emitter bias, voltage divider, Stability factors.

UNIT-III (12 Hrs)

Power Amplifiers: its classifications according to mode of operation and driving output, Class A direct coupled with resistive load, operation of class- B power amplifier, Push-Pull Amplifiers, phase inverter. Concept of feedback in amplifiers; Positive & Negative Feedback, effect of Negative Feedback on voltage gain, input & output resistance

Oscillators: Principle of operation of different oscillator's circuits- RC Phase Shift, Wien Bridge, Hartley Bridge.

UNIT-IV (12 Hrs)

Field Effect Transistors: Theory of FET construction & working P-channel & N-channel. Comparison with BJT, Its Characteristics JFET parameter- ac drain resistance, transconductance, amplification factor, dc drain resistance, Construction & working of MOSFET

Recommended Books

1. Boylstad & Nashelsky, 'Electronic Devices & Circuits', 9th Edn., Prentice Hall Pub., **2010.**
2. Millman & Halkias, 'Integrated Electronics',2nd Edn., Mc-Graw Hill Pub., **2001.**
3. Malvino, 'Electronic Principles', 7th Edn., McGraw Hill Pub, **2007.**
4. V.K. Mehta, 'Principles of Electronics', 10th Edn., S. Chand., **2006.**
5. Donald L. Shilling & Charles Belowl, 'Electronic Circuits',3rd Edn., Tata McGraw Hill., **2009.**

ELECTRICAL MEASUREMENT & MEASURING INSTRUMENTS

Subject Code: BELE1-304 **L T P C** **Duration: 45 Hrs**
3 1 0 4

Learning Objectives

- To aware the students about the basics of Measurements and Instrumentation systems.
- To impart knowledge about different instruments for electrical parameters.
- To provide them basic concepts of different types of sensors and transducers.

Learning Outcomes

- After the completion of course, students will be having skills to design, analyse and instruments.
- Gain the skill knowledge of bridges and CRO operations.

UNIT-I (12Hrs)

Measuring Instruments: Introduction to measuring techniques, Necessity of measurements, block diagram of measurement system, Types of instruments, classification of standards, Fundamental Unit and Derived units. Instrument Characteristics; accuracy and precision, indications of precision, repeatability, Threshold, Sensitivity and span. Different types of errors in measurement, statistical analysis of data, arithmetic mean, deviation, average and standard deviation, probable error. Principle of operation and Constructional Features;

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D'Arsonval Galvanometer, Moving Coil PMMC & Moving Iron instrument (Repulsion and Attraction type), Electrodynamics instruments, Electrostatic instruments and Thermoelectric Instruments Range Extension of Voltmeter and Ammeter.

UNIT-II (10 Hrs)

Measurement of Resistance: Low, Medium and High resistance using Kelvin Double Bridge, Ammeter-Voltmeter method, substitution method, Wheat Stone Bridge, Loss of Charge and Megger.

Measurement of Inductance and Capacitance: Maxwell Inductance, Hay's, Anderson and Schering Bridges, Measurement of frequency by Wein bridge method.

UNIT-III (12 Hrs)

Oscilloscope: Basic principle & construction of Analog CRO, sweep modes, applications in measurement of voltage, frequency (Lissajous pattern), Introduction to Dual Trace Oscilloscope, Digital Storage Oscilloscope, sampling oscilloscope. Comparison between analog and digital oscilloscope

Recorders: Strip Chart Recorders, X-Y Recorders, Ultraviolet Recorders, Magnetic Tape Recorders.

Display Devices: Digital display methods, Seven Segment LED display, Dot Matrix display and LCD Display.

UNIT-IV (11 Hrs)

Basic Concept of measurement system, Transducer and its classifications, basic requirements of Transducer/Sensors. Displacement Transducers: LVDT, RVDT and Piezo Electric. Resistance Thermometer, Thermistors, Thermocouples and Strain Gauge Transducer: Basic principle of operation of Resistance strain gauge.

Recommended Books

1. Cooper Halfrick, 'Modern Electronic Instrumentation and Measurement Techniques', PHI, **1990.**
2. A.K. Sawhney, 'Electronic Instrumentation & Measurement', Dhanpat Rai & Sons, **2011.**
3. Jones & Chin, 'Electronic Instruments and Measurement', 2nd Edn., **2010.**
4. J. Toppin, 'Theory of Errors', 4th Edn,, Wessely Publishing**, 2000.**

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ENGINEERING MATHEMATICS-III

Subject Code: BMAT0-F91	**L T P C** **3 1 0 4**	**Contact Hrs.- 45**

UNIT-I (13 Hrs.)

Fourier Series: Periodic function, Fourier Seies, Dirichlet's conditions, Fourier series for even and odd functions, Change of interval, Half range Fourier series, Other forms of Fourier series.

Fourier Transforms: Dirichlet's conditions, Fourier integral formula (without proof), Fourier transform, Inverse Theorem for Fourier transform, Fourier sine and cosine transforms and their inversion formulae. Properties of Fourier transform, Convolution theorem of Fourier transforms, Parseval's identity.

UNIT-II (10 Hrs.)

Laplace Transforms: Laplace transforms of various standard functions (Exponential, Algebraic, Sine, Cosine), Properties of Laplace transforms, inverse Laplace transforms, transform of derivatives and integrals, Laplace transform of unit step function, impulse function,

Application of Laplace Transforms: Solution of ordinary linear differential equations with constant coefficients, and simultaneous differential equations.

UNIT-III (12 Hrs.)

Partial Differential Equations: Formation of partial differential equations, Linear partial differential equations, homogeneous partial differential equations with constant coefficients. Classification of partial differential equation.

Applications of PDEs: Wave equation and Heat conduction equation in one dimension. Two dimensional Laplace equation in Cartesian Coordinates, solution by the method of separation of variables.

UNIT-IV (10 Hrs.)

Functions of Complex Variable: Limits, continuity and derivative of the function of complex variable, Analytic function, Cauchy-Riemann equations, conjugate functions, harmonic

functions; Conformal Mapping: Definition, standard transformations, translation, rotation, inversion, bilinear. Complex Integration: Line integrals in the complex plane, Cauchy's theorem, Cauchy's integral formula and derivatives of analytic function. Taylor's and Laurent's expansions (without proofs), singular points, poles, residue, Integration of function of complex variables using the method of residues(Integration Of type

$\int_0^{2\pi} F(Cos\theta, Sin\theta)d\theta, \ \int_{-\infty}^{\infty} \frac{f(x)}{F(X)}dx)$

Recommended Books:

1. E. Kreyszing, 'Advanced Engineering Mathematics', 8th Edn., John Wiley, New Delhi.
2. B.S. Grewal, 'Higher Engineering Mathematics', Khanna Publishers, New Delhi.
3. Ian N. Sneedon, 'Elements of Partial Differential Equations', McGraw- Hill, Singapore, **1957**.
4. Peter. V. O'Nil, 'Advanced Engineering Mathematics', Wadsworth Publishing Company.
5. H.C. Taneja, 'Engineering Mathematics', Volume-I & II, I.K. Publisher.

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INSTRUMENTATION & MEASUREMENT LABORATORY

Subject Code: BELE1-305 **L T P C** **Duration: 45 Hrs**

0 0 2 1

Learning Objectives

- To understand the working principal and construction of the measuring instruments and recorders.
- To measuring various electrical parameters using meters and transducers.
- To calibrate the measuring devices such as meters and transducers.

Learning Outcomes

- After the completion of the course, the students could have skills about the basic measurement circuits, their operational characteristics and their applications.
- Ability to use the techniques and skills to CRO.

LIST OF EXPERIMENTS

1. Study of principle of operation of various types of electromechanical measuring instruments.
2. To measure high value of DC current and voltage using shunt and Multiplier.
3. To measurement of low resistance using wheat stone bridge.
4. To measure active and reactive power in 3-phase balanced load by one wattmeter method.
5. To measure the active power in 3-phase balanced and unbalanced load by two wattmeter method and observe the effect of power factor variation on wattmeter reading.
6. To study and calibrate Energy Meter.
7. Measurement of resistance using Kelvin's Bridge.
8. Measurement of self-inductance using Anderson's Bridge.

9. Measurement of capacitance using Schering Bridge.
10. Plotting of Hysteresis loop for a magnetic material using flux meter.
11. Measurement of frequency using Wein's Bridge.
12. To study the connections and use of Current and Potential transformers and to find out ratio error.
13. Determination of frequency and phase angle using CRO.
14. Measurement of unknown voltage using potentiometer.
15. To find 'Q' of an inductance coil and verify its value using Q-meter.

Note: At least ten experiments should be performed in semester.

ELECTRONICS DEVICES & CIRCUIT LABORATORY

Subject Code: BELE1-306 **L T P C**
0 0 2 1

Learning Objectives

- To understand the Characteristics of various semiconductor devices and construction of different electronic circuits using the above devices.
- Tointroducevarietyofsourcestoobtainspecificationsofelectronicdevices&to impartknowledgeaboutwritetechnicalreportsrelatedtobasicelectroniccircuits using correct technical vocabulary.
- Able to understand identification and selection of various electronic components.

Learning Outcomes

- Ability to understand all types of electronics devices and circuits.
- Ability to design and conduct experiments, as well as to analyze and interpret data.

LIST OF EXPERIMENTS

1. To analyze the response of Zener diode as regulator
2. To analyze the response of Half wave, full wave & Bridge rectifiers.
3. To plot the input and output characteristics of CE configuration.
4. To examine the characteristics of a Class- A amplifier.
5. To examine the characteristics of Class- B amplifier.
6. To analyze the characteristics of Class- B push-pull amplifier.
7. To analyze the characteristics of complementary symmetry amplifier.
8. To discuss the response of RC phase shift oscillator and determine frequency of oscillation.
9. To discuss the response of Hartley oscillator and determine frequency of oscillation.
10. To analyze the response of Colpitt’s oscillator and determine frequency of oscillation.
11. To analyze the response of Wien Bridge oscillator and determine frequency of oscillation

Note: At least ten experiments should be performed in semester.

DC MACHINES

Subject Code: BELE1-408 **L T P C** **Duration: 45 Hrs**
3 1 0 4

Learning Objectives

- To understand the basic concepts of D.C machines.
- To introduce different types techniques of speed control of DC machines.
- To Study of different types of testing technique.

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Learning Outcomes

- To acquire skills to understand all aspects of DC motor.
- To acquire skills to understand all aspects of DC generator.
- Ability to operation and control of DC machines.
- Skill to understand the troubleshooting in DC machines

UNIT-I (12 Hrs)

General Concepts of Rotating Electrical Machines: Generalized single and double excited electromechanical energy conversion system. DC machines: principles and construction: generator action, motor action, commutator, commutation, interpolar and compensating windings, brushes, armature core, armature windings and their types, winding pitch, commutator pitch, commutator segments, armature reaction: magnetizing action of armature currents, armature reaction and flux distribution curve, de-magnetizing and cross magnetizing ampere turns.

UNIT-II (12 Hrs)

DC Generators: DC generator: operation, emf equation, torque equation, effect of speed upon voltage and flux, types of DC generators. Characteristics of series, shunt and compound generators, voltage regulation, Condition for maximum efficiency, selection criteria and applications of DC generators

UNIT-III (10 hrs)

DC Motors: EMF equation and concept of back emf, torque equation, power developed, Characteristic of DC motors, armature current, effect of saturation and speed regulation.

UNIT IV (11 hrs)

Starters, Speed Control And Testing: Speed control of DC motors, Ward□Leonard control (Voltage control), various starting techniques for DC motors: Three-point starter, four-point starter, Electric breakings of DC shunt and series motors, Condition for maximum mechanical power, Testing of DC machines: Brake test, Swinburne’s test, Hopkinson’s test, Retardation test, Field’s test, selection criteria applications of DC motors.

Recommended Books

1. P.S. Bimbhra, ‘Electrical Machinery’, Khanna Publishers, **2008.**
2. P.K. Mukherjee and S. Chakravorty, ‘Electrical Machines’, Dhanpat Rai, **2004.**
3. I.J. Nagrath and D.P. Kothari, ‘Electric Machines’, Tata McGraw Hill, **2004.**
4. A.E. Fitzgerald, Kingsley, C. Jr. and Umans, Stephen, ‘Electric Machinery’, McGraw Hill, **2002.**

DIGITAL ELECTRONICS

Subject Code: BELE1-409	**L T P C** **3 1 0 4**	**Duration: 45 Hrs**

Learning Objectives

- To provide knowledge about basics of digital electronics.
- To impart knowledge about designing of digital circuits.
- Students will use schematics and symbolic algebra to represent digital gates inthe creation of solutions to design problems

Learning Outcomes:

- An ability to understand all types of combinational & sequential digital circuits and their designing.
- Students will have skills to simplify a digital design problem as part of the systematic approach to solving a problem.

UNIT-I (12 Hrs)

Number System and Binary Code: Introduction, Binary, decimal, Octal, hexadecimal, BCD number system, Signed and unsigned number, binary operations - Addition, Subtraction. Multiplication and division. Subtractions using 1's and 2's compliment; ASCII code. Excess 3 codes and Gray code. Minimization of logic function:-OR, AND, NOT, NOR, NAND, Ex-OR gates, Basic theorem of Boolean Algebra sum of products and product of sums. Minimisation using theorems, minimisation using K-map up to 4 variables.

UNIT-II (11 Hrs)

Combinational logic circuits: Combinational circuit design, multiplexer, demultiplexer, encoders, decoders, adders (Half adder, full adder), substracters and code converters, parity checker, BCD display drive, magnitude comparators.

UNIT-III (12 Hrs)

Sequential circuits: Flip Flop fundamentals, different flip flop configurations; SR, JK, D, T. Edge triggered and clocked flip flop, Registers; Types of Registers; series & parallel shift, circuit diagram, timing wave form and operations, counter, synchronous & asynchronous, Johnson counter.

UNIT-IV (10 Hrs)

D/A and A/D Converters: Introduction, Weighted register D/A converter, binary ladder D/A converter, D/A accuracy and resolution, parallel A/D converter Counter type A/D converter, Successive approximation A/D converter, Single and dual slope A./D converter, A/D accuracy and resolution.

Recommended Books

1. R.P. Jain, 'Modern Digital Electronics', 4th Edn., Tata McGraw Hill, **2011.**
2. Malvino & Leach, 'Digital Principals & Applications', 4th Edn., Tata McGraw Hill, **1991.**
3. Fletcher, 'An Engg. Approach to Digital Design', PHI, Indian Edn., **2011.**
4. Sanjay Sharma, 'Digital Electronics' Kataria Sons, **2011.**

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ELECTRICAL ENGINEERING MATERIALS

Subject Code: BELE1-410 **L T P C** **Duration: 45 Hrs**
3 1 0 4

Learning Objectives

- To provide knowledge about basics of materials.
- To impart knowledge about electricity generation using variety of materials.
- Students will obtain skills of application of materials in daily life.

Learning Outcomes

- An ability to understand all types of magnetic and conduction materials.
- Students will have skills to simplify a method for power generation using cells.

UNIT-I (12 Hrs)

Dielectric Properties of Insulating Materials: Static Field, Parameters of Dielectric material [Dielectric constant, Dipole moment, Polarization, Polarizability, Introduction to Polar and Non- Polar dielectric materials. Mechanisms of Polarizations-Electronic, Ionic and Orientation Polarization (Descriptive treatment only), Piezo-Electric, Pyro-Electric & Ferro-Electric Materials, Dielectric Loss and loss Tangent. □

Optical Properties of Materials & Cells used for Power Generation: Photo-Conductivity, Photo-Electric Emission, Photo-Voltaic cells (Materials Used, Construction, Equivalent Circuit, Working and Application), materials used for Photo-Conductive cells, Photo-Emissive cells.

UNIT-II (12 Hrs)

Insulating Materials, Properties & Application: Introduction, Characteristics of Good Insulating Material, Classification, Solid Insulating Materials-Paper, Press Board, Fibrous Materials, Ceramics, Mica & Asbestos, Resins, Polymers Ceramics, Enamels. Liquid Insulating Materials such as Transformer Oil, Varnish, Askarel. Insulating Gases like Air, SF_6, Insulating Materials for Power & Distribution Transformers, Rotating Machines, Capacitors, Cables, Line Insulators and Switchgears. Crystal defects.

Dielectric Breakdown: Introduction, Concept of Primary and Secondary Ionization of Gases (Descriptive treatment only), Breakdown Voltage, Breakdown Strength, Factors affecting Breakdown Strengths of Gaseous, Liquid and Solid Dielectric Materials

UNIT-III (11 Hrs)

Magnetic Materials: Introduction, Parameters of Magnetic material Permeability, Magnetic Susceptibility, Magnetization, Classification of Magnetic Materials, Diamagnetism, Para magnetism, Ferromagnetism, Ferri-magnetism, Ferro-magnetic behavior below Critical Temperature, Spontaneous Magnetization & Curie-Weiss law, Anti-ferromagnetism, Ferrites, Applications of Ferro-magnetic Materials, Magnetic materials for Electric Devices such as Transformer Core ,Core of Rotating Machines, Soft Magnetic Materials, Hard Magnetic Materials, Magnetic Recording Materials, Compact Discs**.** Introduction to laser and magnetic strip technology

UNIT-IV (10 hrs)

Conducting Materials: General Properties of Conductor, Electrical Conducting Materials - Copper, Aluminum and its applications, Materials of High & Low Resistivity-Constantan, Nickel-Chromium Alloy, Tungsten, Canthal, Silver & Silver alloys, Characteristics of Copper Alloys (Brass & Bronze), Materials used for Lamp Filaments, Transmission Lines, Electrical Carbon Materials, Material used for Solders, Metals & Alloys for different types of Fuses, Thermal Bimetal & Thermocouple. Introduction to Superconductivity and Super Conductors.

Recommended Books

1. S.P. Seth, 'A Course in Electrical Engineering Materials', Dhanpat Rai and Sons Publication, **2001.**
2. 'Electrical Engineering Materials', T.T.T.I, Madras, **1998.**
3. K.B. Raina & S.K. Bhattacharya, 'Electrical Engineering Materials', S.K. Kataria & Sons, **2004.**
4. P.K. Palanisamy, 'Material Science for Electrical Engineering', SciTech Pub. (India) Pvt. Ltd., Chennai, **2011.**

LINEAR CONTROL SYSTEM

Subject Code: BELE1-411 **L T P C** **Duration: 45 Hrs**
3 1 0 4

Learning Objectives

- To obtained transfer functions for electrical circuits, translational/rotational mechanical systems and electromechanical systems.
- To learn basic goals of control systems in terms of transient/steady state time response behaviour.
- To update the knowledge about control components.

Course Outcomes

- After the completion of the course, the students could have skills about the basics to model the control systems.
- Ability to analyse the stability of designed systems.

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UNIT-I (11 Hrs)

Introductory Concepts: Plant, Systems, Servomechanism, regulating systems, disturbances, Open loop control system, closed loop control systems, stability, linear and non-linear systems, time variant and invariant, pole-zero location, Block diagrams, some illustrative examples.

UNIT-II (12 Hrs)

Modelling: Force voltage analogy, force current analogy, Laplace transforms, Transfer function, Block diagram representation, signal flow graphs and associated algebra, characteristics equation.

Time Domain Analysis: Testing signals, Transient response of the first and second order systems, Time domain specifications, Steady state error and coefficients, PID controller, Absolute & relative stability, Routh-Hurwitz Criterion.

UNIT-III (12 Hrs)

Stability Analysis: Root locus technique, the extreme points of the root loci for positive gain. Asymptotes to the loci, Breakaway points, intersection with imaginary axis, location of roots with given gain and sketch of the root locus plot., Frequency domain analysis: Closed loop frequency response, bode plots, stability and loop transfer function, Frequency response specifications, Relative stability, Relation between time and frequency response for second order systems. Log. Magnitude versus Phase angle plot, Nyquist criterion for stability.

UNIT-IV (10 Hrs)

State Space Analysis: state space representations, transfer function, state transition matrix, controllability, observability

Control Components: Error detectors – potentiometers and synchros, servo motors, A.C. and D.C. techno generators, Magnetic amplifiers.

Recommended Books

1. Dorf Richard C. and Bishop Robert H., ‘Modern Control System’, Addison –Wesley, Pearson New Delhi, **2009.**
2. K. Ogata, ‘Modern Control Engineering’, Prentice Hall, **2011.**
3. B.C. Kuo, ‘Automatic Control System’, Prentice Hall, **1999.**
4. I.J. Nagrath and M. Gopal, ‘Control System Engineering’, Wiley Eastern Ltd., **1997.**
5. B.S. Manke, ‘Linear Control Systems’, **2002.**

ELECTROMAGNETIC FIELD THEORY

Subject Code: BELE1-412	L T P C 3 1 0 4	Duration: 45 Hrs

Learning Objectives

- To provide knowledge about the propagation of electromagnetic wave along different mediums like guided, unguided Medias and in space with basic understanding of transmission lines and the method of solving different problems related to it.
- Study of physical concept and all the important fundamental parameters of transmission lines and waveguides.

Learning Outcome

- After the completion of the course, the students will be familiar with the concepts of electromagnetic field theory and fundamental equations fields.
- The students will have skills to identify, formulates, and solves engineering problems

UNIT-I (10 Hrs)

INTRODUCTION: Fundamentals of Electrostatic and Magnetostatics. Time Varying Fields, Maxwell's equations in differential and integral forms concept of displacement current.

MRSPTU

Boundary conditions. Wave equation and its solution in different media, plane wave, Sinusoidal time variation, polarization.

UNIT-II (12 Hrs)

ELECTROMAGNETIC WAVES: Reflection of waves by perfect dielectrics and by perfect insulators. Surface impedance, Poynting theorem and Poynting vector. Guided Waves: Waves between parallel planes. TE and TM waves and their characteristics. TEM waves, velocities of propagation, Attenuation in parallel plane guides, wave impedance.

UNIT-III (11 Hrs)

TRANSMISSION LINES: Circuit representation of parallel plane transmission lines. Parallel plane transmission line with losses. Law loss RF and UHF transmission lines. Distortion less condition. Transmission line charts-impedance matching.

UNIT-IV (12 Hrs)

WAVE GUIDES: Rectangular and circular wave guides. TE and TM waves in rectangular wave guides. Impossibility of TEM wave in wave guides. Wave impedance and characteristics impedances. Transmission line analogy for wave guides. Attenuation and factor of wave guides. Dielectric slab wave guides.

Recommended Books

1. Jordan and Balmain, 'Electromagnetic Wave', PHI and Radiation System, **2010.**
2. Kraus, 'Electromagnetics', Tata McGraw Hill, **2003.**
3. W.H. Hayt and J.A. Buck, 'Problem and Solutions in Electromagnetics', Tata McGraw Hill, **1999.**
4. W.H. Hayt, 'Engineering Electromagnetics', T.M.H., **2012.**

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ELECTRICAL MACHINE-I LABORATORY

Subject Code: BELE1-413 **L T P C**
0 0 2 1

Learning Objectives

- To understand the basics of D.C Machines.
- To introduce variety of speed control of dc shunt motor.
- To Study of universal motor.

Learning Outcomes

- To acquire skills to understand all types of dc machines.
- Ability to analyse the speed control of machine.

LIST OF EXPERIMENTS

1. To study various components/cut-section of DC machine
2. To perform starting techniques of various DC machines.
3. To obtain torque and speed characteristics of a D.C. Shunt motor
4. To obtain external characteristics of a D.C. shunt generator
5. To obtain external characteristics of a D.C. series generator.
6. To obtain external characteristics of DC compound generator.
7. Speed control of a dc shunt motor by varying armature circuit and field circuit method
8. To obtain performance characteristics of universal motor.
9. To perform Swinburne's Test
10. To perform Hopkinson's Test
11. To perform the Brake Load Test
12. Calculate the power rating of DC machines.
13. To determine losses and efficiency of DC machines

CONTROL SYSTEM LABORATORY

Subject Code: BELE1-414 **L T P C**
0 0 2 1

Learning Objectives

- To understand the basics of MATLAB software.
- To introduce variety of control system strategies.
- To comment about the stability of designed systems.

Learning Outcomes

- To acquire skills to understand all types of control components
- Ability to analyse the stability of control systems

LIST OF EXPERIMENTS

1. Familiarization with MATLAB control system toolbox, MATLAB Simulink toolbox & PSPICE.
2. Determination of step response for first order& second order system with unity feedback and their display on CRO. Calculation and verification of time constant, peak overshoot, setting time etc. from the response.
3. Simulation of step response&impulseresponsefortype-0, type-1& type-2 systems with unity feedback using MATLAB & PSPICE.
4. Determination of Root Locus, Bode-Plot, Nyquist Plot using MATLAB-Control system toolbox for 2nd order system. Determination of different control system performance indices from the plots.
5. Determination of PI, PD, PID controller action of first order simulated process.
6. Experimental determination of approximate transfer function from Bode plot.
7. Evaluation of steady state error, setting time, percentage peak overshoot, gain margin, phase margin, with addition of lead compensator & by compensator in forward path transfer function for unity feedback control system using PSPICE.
8. Determination of control system specifications for variations of system parameters in practical position control system.
9. Design of a second order linear time invariant control system and study of system response with unit step input.
10. To study the characteristics of potentiometers and to use 2- potentiometers as an error detector in a control system.
11. To study the synchro Transmitter-Receiver set and to use it as an error detector
12. To study the Speed – Torque characteristics of an AC Servo Motor and to explore its applications.
13. To study the Speed – Torque characteristics of a DC Servo Motor and explore its applications.
14. To study various electro-mechanical transducers i.e. resistive, capacitive and inductive transducers
15. To study a LVDT (AC-AC, DC-DC) as a transducer and its processing circuits
16. To obtain the transfer function of a D.C. motor – D.C. Generator set using Transfer Function Trainer
17. To study the speed control of an A.C. Servo Motor using a closed loop and an open loop system
18. a) To study the operation of a position sensor and study the conversion of position in to corresponding voltage
    b) To study an PI control action and show its usefulness for minimizing steady state error of time response.

MRSPTU

At least ten experiments should be performed in a semester

DIGITAL ELECTRONICS LABORATORY

Subject Code: BELE1-415 **L T P C**
0 0 2 1

Learning objectives

- To give students a practical knowledge about all types of digital circuits.
- To give students a working knowledge to connect digital circuits and verify their truth tables.
- To give students acknowledge about integrated circuits of different combinational and sequential circuits.

Learning Outcomes

- Anabilitytotestandverifyworkingandtruthtablesofcombinationalandsequentialcircuits
- Working knowledge to study input output wave forms on digital storage oscilloscope
- Understand and commit to professional, ethics, responsibilities and norms of engineering practice.

LIST OF EXPERIMENTS

1. To Study of Logic Gates: Truth-table verification of OR, AND, NOT, XOR, NAND and NOR gates and their Realization of OR, AND, NOT and XOR functions using universal gates.
2. To Realize of Half Adder using Logic gates.
3. To Realize of Full Adder using Logic gates.
4. To Realize of Half Subtractor using Logic gates
5. To Realize of Full Subtractor using Logic gates
6. To Design 4-Bit Binary-to-Gray Code Converter.
7. To Design 4-Bit Gray-to-Binary Code Converter.
8. To study and design 4-Bit magnitude comparator using logic gates.
9. To study and design multiplexer Truth-table and their verification.
10. Realization of Half adder and Full adder using MUX.
11. To study and design Demultiplexer Truth table and their verification
12. Realization of Half subtractor and Full subtractor using DEMUX.
13. To study and verify Truth-table of RS, JK, D, JK Master Slave Flip Flops.
14. To design MOD-7 Synchronous up-counter using JK/RS/D Flip Flops.
15. To Study different shift registers, viz. SIPO, SISO, PIPO, PISO.
16. To Study digital logic families.

At-least ten experiments should be performed.

MRSPTU

B. TECH. ELECTRONICS & COMMUNICATION ENGINEERING

Total Contact Hours = 30 Total Marks = 900 Total Credits = 25

SEMESTER 3rd		Contact Hrs.			Marks			Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
BMAT0-F91	Mathematics –III	3	1	0	40	60	100	4
BECE1-301	Electronic Devices and Circuits – I	3	1	0	40	60	100	4
BECE1-302	Network Analysis & Synthesis	3	1	0	40	60	100	4
BECE1-303	Digital Electronics	3	1	0	40	60	100	4
BECE1-304	Signal & Systems	3	1	0	40	60	100	4
BECE1-305	Electronic Devices and Circuits - I Lab.	0	0	2	60	40	100	1
BECE1-306	Digital Electronics Lab.	0	0	2	60	40	100	1
BSOS0-F91	Soft Skills – I	0	0	2	60	40	100	1
BECE1-307	Training – I	0	0	4	60	40	100	2
Total	**Total 5 Theory & 2 Lab. Courses**	**15**	**5**	**10**	**440**	**460**	**900**	**25**

Total Contact Hours = 27 Total Marks = 900 Total Credits = 23

SEMESTER 4th		Contact Hrs.			Marks			Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
BECE1-408	Electronic Devices & Circuits –II	3	1	0	40	60	100	4
BECE1-409	Analog Communication Systems	3	1	0	40	60	100	4
BECE1-410	Object Oriented Programming	3	1	0	40	60	100	4
BECE1-411	Electromagnetic Field Theory	3	1	0	40	60	100	4
Departmental Elective-I (Select any one)		3	0	0	40	60	100	3
BECE1-456	Antenna &Wave Propagation							
BECE1-457	Data Structures and Algorithms							
BECE1-458	Electronic Instrumentation							
BECE1-459	Reliability Engineering							
BECE1-412	Electronic Devices & Circuits -II Lab.	0	0	2	60	40	100	1
BECE1-413	Analog Communication Systems Lab.	0	0	2	60	40	100	1
BECE1-414	Object Oriented Programming Lab.	0	0	2	60	40	100	1
BSOS0-F92	Soft Skills -II	0	0	2	60	40	100	1
Total	**Total 5 Theory & 3 Lab. Course**	**15**	**4**	**8**	**440**	**460**	**900**	**23**

In House / Industrial Training of 6 Weeks during Summer vacations

Total Contact Hrs. = 26 Total Marks = 1000 Total Credits = 24

Semester 5th		Contact Hours			Marks			Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
BECE1-515	Linear Integrated Circuits	3	1	0	40	60	100	4
BECE1-516	Microprocessor and Interfacing	3	1	0	40	60	100	4
BECE1-517	Digital Communication Systems	3	1	0	40	60	100	4
BECE1-519	Linear Integrated Circuits Lab.	0	0	2	60	40	100	1
BECE1-519	Microprocessor Lab.	0	0	2	60	40	100	1
BECE1-520	Digital Communication Systems Lab.	0	0	2	60	40	100	1
BECE1-521	Training –II				60	40	100	2
	Professional Skills -III	0	0	2	60	40	100	1
Departmental Elective-II (Select any one)		3	0	0	40	60	100	3
BECE1-560	Data Communication Networks							
BECE1-561	Human Resource Management							
BECE1-562	Digital System Design							
BECE1-563	Biomedical Electronics and Instrumentation							
BECE1-564	Micro-electronics							
Open Elective – I		3	0	0	40	60	100	3
Total		**15**	**3**	**8**	**500**	**500**	**1000**	**24**

Total Contact Hrs. = 24 Total Marks = 700 Total Credits = 21

Semester 6th		Contact Hours			Marks			Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
BECE1-622	Microwave and Antenna Theory	3	1	0	40	60	100	4
BECE1-623	Microcontroller and Embedded System	3	1	0	40	60	100	4
BECE1-624	Linear Control System	3	1	0	40	60	100	4
BECE1-625	Microwave Engineering lab	0	0	2	60	40	100	1
BECE1-626	Microcontroller Lab.	0	0	2	60	40	100	1
BECE1-627	Professional Skills-IV	0	0	2				1
Departmental Elective-II (Select any one)		3	0	0	40	60	100	3
BECE1-665	Nano Science and Nano-Technology							
BECE1-666	Advanced Microprocessor							
BECE1-667	Image and Speech Processing							
BECE1-668	Optical Fibre Communication							
BECE1-669	Operation Research							
Open Elective – II		3	0	0	40	60	100	3
Total		**15**	**3**	**6**	**320**	**380**	**700**	**21**

***In House / Industrial Training of 8 Weeks during summer vacations**

Total Contact Hrs. = 14 Total Marks = 700 Total Credits = 23

Semester 7th		**Contact Hours**			**Marks**			**Credits**
Subject Code	**Subject Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
BECE1- 728	Wireless Communication Systems	3	1	0	40	60	100	4
BECE1- 729	Digital Signal Processing	3	1	0	40	60	100	4
BECE1- 730	Digital Signal Processing Lab	0	0	2	60	40	100	1
BECE1- 731	Training-III				60	40	100	4
BECE1- 732	Minor Project				60	40	100	4
Departmental Elective-II (Select any one)		3	0	0	40	60	100	3
BECE1-770	Cognitive Radio							
BECE1-771	Relational Data Base Management System							
BECE1-772	Computer Architecture and Organization							
BECE1-773	Soft Computing							
Open Elective – III		3	0	0	40	60	100	3
Total		**12**	**2**	**2**	**340**	**360**	**700**	**23**

Total Contact Hrs. = 9 Total Marks = 400 Total Credits = 14

Semester 8th		**Contact Hours**			**Marks**			**Credits**
Subject Code	**Subject Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
BECE1- 833	VLSI Design	3	1	0	40	60	100	4
BECE1- 834	VLSI Design Lab	0	0	2	60	40	100	1
BECE1- 835	Major Project	0	0	0	60	40	100	6
Departmental Elective-II (Select any one)		3	0	0	40	60	100	3
BECE1-874	Cellular and Mobile Communication							
BECE1-875	Wireless Sensor Networks							
BECE1-876	Information Theory and Coding							
BECE1-877	Operating Systems							
BECE1-878	Satellite Communication							
Total		**6**	**1**	**2**	**200**	**200**	**400**	**14**

Total Credits

Semester	**Credits**
I	25
II	25
III	25
IV	23
V	24
VI	21
VII	23
VIII	14
Total	**180**

ENGINEERING MATHEMATICS-III

Subject Code: BMAT0-F91 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

UNIT-I (13 Hrs.)

Fourier Series: Periodic function, Fourier Seies, Dirichlet's conditions, Fourier series for even and odd functions, Change of interval, Half range Fourier series, Other forms of Fourier series.
Fourier Transforms: Dirichlet's conditions, Fourier integral formula (without proof), Fourier transform, Inverse Theorem for Fourier transform, Fourier sine and cosine transforms and their inversion formulae. Properties of Fourier transform, Convolution theorem of Fourier transforms, Parseval's identity.

UNIT-II (10 Hrs.)

Laplace Transforms: Laplace transforms of various standard functions (Exponential, Algebraic, Sine, Cosine), Properties of Laplace transforms, inverse Laplace transforms, transform of derivatives and integrals, Laplace transform of unit step function, impulse function,
Application of Laplace Transforms: Solution of ordinary linear differential equations with constant coefficients, and simultaneous differential equations.

UNIT-III (12 Hrs.)

Partial Differential Equations: Formation of partial differential equations, Linear partial differential equations, homogeneous partial differential equations with constant coefficients. Classification of partial differential equation.
Applications of PDEs: Wave equation and Heat conduction equation in one dimension. Two dimensional Laplace equation in Cartesian Coordinates, solution by the method of separation of variables.

UNIT-IV (10 Hrs.)

Functions of Complex Variable: Limits, continuity and derivative of the function of complex variable, Analytic function, Cauchy-Riemann equations, conjugate functions, harmonic functions; Conformal Mapping: Definition, standard transformations, translation, rotation, inversion, bilinear. Complex Integration: Line integrals in the complex plane, Cauchy's theorem, Cauchy's integral formula and derivatives of analytic function. Taylor's and Laurent's expansions (without proofs), singular points, poles, residue, Integration of function of complex variables using the method of residues(Integration Of type $\int_0^{2\pi} F(Cos\theta, Sin\theta)d\theta,\ \int_{-\infty}^{\infty} \frac{f(x)}{F(X)}dx$)

Recommended Books

1. E. Kreyszing, 'Advanced Engineering Mathematics', 8th Edn., John Wiley, New Delhi.
2. B.S. Grewal, 'Higher Engineering Mathematics', Khanna Publishers, New Delhi.
3. Ian N. Sneedon, 'Elements of Partial Differential Equations', McGraw Hill, Singapore, **1957**.
4. Peter. V. O'Nil, 'Advanced Engineering Mathematics', Wadsworth Publishing Company.
5. H.C. Taneja, 'Engineering Mathematics', Volume-I & II, I.K. Publisher.

ELECTRONIC DEVICES AND CIRCUITS - I

Subject Code: BECE1-301 **L T P C** **Duration: 45 Hrs.**

3 1 0 4

Learning Objectives: This Learning is meant to provide fundamental knowledge to ECE students for understanding of the basic semi-conductor devices and their behaviour under various conditions.

Learning Outcomes:

Student after undergoing this Learning student will be able to:

1. Understand the concepts of PN junction diode and their applications
2. Understand BJT characteristics and determine their behavior under low and high frequencies.
3. Understanding of FETs and their characteristics
4. To understand low and high frequency models

UNIT-I (11 Hrs.)

Semiconductor Diodes: Semi-conductor materials and their characteristics, PN junction Diode - VI characteristics, qualitative and quantitative analysis of its behaviour, Diode resistance, Transition capacitance and Diffusion capacitance, clippers, clampers, rectifiers. Special purpose diodes - Zener diode, varactor diode, schottky diode.

UNIT-II (11 Hrs.)

Bipolar Junction Transistor: BJT – Transistor current components, BJT configurations – CE, CB, CC and their characteristics. Transistor Biasing –Operating point determination, fixed bias, emitter bias, voltage-divider bias. Bias stability – Stabilization against variation in Ico, V_{BE} and β, Bias compensation.

UNIT-III (12 Hrs.)

Field-Effect Transistor: The junction FET - construction, operation, characteristics, parameters, Biasing of JFET, Small signal analysis of JFET as an amplifier- common source and common drain amplifiers.

Metal Oxide Semiconductor FET: MOSFET- construction, operation, characteristics, parameters, CMOS devices, CMOS inverter characteristics, metal semiconductor.

UNIT-IV (11 Hrs.)

Low & High Frequency Transistor Model: Transistor Hybrid Model, h parameter equivalent circuit of transistor, Analysis of transistor amplifier using h-parameters in CB, CE and CC configuration, The high frequency T model, hybrid pi CE transistor model, hybrid pi conductance in terms of low frequency h parameters.

Recommended Books

1. Millman, Jacob, Halkias Christos C. and Satyabratajit, 'Electronic Devices and Circuits', Tata McGraw Hill, New Delhi.
2. Boylestad Nashelsky, 'Electronic Devices and Circuit Theory', Pearson Education.
3. Floyd, L. Thomas, 'Electronic Devices', 6th Edn., Pearson Education, **2002.**
4. S. Adel Sedra, and Kenneth C. Smith, 'Microelectronic Circuits', Oxford University Press, New York.
5. Streetman Ben J., Sanjay Banerjee, 'Solid State Electronic Devices', PHI.

NETWORK ANALYSIS & SYNTHESIS

Subject Code: BECE1-302 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

Learning Objectives

- To aware the students about the basics of networks.
- To provide them basic concepts of different types of network theorems & their applications.
- To impart knowledge about different circuit analyzing and synthesizing methods of circuits

Learning Outcomes

- An ability to design, analyze and synthesize the circuits.
- Knowledge of mathematical forms such as Laplace transforms & designing of filters and circuits.
- Understand fundamental concepts of network synthesis.
- To understand design and analysis of filters.

UNIT-I (12 Hrs.)

Laws and Basic Theorems: Fundamental Laws and Concepts – Kirchhoff's current and voltage laws, Node and mesh analysis using classical method and Laplace transform, Concept of independent and dependent sources, Analysis of special signal waveforms, Duality in networks. Network Theorems –Superposition, Reciprocity, Thevenin's, Norton's, Millman's, Maximum power transfer, Tellegan's, Circuit analysis using these theorems.

UNIT-II (12 Hrs.)

Transient Analysis: Fundamental signals and their mathematical expressions, Transient response analysis of RL, RC and RLC for various signals using differential equations and Laplace transform

UNIT-III (12 Hrs.)

Two Port Networks: Fundamental concepts of network synthesis, Hurwitz Polynomials, Positive real functions, Properties of RC, RL & LC networks, Foster and Cauer forms of realization, Transmission zeroes, Synthesis of transfer functions.

UNIT-IV (12 Hrs.)

Passive Filter: Design and analysis of Butterworth and Chebyshev approximations, Normalized specifications, Frequency transformations, Frequency and impedance denormalisation, Types of frequency selective filters, Linear phase filters.

Recommended Books

1. Vanvalkenburg, 'Network Analysis', Prentice Hall of India Pvt. Ltd., New Delhi.
2. D. Roy Choudhary, 'Network and Systems', New Age International Publisher.
3. Franklin F. Kuo, 'Network Analysis and Synthesis', John Wiley Publications.

DIGITAL ELECTRONICS

Subject Code: BECE1- 303 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

Learning Objectives

- To provide knowledge about basics of Digital Electronics.
- To impart knowledge about designing of digital circuits.

- Students will use schematics and symbolic Algebra to represent digital gates in the creation of solutions to design problems

Learning Outcomes

- An ability to understand all types of combinational & sequential digital circuits and their designing.
- Students will restate and simplify a digital design problem as part of the systematic approach to solving a problem.
- To understand various sequential circuits & various Digital Logic families
- Understand Analog to Digital and Digital to Analog converters and finite state machines

UNIT I (10 Hrs.)

Fundamentals of Digital Techniques: Digital signal, logic gates: AND, OR, NOT, NAND, NOR, EX-OR, EX-NOR, Boolean algebra. Review of Number systems. Binary codes: BCD, Excess-3, Gray, EBCDIC, ASCII, Error detection and correction codes.

UNIT II (11 Hrs.)

Combinational Design Using Gates: Design using gates, Karnaugh map and Quine Mcluskey methods of simplification.

Combinational Design Using MSI Devices: Multiplexers and Demultiplexers and their use as logic elements, Decoders, Adders / Subtractors, BCD arithmetic circuits, Encoders, Decoders / Drivers for display devices.

UNIT III (12 Hrs.)

Sequential Circuits: Flip Flops: S-R, J-K, T, D, master-slave, edge triggered, shift registers, sequence generators, Counters, Asynchronous and Synchronous Ring counters and Johnson Counter, Design of Synchronous and Asynchronous sequential circuits.

Digital Logic Families: Switching mode operation of p-n junction, bipolar and MOS. devices. Bipolar logic families: RTL, DTL, DCTL, HTL, TTL, ECL, MOS, and CMOS logic families. Tristate logic, Interfacing of CMOS and TTL families.

UNIT IV (12 Hrs.)

A/D and D/A converters: Sample and hold circuit, weighted resistor and R -2 R ladder D/A Converters, specifications for D/A converters. A/D converters: Quantization, parallel -comparator, successive approximation, counting type, dual-slope ADC, specifications of ADCs.

Programmable Logic Devices: ROM, PLA, PAL, FPGA and CPLDs.

Finite State Machines: Finite state model, Memory elements and their excitation functions, Synthesis of Synchronous sequential circuits, Capabilities and limitations of FSM, Design, Modelling and Simulation of Moore and Mealy machines.

Recommended Books

1. R.P. Jain, ‘Modern Digital Electronics’, Tata McGraw Hill.
2. Malvino & Leach, ‘Digital Principles and Applications’, McGraw Hill.
3. Taub & Schilling, ‘Digital Integrated Electronics’, McGraw Hill.

SIGNAL & SYSTEMS

Subject Code: BECE1-304 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

Learning Objectives

- To introduce the students about the theoretical concepts associated with processing continuous & discrete time signals & systems.
- To be able to think critically & to apply problem solving & reasoning strategies to the analysis of various types of signals & systems.
- To impart them knowledge of various types of noises.

Learning Outcomes

- An ability to analyze various types of signals in communication system.
- Developing skills to understand random signals
- To understand various types of noises
- Understand signal transmission through linear networks.

UNIT-I (12 Hrs.)

Systems and Signal Analysis: Detailed Classification of Signals and Systems, Fourier Series and its properties, Fourier transform and its properties along with applications, Discrete Time Fourier Series (DTFS) and Discrete Time Fourier Transform (DTFT).

Correlation and Spectral Density: Definition of Correlation and Spectral Density, Analogy between correlation, covariance and convolution, conceptual basis, auto-correlation, cross correlation, energy/power spectral density, properties of correlation and spectral density, inter relation between correlation and spectral density.

UNIT-II (12 Hrs.)

Random Signal Theory: Introduction to Probability Theory, Definition of Probability of Random Events. Joint and Conditional Probability, Probability Mass Function, Statistical Averages. Probability Density Functions (PDF) and Statistical Averages, mean, moments and expectations, standard deviation and variance. Probability models: Uniform, Gaussian, Binomial. Examples of PDF, Transformation of Random Variables. Random Processes, Stationary and Ergodicity.

UNIT-III (11 Hrs.)

Introduction to Noise: Thermal Noise, Shot noise, Partition noise, Flicker noise, Gaussian Noise, Noise in Bipolar Junction Transistors (BJTs), FET noise. Equivalent input noise, Signal to Noise Ratio (SNR), Noise Temperature, Noise equivalent Bandwidth, Noise Figure. Experimental determination of Noise Figure, Pulse Response and Digital Noise and its elimination.

UNIT-IV (10 Hrs.)

Signal Transmission Through Linear Networks: Convolution Theorem and its graphical interpretation. The Sampling Theorem, Low Pass and Band Pass Networks, Matched Filter, Enveloped detector.

Recommended Books

1. B.P. Lathi, ‘Digital and Analog Communication System’, 4th Edn., Oxford University Press, **2000.**
2. Ravi Kumar, ‘Signals and Systems’, PHI Learning, **2009.**
3. Simon Haykin, ‘Signals and Systems’, 2nd Edn., Wiley Publications, **2008.**

4. D. Ganesh Rao and Satish Tunga, ‘Signals and Systems’, Pearson Publications, **2000**

ELECTRONIC DEVICES AND CIRCUITS LAB. - I

Subject Code: BECE1-305 **L T P C**
0 0 2 1

Learning Objectives

- To understand the Characteristics of various semiconductor devices and construction of different electronic circuits using the above devices.
- To introduce variety of sources to obtain specifications of electronic devices & to impart knowledge about write technical reports related to basic electronic circuits using correct technical vocabulary.
- Able to understand identification and selection of various electronic components.

Learning Outcomes

- An ability to understand all types of electronics devices and circuits
- An ability to design and conduct experiments, as well as to analyze and interpret data

CONTENTS

1. Study of Zener regulator as voltage regulator
2. Study of Half wave, full wave & Bridge rectifiers.
3. To plot the input and output characteristics of CE configuration.
4. To study the characteristics of a Class- A amplifier.
5. To study the characteristics of Class- B amplifier.
6. To study the characteristics of Class- B push-pull amplifier.
7. To study the characteristics of complementary symmetry amplifier.
8. To plot a load line for a CE amplifier and show effect of input signal on Q-point.
9. To demonstrate use of a BJT in a CE amplifier circuit configuration and study its frequency response.
10. To demonstrate use of a BJT in a CC amplifier circuit configuration and study its frequency response.
11. To demonstrate use of a power BJT as an amplifier.

Note: At least 08 experiments are required to be performed.

DIGITAL ELECTRONICS LAB.

Subject Code: BECE1-306 **L T P C**
0 0 2 1

Learning Objectives

- To provide knowledge about basics of Digital Electronics.
- To impart knowledge about designing of digital circuits.
- Students will use schematics and symbolic Algebra to represent digital gates in the creation of solutions to design problems

Learning Outcomes

- An ability to understand all types of combinational & sequential digital circuits and their designing.

- Students will restate and simplify a digital design problem as part of the systematic approach to solving a problem.

EXPERIMENTS

1. Study of Logic Gates: Truth-table verification of OR, AND, NOT, XOR, NAND and NOR gates;
2. Realization of OR, AND, NOT and XOR functions using universal gates.
3. Realization Half Adder / Full Adder using Logic gates.
4. Realization Half Subtractor / Full Subtractor using Logic gates
5. Design 4-Bit Binary-to-Gray & Gray-to-Binary Code Converter.
6. Design 4-Bit magnitude comparator using logic gates. Multiplexer: Truth-table verification and realization of Half adder and Full adder using MUX.
7. Demultiplexer: Truth-table verification and realization of Half subtractor and Full subtractor using DEMUX.
8. Flip Flops: Truth-table verification of RS, JK, D, JK Master Slave Flip Flops.
9. Design MOD-7 Synchronous up-counter using JK/RS/D Flip Flops.
10. Shift Register: Study of shift right, SIPO, SISO, PIPO, PISO & Shift left operations using IC7495 chip.

Note: At least 08 experiments are required to be performed.

ELECTRONIC DEVICES AND CIRCUITS - II

Subject Code: BECE1-408 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

Learning Objectives

1. To aware the students about Basic Electronic Components.
2. To update the Knowledge about amplification circuits to amplify the signal.
3. Various types of circuits to generate signals.
4. How electronic components are specified and selected for industrial applications.

Learning Outcomes:

1. After the completion of the Course, the students could have learnt about the basic Electronic Circuits, their operational characteristics and their applications.
2. To generate an ability to understand various amplifiers including push pull and complementary symmetry.
3. Understand types of feedback amplifiers and oscillator circuits.
4. To understand a stable multivibrators

UNIT-I (12 Hrs.)

Single Stage Amplifiers: Classification of Amplifiers - Distortion in Amplifiers, Analysis of CE, CC, and CB Configurations with simplified hybrid Model, Analysis of CE amplifier with Emitter Resistance and Emitter follower, Miller's Theorem and its dual, Design of Single Stage RC Coupled Amplifier using BJT.

Multistage Amplifiers: Frequency response – Single stage amplifiers, multistage amplifiers. Couplings – Various coupling methods for multistage amplifiers.

UNIT-II (11 Hrs.)

Transformer Coupled Audio Amplifier: construction, working, efficiency & distortion analysis; Classifications: Class-A, Class-B, class-AB and Class-C amplifiers, efficiency.

Push-Pull Amplifiers – operation of Class-B push-pull amplifier, crossover distortion, transistor phase inverter, complementary symmetry amplifier.

UNIT-III (12 Hrs.)

Feedback amplifiers – Feedback concept, advantages and disadvantages of negative and positive feedback.

Oscillators: Classification of Oscillators, frequency and frequency stability of oscillatory circuits, Tuned Oscillators, Hartley Oscillator, Colpitts Oscillators Clapp Oscillator, Crystal Oscillator, Phase Shift Oscillator, Wein Bridge Oscillator.

UNIT-IV (10 Hrs.)

Astable Multivibrators: Astable Collector coupled and emitter coupled multivibrator, complementary Transistor Astable multivibrator.

Switching Characteristics of Devices: Diode and transistor as electronic switch, Breakdown mechanism in diode, Effect of temperature on diode, Charge storage phenomena, switching times in diode and transistor, Delay time, Rise time, Storage time and fall time.

Recommended Books

1. Millman, Jacob, Halkias Christos C. and Satyabratajit, 'Electronic Devices and Circuits', 3rd Edn., Tata McGraw- Hill, New Delhi, **2010.**
2. Boylestad Nashelsky, 'Electronic Devices and Circuit Theory', Pearson Education, **2004.**
3. Thomas L. Floyd, 'Electronic Devices', 6th Edn., Pearson Education, **2002.**
4. Adel S. Sedra and Kenneth C. Smith, 'Microelectronic Circuits', 4th Edn., Oxford University Press, New York, 1997.
5. Streetman Ben J., Sanjay Banerjee, 'Solid State Electronic Devices'. 5th Edn., Prentice Hall of India, **2004.**

ANALOG COMMUNICATION SYSTEMS

Subject Code: BECE1-409	**L T P C** **3 1 0 4**	**Duration: 45 Hrs.**

Learning Objectives

- To study & understand the building blocks of analog communication system in general and understand bandwidth consideration
- Inter-symbol Interference allows the students to understand the interference causes and the corrective measures taken by base band Pulse shaping solutions
- To study coherent and non-coherent detection techniques and Simulation of these techniques using Mat lab.

Learning Outcomes

- An ability to understand analog communication system and modulation techniques
- An ability to learn design of useful circuits required in analog communication system.
- An ability to explore knowledge about various transmitter and receiver circuits used in communication.
- An ability to provide students with tools for communication signal analysis

UNIT-I (11 Hrs.)

Wave Propagation: Free space equation, Reflection from earth's surface, Surface and Space wave propagation, Range of space wave propagation, Effective earth's radius, Duct propagation, Troposphere propagation. Structure of ionosphere, propagation of radio waves through ionosphere, Critical frequency, Maximum usable frequency, Optimum working frequency, lowest usable high frequency, virtual height, Skip Distance, Effect of earth's magnetic field.

UNIT II (11 Hrs.)

Analog Modulation Techniques: Introduction, Theory of Amplitude Modulation; AM Power Calculations, AM Modulation with a Complex wave, Theory of Frequency Modulation (FM); Spectra of FM Signals, Narrow Band and Wide Band FM, Theory of Phase Modulation, Comparison of AM and FM, Comparison of PM and FM, Noise and Frequency Modulation, Pre-emphasis and De-emphasis.

UNIT-III (11 Hrs.)

AM Transmission/AM Reception: Introduction, Generation of Amplitude Modulation, Basic Principles of AM Generation; Square law Diode Modulation, Vander Bijl Modulation, Suppressed Carrier AM Generation, Ring Modulator, Balanced Modulator. Tuned Radio Frequency (TRF) Receiver, Basic Elements of AM Super-heterodyne receiver; RF Amplifiers Characteristics-Sensitivity, Selectivity, Image Frequency Rejection, Mixers Tracking and Alignment, Local Oscillator, IF Amplifier, AM Detectors; Envelope or
Diode Detector, AGC, AM Receiver using Transistors Communication Receiver, Applications of AM with different Band ranges

UNIT-IV (12 Hrs.)

FM Transmission/FM Reception: Generation of FM by Direct Methods. Indirect Generation of FM; The Armstrong Method, FM Stereo Transmission.FM Receiver Direct Methods of Frequency Demodulation; Slope Detector, Travis Detector Foster Seely or Phase Discriminator, Indirect methods of FM Demodulation; FM Detector using PLL and Stereo FM Multiplex Reception. SSB Transmission/SSB Reception: Advantages of SSB transmission, Generation of SSB; Independent Side-Band Systems (ISB), Vestigial Side-Band Modulation (VSB). SSB Product Demodulator, Balanced Modulator as SSB Demodulator, ISB/Suppressed Carrier receiver, Applications of FM with Band ranges.

Recommended Books

1. George Kennedy, 'Electronic Communication System', McGraw Hill, **2000.**
2. Gary M. Miller and Jeffery S. Beasley, 'Modern Electronic Communications' PHI, **2009.**
3. Simon Haykin, 'Communication Systems' 3rd Edn., Wiley Publishers, **2007.**
4. Wayne Tomasi, 'Electronics Communication Systems', 5th Edn., Pearson Publishers, **2008.**

OBJECT ORIENTED PROGRAMMING

Subject Code: BECE1-410 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

Learning Objectives

- To provide knowledge regarding the Object oriented programming C++, data types and about classes.
- To provide understanding of inheritance and memory management in C++.
- To describe how to represent pointers, and understanding the concept of binding and polymorphism.
- To make the students familiar with the File handling and generic functions.

Learning Outcomes

- An ability to learn programming in C++ using OOPs in a better way.
- Enable students to develop their skills in programing with C++.

UNIT-I (12 Hrs.)

Object-Oriented Programming Concepts: Introduction, comparison between procedural programming paradigm and object-oriented programming paradigm, basic concepts of object-oriented programming — concepts of an object and a class, interface and implementation of a class, operations on objects, relationship among objects, abstraction, encapsulation, data hiding, inheritance, overloading, polymorphism, messaging.

Standard Input/Output: Concept of streams, hierarchy of console stream classes, input/output using overloaded operators >> and << and members functions of i/o stream classes, formatting output, formatting using ios class functions and flags, formatting using manipulators.

Classes and Objects: Specifying a class, creating class objects, accessing class members, access specifiers, static members, use of *const* keyword, friends of a class, empty classes, nested classes, local classes, abstract classes, container classes, bit fields and classes.

UNIT-II (11 Hrs.)

Pointers and Dynamic Memory Management: Declaring and initializing pointers, accessing data through pointers, pointer arithmetic, memory allocation (static and dynamic), dynamic memory management using *new* and *delete* operators, pointer to an object, *this* pointer, pointer related problems - dangling/wild pointers, null pointer assignment, memory leak and allocation failures.

Constructors and Destructors: Need for constructors and destructors, copy constructor, dynamic constructors, explicit constructors, destructors, constructors and destructors with static members, initializer lists.

Operator Overloading and Type Conversion: Overloading operators, rules for overloading operators, overloading of various operators, type conversion - basic type to class type, class type to basic type, class type to another class type.

UNIT-III (11 Hrs.)

Inheritance: Introduction, defining derived classes, forms of inheritance, ambiguity in multiple and multipath inheritance, virtual base class, object slicing, overriding member functions, object composition and delegation, order of execution of constructors and destructors.

Virtual functions & Polymorphism: Concept of binding - early binding and late binding, virtual functions, pure virtual functions, abstract classes, virtual destructors.

UNIT-IV (11 Hrs.)

Exception Handling: Review of traditional error handling, basics of exception handling, exception handling mechanism, throwing mechanism, catching mechanism, rethrowing an exception, specifying exceptions.

Templates and Generic Programming: Template concepts, Function templates, class templates, illustrative examples.

Files: Fill streams, hierarchy of file stream classes, reading/writing of files, error handling during file operations, accessing records, randomly, updating files.

Recommended Books

1. E. Balagurusamy, 'Object Oriented Programming with C++', Tata McGraw Hill.
2. R.S. Salaria, 'Mastering Object-Oriented Programming with C++', Salaria Publishing House.
3. R. Lafore, 'Object Oriented Programming in C++', Waite Group.

ELECTROMAGNETIC FIELD THEORY

Subject Code: BECE1-411 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

Learning Objectives

1. To provide knowledge about the propagation of electromagnetic wave along different mediums like guided, unguided medias and in space with basic understanding of transmission lines and the method of solving different problems related to it.
2. Study of physical concept and all the important fundamental parameters of transmission lines and waveguides.

Learning Outcome

1. After the completion of the Course, the students will be familiar with the concepts of electromagnetic field theory and fundamental equations fields.
2. An ability to Understand Maxwell's equations in differential and integral form,
3. To understand transmission lines and smith chart

UNIT-I (11 Hrs.)

Introduction: Fundamental of vector algebra, Scalar & vector fields, Introduction and transformation on different coordinate systems: (rectangular, cylindrical and spherical co-ordinate system). Introduction to line, surface and volume integrals, definition of gradient, divergent and curl of a vector and their physical significance.

UNIT-II (12 Hrs.)

Electrostatics: Principal of Coulomb's law, definition of electric field intensity from point charges, field due to continuous distribution of charges on an infinite and finite line, Electric Field due to an infinite uniformly charged sheet. Gauss's law and its applications, Electric flux density, potential fields duo to electric dipole, Laplace and poisons equations.

Magnetostatics: Definition and explanation on Magnetic Field intensity due to a finite and infinite wire carrying current. Magnetic field intensity on rectangular loop carrying current, Ampere's Circuital law and its applications, Biot-savart law, the Lorentz force equation for a moving charge, Magnetic Vector Potential

UNIT-III (11 Hrs.)

Time Varying EM Fields: Maxwell's equation in differential and integral vector form and their interpretations, continuity of currents, conduction and displacement current, boundary conditions, Helmholtz equations, uniform plane wave in dielectric and conductor media, skin effect and depth of penetration, reflection and refraction of plane waves at boundaries for normal incidence and surface impedance. Energy Flow and Poynting theorem, interpretation of E×H, Simple application, complex pointing vector.

UNIT-IV (11 Hrs.)

Transmission Lines: Transmission line model, parameters and properties of transmission line equations, reflections in transmission lines; voltage, current and impedance relations-open, short circuit and matched lines, Standing wave ratio; impedance matching, quarter and half wave lines, single stub and double stub matching; circle diagram – Smith chart.

Recommended Books

1. Matthew N.O. Sadiku, 'Elements of Engineering Electromagnetics', Oxford University Press.
2. William Hayt, 'Engineering Electromagnetics', Tata McGraw-Hill.

3. Narayana Rao, ‘Elements of Engineering Electromagnetics’, Pearson Education.
4. R.F. Jorden, ‘Electromagnetic Waves & Radio System’, Prentice Hall India.
5. J.D. Kraus, ‘Electromagnetics’, McGraw Hill.

ELECTRONIC DEVICES AND CIRCUITS LAB - II

Subject Code: BECE1-412 **L T P C**
0 0 2 1

Learning Objectives

1. To understand the Characteristics of various semiconductor devices and construction of different electronic circuits using the above devices.
2. To introduce variety of sources to obtain specifications of electronic devices & to impart knowledge about write technical reports related to basic electronic circuits using correct technical vocabulary.
3. Able to understand identification and selection of various amplifiers and oscillators.

Learning Outcomes

1. An ability to understand all types of electronics devices and circuits
2. An ability to design and conduct experiments, as well as to analyze and interpret data

EXPERIMENTS

1. To study frequency response of a tuned amplifier.
2. To demonstrate and study a two stage RC coupled amplifier.
3. To demonstrate and study a Transformer coupled amplifier.
4. To study the response of RC phase shift oscillator and determine frequency of oscillation.
5. To study the response of Hartley oscillator and determine frequency of oscillation.
6. To study the response of Colpitt’s oscillator and determine frequency of oscillation.
7. To study the response of Wien Bridge oscillator and determine frequency of oscillation
8. To demonstrate working of a JFET and study its V-I characteristics.
9. To experimentally study working of a CS JFET amplifier.
10. To demonstrate working of a LED and calculate appropriate value of series Resistance RS for it.

Note: At least 08 experiments are required to be performed.

ANALOG COMMUNICATION SYSTEMS LAB.

Subject Code: BECE1-413 **L T P C**
0 0 2 1

Learning Objectives

- The main objective of this lab is to motivate the students to familiarize with modulation & Demodulation Techniques and study their waveforms on Digital storage oscilloscope.
- To give students a working knowledge to perform wired and wireless communication in lab.
- The objective of the Analog Communications Course is to familiarize students with the functions of oscillators, filters, amplifiers, LC networks, modulators, limiters, mixers, and detectors in AM, FM, PM, SSB, and PLL circuit

Learning Outcomes

1. An ability to perform transmission of signals from transmitter to receiver using various analog modulation and demodulation techniques.
2. Study of transmission through different types of antenna.

EXPERIMENTS

1. To study Amplitude Modulation using a transistor and determine depth of modulation.
2. To study envelope detector for demodulation of AM signal and observe diagonal peak clipping effect.
3. Frequency Modulation using Voltage Controlled Oscillator.
4. Generation of DSB-SC signal using Balanced Modulator.
5. Generation of Single Side Band (SSB) signal.
6. Study of Phase Lock Loop (PLL) and detection of FM Signal using PLL.
7. Measurement of Noise Figure using a noise generator.
8. Study functioning of Super heterodyne AM Receiver.
9. Familiarization of PLL, measurement of lock/captures range, frequency demodulation, and frequency multiplier using PLL.
10. Measurement of Sensitivity, Selectivity and Fidelity of radio receivers.

Note: At least 08 experiments are required to be performed.

OBJECT ORIENTED PROGRAMMING LAB.

Subject Code: BECE1-414 **L T P C**
0 0 2 1

Learning Objectives

- To provide the basic knowledge about control statements, looping statements, various I/O statements and various data structures.
- To describe how to create classes in C++ for understanding of basic OOPS features.
- To discuss various concepts of data hiding, function overloading and operator overloading

Learning Outcomes

- Enable students to develop their skills in programing with C++.
- To describe functions of creating constructors, destructor, inheritance, polymorphism and file handling programs

EXPERIMENTS

1. [Classes and Objects] Write a program that uses a class where the member functions are defined
inside a class.
2. [Classes and Objects] Write a program that uses a class where the member functions are defined
outside a class.
3. [Classes and Objects] Write a program to demonstrate the use of static data members.
4. [Classes and Objects] Write a program to demonstrate the use of const data members.
5. [Constructors and Destructors] Write a program to demonstrate the use of zero argument and
6. parameterized constructors.
7. [Constructors and Destructors] Write a program to demonstrate the use of dynamic constructor.

8. [Constructors and Destructors] Write a program to demonstrate the use of explicit constructor.
9. [Initializer Lists] Write a program to demonstrate the use of initializer list.
10. [Operator Overloading] Write a program to demonstrate the overloading of increment and decrement operators.
11. [Operator Overloading] Write a program to demonstrate the overloading of binary arithmetic operators.
12. [Operator Overloading] Write a program to demonstrate the overloading of memory management operators.
13. [Typecasting] Write a program to demonstrate the typecasting of basic type to class type.
14. [Typecasting] Write a program to demonstrate the typecasting of class type to basic type.
15. [Typecasting] Write a program to demonstrate the typecasting of class type to class type.
16. [Inheritance] Write a program to demonstrate the multilevel inheritance.
17. [Inheritance] Write a program to demonstrate the multiple inheritances.
18. [Inheritance] Write a program to demonstrate the virtual derivation of a class.
19. [Polymorphism] Write a program to demonstrate the runtime polymorphism.
20. [Exception Handling] Write a program to demonstrate the exception handling.
21. [Templates and Generic Programming] Write a program to demonstrate the use of function template.
22. [Templates and Generic Programming] Write a program to demonstrate the use of class template
23. **[File Handling]** Write a program to copy the contents of a file to another file byte by byte. The name of the source file and destination file should be taken as command-line arguments,
24. **[File Handling]** Write a program to demonstrate the reading and writing of mixed type of data.

Note: At least 15 experiments are required to be performed

ANTENNA & WAVE PROPAGATION

Subject Code: BECE1-456	**L T P C** **3 0 0 3**	**Duration: 37 Hrs.**

Learning Objectives

- To provide knowledge about the propagation of electromagnetic wave along different mediums like guided, unguided medias and in space with basic understanding of transmission lines and the method of solving different problems related to it.
- Study of physical concept of radiation patterns and all the important Fundamental Parameters of antennas with antenna Arrays in the antenna terminology

Learning Outcome

- An ability and development of skill of students to design highly effective communication system.
- After completion of the Course, students will be aware with the various performance parameters of the antenna system design and antenna arrays.
- Understand various types of antennas such as micro strip and Yagi-uda antennas.
- To understand Ground wave propagation.

UNIT-I

ANTENNA BASICS: Directional properties of antennas, Radiation patterns, antenna gain and aperture, antenna terminal impedance, self and mutual impedance, front to back ratio, antenna beam width and bandwidth, antenna efficiency, antenna beam area, polarization, antenna temperature and Reciprocity properties of antennas.

UNIT-II

ANTENNA ARRAYS: Classification of arrays, linear arrays of two point sources, linear arrays of n-point sources, pattern multiplication, array factor, linear arrays of equal amplitude and spacing (Broadside and end fire arrays) of n-point sources, directivity and beam width, non-uniform arrays excitation using Binomial series.

UNIT-III

SPECIAL ANTENNAS: VLF and LF antennas (Hertz and Marconi antennas), effects of antenna height and effect of ground on performance of antenna, Rhombic antennas, Loop antennas, receiving antenna and radio direction finders. Folded dipole antennas, Yagi-uda antenna, horn antennas, microwave dish, helical antennas, frequency independent antennas, micro strip antennas, fractal antennas.

UNIT-IV

GROUND WAVE PROPAGATION: Characteristics for ground wave propagation, reflection at the surface of a finitely conducting plane and on earth, Attenuation Calculation of field strength at a distance.

IONOSPHERE PROPAGATION: The ionosphere, formation of the various layers, their effective characteristics, reflection and refraction of waves by ionosphere, virtual height, maximum frequency, skip distance, regular and irregular variation of ionosphere, Fading and Diversity reception, ordinary and extraordinary waves.

SPACE WAVE PROPAGATION: Space wave, range and effect of earth, Troposphere waves-reflection, refraction, duct propagation, Troposphere scatter propagation link

Recommended Book

1. J.D. Kraus, ‘Antennas’, McGraw Hill.
2. C.A. Balanis ‘Antennas Theory and Design’, Willey.
3. K.D. Prasad, ‘Antenna & Wave Propagation’, Satya Parkashan, New Delhi.

DATA STRUCTURES AND ALGORITHMS

Subject Code: BECE1-457 **L T P C** **Duration: 37 Hrs.**

3 0 0 3

Learning Objectives

- To use object oriented programming to implement data structures.
- To introduce linear, non-linear data structures and their applications.

Learning Outcomes

Upon completion of the Course, students will be able to:

- Explain the concepts of algorithms, trees and graphs.
- Write simple applications of data structures.
- Discuss the different methods of organizing large amount of data.

UNIT-I

INTRODUCTION: Data types, data structures, abstract data types, the running time of a program, the running time and storage cost of algorithms, complexity, asymptotic complexity, big O notation, obtaining the complexity of an algorithm.

DEVELOPMENT OF ALGORITHMS: Notations and Analysis, Storage structures for arrays - sparse matrices - structures and arrays of structures, Stacks and Queues: Representations, implementations and applications.

UNIT-II

LINKED LISTS: Singly linked lists, linked stacks and queues, operations on Polynomials, Doubly Linked Lists, Circularly Linked Lists, Operations on linked lists- Insertion, deletion and traversal, dynamic storage management – Garbage collection and compaction.

TREES: Basic terminology, General Trees, Binary Trees, Tree Traversing: in-order, pre-order and post-order traversal, building a binary search tree, Operations on Binary Trees - Expression Manipulations - Symbol Table construction, Height Balanced Trees (AVL), B-trees, B+ -trees.

UNIT-III

GRAPHS: Basic definitions, representations of directed and undirected graphs, the single-source shortest path problem, the all-pair shortest path problem, traversals of directed and undirected graphs, directed acyclic graphs, strong components, minimum cost spanning tress, articulation points and bi-connected components, graph matching.

UNIT-IV

SORTING AND SEARCHING TECHNIQUES: Bubble sorting, Insertion sort, Selection sort, Shell sort, Merge sort, Heap and Heap sort, Quick sort, Radix sort and Bucket sort, Address calculation, Sequential searching, Binary Searching, Index searching, Hash table methods.

Recommended Books

1. J.P. Tremblay and P.G. Sorenson, 'An Introduction to Data Structures with Applications', Tata McGraw Hill.
2. S. Sahni, 'Data Structures, Algorithms ad Applications in C++', WCB/McGraw Hill.
3. Aho, Ullman and Hopcroft, 'Data Structures and Algorithms'.
4. Y. Langsam, M.J. Augenstein and A.M. Tenenbaum, 'Data Structures using C', Pearson Education.

ELECTRONIC INSTRUMENTATION

Subject Code: BECE1-458 **L T P C** **Duration: 37 Hrs.**
3 0 0 3

Learning Objectives

- To provide knowledge about different types of measuring, waveform generation, and analysis electronics instruments.
- Exposure to various methods of data transmission and transduction.
- Elaborate discussion about recorder & display devices.

Learning Outcomes

- Able to understand operation of different instruments and able to describe different terminology related to measurements.
- A recognition and understanding of various analog measuring instruments.
- Measurement of Resistance and understanding of CRO

UNIT – I

Units, Dimensions and Standards: SI Units, Determination of absolute units of current and resistance, Standards of EMF, Resistance, Capacitance, Mutual inductance and their construction, Equivalent circuit representation, Figures of Merit, Construction of variable standards and Decade Boxes.

General Theory of Analog Instruments: Primary and secondary instruments, indicating recording and integrating types, operating torques damping and controlling torques, Torque/ weight ratio, pointers and scales

UNIT –II

Analog Measuring Instruments: Principles of operation, Construction, Errors, calibration, areas of application of the following types of instruments for measurement of voltage, current, power, energy, frequency and power factor: (a) PMMC (b) Dynamometer (c) Moving Iron (d) Induction (e) Thermal (f) Electrostatic Extension of Ranges by Shunts. Multipliers: Power and Energy Measurements in Poly Phase Circuits.

Potentiometers (Only Principles, Operation & applications of DC & AC potentiometer) (a) Simple concepts of potentiometers. (b) Principle of DC potentiometer, applications. (c) Principle operation of AC potentiometer with advantages/ Disadvantages/applications.

UNIT – III

Measurement of Resistances: Low, Medium & High Resistance their measurement.

Bridges: Measurement of R, L, C, M, O by Wheatstone, Kelvin, Maxwell Hay, Anderson, Owen, Heaviside, Campbell, Schering, Wien bridges, Bridge sensitivity, Errors, Detectors, Shielding and screening, Wanger, Earthing.

UNIT-IV

Cathodes Ray Oscilloscopes: Principles and working of CRO, CRO– probes, Measurement of voltage, frequency and phase angle with CRO.

Recommended Books

1. A.K. Sawhney, ‘Electrical & electronic Measurement and Instrumentation’, Dhanpat Rai & Sons.
2. J.B. Gupta, ‘A Course in Electrical and Electronics Measurement & Instrumentation’, S.K. Kataria & Sons.

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RELIABILITY ENGINEERING

Subject Code: BECE1-459 **L T P C** **Duration: 38 Hrs.**
3 0 0 3

Learning Objectives

1. To provide students with a comprehensive understanding on various aspects of reliability engineering
2. To enable students to understand reliability considerations in designing machine components, elements and systems
3. To ensure sound maintenance of machines and systems and bring about reliability improvement
4. To perform reliability engineering analysis and its management throughout the product life cycle.

Learning Outcomes

After successful completion of this Learning the students will be able to:

1. Demonstrate understanding of basic reliability measures such as failure rate, availability, MTTR, etc.
2. Compute and evaluate reliability for redundant, series, and parallel systems

3. Develop fault trees and apply various reliability models to identify and analysis possible faults in machine systems and assess their impact on overall system reliability & maintainability.
4. Use reliability improvement techniques and undertake product testing.

UNIT-I

Introduction: Definition for Reliability, Static and Dynamic Reliability Need for reliability Engineering, success and failure models, Causes of failures, catastrophic failures and degradation failures Characteristic types of failures, useful life of components, Exponential case of chance failure, Reliability Measures; MTBF, MTTR, hazard rate, probability distribution function, Derivation for exponential distribution function, other kinds of distributions, Binomial, Poisson uniform, Raleigh, Weibull, Gamma distribution, marks, Chains, failures data analysis.

UNIT-II

Series Parallel Systems: Reliability Block Diagrams, series systems, parallel systems, K-out of-M systems, open and short circuits failures, standby systems.

Reliability Analysis of Non-Series Parallel System: Boolean algebra Method, Outset approach, delta star method, logical signal relation method, Bay’s Theorem Method.

Reliability Prediction: objective of reliability prediction, classification, and information sources for failure rate data, prediction methodologies, general requirements, Role and limitations of Reliability prediction.

UNIT-III

Reliability Allocation: subsystems reliability improvement, allocation for new units, criticality. Maintainability and Availability: forms of maintenance, measures of Maintainability and availability, maintainability function, availability function, two-unit parallel system with repair, Markov Model for two unit systems, preventive maintenance, provisioning of spares.

UNIT-IV

Reliability Testing: kinds of testing, component reliability measurements, parametric methods, confidence limits, accelerated testing, equipment acceptance testing, standard life testing plans, accelerated life testing, system safety analysis-FMECA, risk priority number and its allocation. Economics of Reliability Engineering: Reliability cost, Life Cycle Costing, effect of reliability on cost, reliability achievement cost models, reliability Utility cost models, Replacement policies.

Recommended Books

1. K.K. Agarwal, ‘Reliability Engineering’, Kluwer Academic Press, USA, **1993.**
2. E. Balagurusamy, ‘Reliability Engineering’, Tata McGraw Hill, 4th Reprint, **2003.**
3. L.S. Srinath, ‘Reliability Engineering’, East West Press Pvt. Ltd, 3rd Edn., **1991.**
4. Brijendra Singh, ‘Quality Control and Reliability Analysis’, Khanna Publishers, **1998.**
5. E.E. Lewis, ‘Introduction to Reliability Engineering’, John Wiley and Sons, **1987.**

LINEAR INTEGRATED CIRCUITS

Subject Code: BECE1-516 **L T P C** **Duration: 48 Hrs.**

3 1 0 4

Learning Objectives

1. To introduce the basic building blocks of linear integrated circuits.
2. To learn the linear and non-linear applications of operational amplifiers.
3. To introduce the theory and applications of analog multipliers and PLL.
4. To learn the theory of ADC and DAC.

5. To introduce the concepts of waveform generation and introduce some special function ICs.

Learning Outcomes

Upon Completion of the Learning, the students will be able to:

1. Design linear and nonlinear applications of op – amps.
2. Design applications using analog multiplier and PLL.
3. Design ADC and DAC using op – amps.
4. Generate waveforms using op – amp circuits.
5. Analyze special function ICs.

UNIT-I (10 Hrs.)

Introduction to Op–Amp: Operational Amplifier, Block diagram, analysis and its schematic symbol, interpretation of IC 741 datasheet and characteristics, practical op–amp, all important electrical parameters and their values, Op-amp applications in open loop configuration.

Concept of Feedback, Op–Amp with Negative Feedback: Introduction and Block diagram representation of feedback configurations, Voltage Series feedback amplifier, Voltage Shunt feedback and derivation of important electrical parameters

UNIT-II (14 Hrs.)

Introduction to Operational Amplifiers and Characteristics: Introduction, Block diagram, characteristics and equivalent circuits of an ideal op-amp, various types of Operational Amplifiers and their applications, Power supply configurations for OP-AMP applications, inverting and non-inverting amplifier configurations.

The Practical op-amp Introduction, input offset voltage, offset current, thermal drift, Effect of variation in power supply voltage, common-mode rejection ratio, slew rate and its Effect, PSRR and gain –bandwidth product, frequency limitations and compensations, transient response, interpretation of TL082 datasheet.

UNIT-III (14 Hrs.)

Amplifiers and Oscillators Summing amplifier, Integrators and differentiators, Instrumentation amplifier, Differential input and differential output amplifier, Voltage-series feedback amplifier, Voltage-shunt feedback amplifier, Log/ Antilog amplifier, isolation amplifiers, Triangular/rectangular wave generator, phase-shift oscillators, Wein bridge oscillator, analog multiplier-MPY634, VCO.

Active Filters: Characteristics of filters, Classification of filters, Magnitude and frequency response, Butterworth 1st and 2nd order Low pass, High pass and band pass filters, Chebyshev filter characteristics, Band reject filters, notch filter; all pass filters, self-tuned filters.

UNIT-IV (10 Hrs.)

Advanced Applications: Applications as Frequency Divider, PLL, AGC, AVC using op-AMP and analog multipliers, Amplitude modulation using analog multiplier, Frequency Shift Keying, simple OP-AMP Voltage regulator, Fixed and Adjustable Voltage Regulators, Dual Power supply, Basic Switching Regulator and characteristics of standard regulator ICs – TPS40200, TPS40210, ADC TL0820 & DAC- 7821

Recommended Books

1. Ramakant A. Gayakward, 'Op–Amps & Linear Integrated Circuits', Pearson Education.
2. William D. Stanley, 'Operational Amplifiers with Linear Integrated Circuits', 4th Edn.
3. Millman & Grabal, 'Micro Electronics', Tata McGraw Hill.

MICROPROCESSOR AND INTERFACING

Subject Code: BECE1-517 **L T P C** **Duration: 48 Hrs.**
3 1 0 4

Learning Objectives

1. To understand the basic architecture of 8 and 16-bit microprocessor.
2. To understand interfacing of microprocessor with memory and peripheral chips involving system design.
3. To understand the techniques for faster execution of instructions and improve the performance of microprocessor.
4. To understand the concepts of multi core processor.

Learning Outcomes

1. The students will able to write program to run on 8085 microprocessor based systems.
2. Design system using memory chips and peripheral chips.
3. Understand and devise techniques for faster execution of instructions, improve speed of operations and enhance performance of microprocessors.

UNIT I (10 Hrs.)

Introduction: Introduction to microprocessor, Intel 8085 microprocessor architecture and pin diagram, Data flow to/from memory, from/to microprocessor unit, multiplexing and de-multiplexing of address data bus. Bus timings, T state, machine cycle, timing diagram, Memories-RAM, DDR/SDR, ROM, EROM, EPROM, EEPROM, Flash Memory, Cache Memory.

UNIT II (13 Hrs.)

Programming with 8085: Addressing modes, Detail study of 8085 instruction set. I/O and Memory mapping, Interfacing I/O Devices, Interrupts, stack and subroutines, Counter and Time Delays, Code conversion, BCD Arithmetic and 16-bit data operations, Programming techniques with additional instructions, Program Debugging.

UNIT III (12 Hrs.)

Interfacing with 8085: Architecture, interfacing and programming of 8155/8156 (programmable I/O port timer), 8251(universal synchronous, asynchronous receiver transmitter), 8253/ 8254 (programmable interval timer), 8255 (programmable peripheral interface), 8279 (keyboard display controller), and 8257 (direct memory access controller).

UNIT IV (10 Hrs.)

Other Microprocessor and Interfacing: 8086 -Block diagram, Architecture, pipelining, flag register, register bank operation, memory segmentation, addressing modes. Introduction to 80186, 80286, 80386, 80486 and Pentium and their comparison, Comparative study of 8-bit microprocessors: Intel 8085, Motorola 6800, Zilog Z-80.

Recommended Books

1. R.S. Gaonkar, 'Microprocessor Architecture Programming and Applications with the 8085', Penram International Pub.
2. D.V. Hall, 'Microprocessor and Interfacing Programming and Hardware', McGraw Hill Co.
3. Barry B. Brey, 'The Intel Microprocessors, Architecture Programming and Interfacing' PHI Publications.
4. B. Ram, 'Fundamentals of Microprocessor and Microcontrollers', Dhanpat Rai and Sons, New Delhi.

DIGITAL COMMUNICATION SYSTEMS

Subject Code: BECE1-518 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

Learning Objectives

1. To provide knowledge about basics of Communication system and various digital modulation
2. and demodulation techniques.
3. To learn design of useful circuits required in communication system.
4. To provide knowledge about various transmitter and receiver circuits used in communication.
5. To provide students with tools for communication signal analysis.

Learning Outcomes

1. Analyze the performance of a baseband and pass band digital communication system
2. Perform the time and frequency domain analysis of the signals in a digital communication system.
3. Select the blocks in a design of digital communication system.
4. Analyze the performance of spread spectrum communication system.

UNIT-I (10 Hrs.)

Introduction: Block Diagram of Digital Communication System, Advantages of Digital communication system over Analog communication systems, Sampling theorem, Signal reconstruction in time domain, Practical and Flat Top Sampling, Sampling of Bandpass Signal, Aliasing Problem, Uniform and Non-uniform quantization. Signal to Quantization ratio of Quantized Signal.

UNIT-II (11 Hrs.)

Baseband Transmission: Line Coding & its properties. Various types of PCM waveforms. Attributes of PCM waveforms, M-ary Pulse Modulation waveforms, Differential pulse code modulation, Multiplexing PCM signals, Delta modulation, Idling noise and slope overload, Adaptive delta modulation, Adaptive DPCM, Comparison of PCM and DM.

UNIT-III (12 Hrs.)

Baseband Detection: Error performance degradation in communication systems, E_b/N_O parameter, Matched filter and its derivation, Inter-Symbol Interference (ISI), Nyquist criterion for zero ISI & raised cosine spectrum, Correlation detector decision threshold and error probability for binary unipolar (on-off) signaling.

UNIT-IV (12 Hrs.)

Band-pass Modulation and Memodulation: Types of digital modulation, Wave forms for Amplitude, Frequency and Phase Shift Keying, Method of generation and detection of coherent & non-coherent binary ASK, FSK & PSK, Differential phase shift keying, Quadrature modulation techniques, M-ary FSK, Minimum Shift Keying (MSK), Probability of error and comparison of various digital modulation techniques.

A base band signal receiver, Probability of error, The Optimum filter, Matched Filter, Probability of error in Matched filter, Coherent reception, Coherent reception of ASK, PSK and FSK, Non-Coherent reception of ASK, FSK, PSK and QPSK, Calculation of bit error probability of BPSK and BFSK, Error probability for QPSK.

Multiple Access Techniques: Time division multiplexing, Frequency division multiplexing, code division multiplexing, Introduction to upcoming techniques of transmission.

Recommended Books

1. Simon Haykin, 'Communication Systems', Wiley Publication.
2. Bernard Sklar, 'Digital Communication-Fundamentals and Applications', Pearson Education India.
3. Miller Gary M., 'Modern Electronic Communication', Prentice Hall.
4. John Proakis, 'Digital Communications', Tata McGraw Hill.
5. Wayne Tomsi, 'Electronic Communication Systems, Fundamentals Through Advanced', Pearson Education.

LINEAR INTEGRATED CIRCUITS LAB.

Subject Code: BECE1-519 **L T P C**
0 0 2 1

Learning Objectives

1. To study the applications of op-amp as summing, scaling, averaging, instrumentation amplifiers, saw-tooth generator, zero-crossing detector and Schmitt trigger.
2. To study design of delay circuit using 555 timer and design a series regulator.

Learning Outcomes

At the end of the Course, the student should be able to:

1. Design oscillators and amplifiers using operational amplifiers.
2. Design filters using Op-amp and perform experiment on frequency response.
3. Analyze the working of voltage control oscillator.
4. Design DC power supply using ICs.

EXPERIMENTS

1. To study differential amplifier configurations.
2. To measure the performance parameters of an Op amp.
3. Application of Op amp as Inverting and Non Inverting amplifier.
4. To study frequency response of an Op Amp
5. To use the Op-Amp as summing, scaling & averaging amplifier.
6. To use the Op-Amp as Instrumentation amplifier
7. Design differentiator and Integrator using Op-Amp.
8. Application of Op Amp as Log and Antilog amplifier. Design Low pass, High pass and Band
9. pass 1st order butterworth active filters using Op Amp.
10. Design Phase shift oscillator using Op-Amp.
11. Design Wein Bridge oscillator using Op-Amp.
12. Application of Op Amp as Sawtooth wave generator.
13. Application of Op Amp as Zero Crossing detector and window detector.
14. Application of Op Amp as Schmitt Trigger.
15. Design a delay circuit using 555 timer.
16. Design of a function generator
17. Design of a Voltage Controlled Oscillator
18. Note: At least 12 experiments are required to be performed.

MICROPROCESSOR LAB.

Subject Code: BECE1-520 **L T P C**
0 0 2 1

Learning Objectives

The student should be made to:

1. Introduce assembling language Programming concepts and features
2. Write assembling language Programming for arithmetic and logical operations in 8085
3. Differentiate Serial and Parallel Interface
4. Interface different I/Os with Microprocessors

Learning Outcomes

At the end of the Course, the student should be able to:

1. Write assembling language Programmes for fixed and Floating Point and Arithmetic
2. Interface different I/Os with processor
3. Generate waveforms using Microprocessors
4. Execute Programs in 8085

EXPERIMENTS

1. Study of 8085 and 8086 Microprocessor Kits.
2. Write a program to add two 8-bit number using 8085.
3. Write a program to add two 16-bit number using 8085.
4. Write a program to subtract two 8-bit number using 8085.
5. Write a program to subtract two 16-bit number using 8085.
6. Write a program to multiply two 8 bit numbers by repetitive addition method using 8085.
7. Write a program to sort series using bubble sort algorithm using 8085.
8. Write a program to copy 12 bytes of data from source to destination using 8086.
9. Write a program to find maximum and minimum from series using 8086.
10. Write a program to control the operation of stepper motor using 8085/8086 microprocessors and 8255 PPI.
11. Write a program to control speed of DC motor using 8085/8086 microprocessors and 8255 PPI.

Note: At least 08 experiments are required to be performed.

DIGITAL COMMUNICATION SYSTEMS LAB.

Subject Code: BECE1-521 **L T P C**
0 0 2 1

Learning Objectives

1. To know the principles of sampling & quantization
2. To study the various waveform coding schemes
3. To learn the various baseband transmission schemes
4. To understand the various Band pass signaling schemes
5. To know the fundamentals of channel coding

Learning Outcomes

Upon completion of the Course, students will be able to

1. Design PCM systems.
2. Design and implement base band transmission schemes
3. Design and implement band pass signaling schemes
4. Analyze the spectral characteristics of band pass signaling schemes and their noise performance
5. Design error control coding schemes

EXPERIMENTS

1. Study of Time Division Multiplexing system.
2. Study of pulse code modulation and demodulation.
3. Study of delta modulation and demodulation and observe effect of slope overload.
4. Study pulse data coding techniques for various formats.
5. Data decoding techniques for various formats.
6. Study of amplitude shift keying modulator and demodulator.
7. Study of frequency shift keying modulator and demodulator.
8. Study of phase shift keying modulator and demodulator.
9. Error Detection & Correction using Hamming Code
10. Digital link simulation; error introduction & error estimation in a digital link using MATLAB (SIMULINK)/ communication simulation packages.

Note: At least 08 experiments are required to be performed

DATA COMMUNICATION NETWORKS

Subject Code: BECE1-560 **L T P C** **Duration: 48 Hrs.**
3 0 0 3

Learning Objectives

The student should be made to:

1. Understand the division of network functionalities into layers.
2. Be familiar with the components required to build different types of networks
3. Be exposed to the required functionality at each layer
4. Learn the flow control and congestion control algorithms

Learning Outcomes

At the end of the Course, the student should be able to:

1. Identify the components required to build different types of networks
2. Choose the required functionality at each layer for given application
3. Identify solution for each functionality at each layer
4. Trace the flow of information from one node to another node in the network

UNIT-I (12 Hrs.)

Introduction to Data Communication: Goals and Applications of Networks, Wireless Network, Interfaces and services. Reference Models: The OSI reference model, TCP/IP reference model. **Physical Layer:** Data and Signals, Digital and Analog transmission, Transmission Media, Wireless transmission, Switching

UNIT-II (14 Hrs.)

Data Link Layer: Data link layer design issues, Services provided to Network layers, Framing, Error control, Flow control, Error detection and correction, Elementary data link protocols, An unrestricted Simplex protocol, A Simplex Stop-and-Wait protocol, Simplex Protocol for a noisy channel, Sliding Window protocols, A protocol using go-back-N, A protocol using selective repeat, Example data link protocol-HDLC, PPP.

UNIT-III (12 Hrs.)

Medium Access Sublayer: Channel Allocations, Random Access, ALOHA, Carrier Sense Multiple Access Protocols, Collision free Protocols, Limited contention protocols, Controlled Access, Channelization, Wired LANs: Ethernet, Wireless LANs.

UNIT-IV (10 Hrs.)

Network Layer: Network Layer Design issue, Logical Addressing, Address Mapping, Error Reporting and Multicasting, Delivery Forwarding and Routing.

Transport Layer: Process to Process Delivery: UDP, TCP and SCTP.

Application Layer: Design issues of the layer, Domain Name systems, File Transfer, http, web documents, Virtual Terminals.

Recommended Books

1. J. Frauzon, 'Computer Communication and Networks', Tata McGraw Hill.
2. W. Stallings, 'Data and computer communication', Prentice Hall of India.
3. S. Keshav, 'An Engineering Approach on Computer Networking', Addison Welsey.
4. Wayne Tomasi, 'Introduction to Data Communications and Networking', Pearson.
5. A.S. Tanenbaum, 'Computer Networks', Prentice Hall of India.

HUMAN RESOURCE MANAGEMENT

Subject Code: BECE1-561	**L T P C** **3 0 0 3**	**Duration: 48 Hrs.**

Leaning Objectives: Understand and apply the policies and practices of the primary areas of human resource management, including staffing, training, Integration, management and compensation.

Learning Outcomes

1. Apply effective written and oral communication skills to business situations.
2. Analyze the global business environment.
3. Analyse the local business environment.
4. Use critical thinking skills in business situations.
5. Apply an ethical understanding and perspective to business situations.

UNIT-I (12 Hrs.)

Introduction: Introduction to Human Resource Management and its definition, functions of Human Resource Management & its relation to other managerial functions. Nature, Scope and Importance of Human Resource Management in Industry, Role & position of Personnel function in the organization.

Procurement and Placement: Need for Human Resource Planning; Process of Human Resource Planning; Methods of Recruitment; Psychological tests and interviewing; Meaning and Importance of Placement and Induction, Employment Exchanges (Compulsory Notification of vacancies) Act 1959, The Contract Labour (Regulation & Abolition) Act 1970.

UNIT-II (12 Hrs.)

Training & Development: Difference between training and Development; Principles of Training; Employee Development; Promotion-Merit v/s seniority Performance Appraisal, Career Development & Planning.

Job analysis & Design: Job Analysis: Job Description & Job Description, Job Specification.
Job Satisfaction: Job satisfaction and its importance; Motivation, Factors affecting motivation, introduction to Motivation Theory; Workers ' Participation, Quality of work life.
The Compensation Function: Basic concepts in wage administration, company's wage policy, Job Evaluation, Issues in wage administration, Bonus & Incentives, Payment of Wages Act-1936, Minimum Wages Act-1961.

UNIT-III (12 Hrs.)

Integration: Human Relations and Industrial Relations; Difference between Human Relations and Industrial Relations, Factors required for good Human Relation Policy in Industry; Employee Employer Relationship Causes and Effects of Industrial disputes; Employees Grievances & their Redressal, Administration of Discipline, Communication in organization, Absenteeism, Labour Turnover, Changing face of the Indian work force and their environment, Importance of collective Bargaining; Role of trade unions in maintaining cordial Industrial Relations.

UNIT-IV (12 Hrs.)

Maintenance: Fringe & retirement terminal benefits, administration of welfare amenities, Meaning and Importance of Employee Safety, Accidents-Causes & their Prevention, Safety Previsions under the Factories Act 1948; Welfare of Employees and its Importance, Social security, Family Pension Scheme, ESI act 1948, Workmen's Gratuity Act 1972, Future challenges for Human Resource Management.

Recommended Books

1. T.N. Chhabra, 'Human Resource Management', Dhanpat Rai & Co.
2. Lowin B. Flippo, 'Principles of Personnel Management', McGraw Hill.
3. R.C. Saxena, 'Labour Problems and Social Welfare', K. Math & Co.
4. A. Minappa and M.S. Saiyada, 'Personnel Management', Tata McGraw Hill.
5. C.B. Mamoria, 'Personnel Management', Himalaya Publishing House, Bombay.
6. T.N. Bhagotiwal, 'Economics of Labour and Industrial Relations', Sahitya Bhawan, Agra.

DIGITAL SYSTEM DESIGN

Subject Code: BECE1-562 **L T P C** **Duration: 37 Hrs.**
3 0 0 3

Learning Objectives

1. To outline the formal procedures for the analysis and design of combinational circuits and
2. sequential circuits
3. To introduce the concept of memories and programmable logic devices.
4. To illustrate the concept of synchronous and asynchronous sequential circuits

Learning Outcomes

Students will be able to:

1. Design and implement Combinational circuits.
2. Design and implement synchronous and asynchronous sequential circuits.
3. Multi-input system controller design.
4. Write simple HDL codes for the circuits.

UNIT-I

Introduction to Digital Design Concepts: Review of digital design fundamentals, minimization and design of combinational circuits, sequential machine fundamentals.

Clocked Sequential Finite State Machines: State diagram, analysis of synchronous circuits, derivation of state graphs and tables, reduction of state tables, state assignment, design of sequence detectors, serial data code conversion, design of synchronous sequential state machine, design and applications of counters and shift registers.

UNIT-II

Multi-input System Controllers Design: System controller, controller design principles, timing and frequency considerations, DFD development, controller architecture design, asynchronous input handling, state assignment concepts, flip-flop level implementation using VEM's.

Sequential Design using LSI & MSI Circuits: Using decoders, multiplexers in sequential circuits, sequential network design using ROMs, PLAs and PALs, Programmable gate Arrays (PGAs).

UNIT-III

Asynchronous Sequential Finite State Machines: Introduction, analysis of asynchronous networks, races and cycles, derivation of primitive flow tables, reduction of primitive flow tables, state assignments, hazards, asynchronous sequential network design.

UNIT-IV

VHDL: Basic Language Elements, Data objects, classes and data types, operators, overloading, logical operators, VHDL representation of Digital design entity and architectural declarations, introduction to behavioural, dataflow and structural models.

Recommended Books

1. William I. Fletcher, 'An Engineering Approach to Digital Design', PHI.
2. M. Morris Mano, 'Digital Design', Pearson Education.
3. Z. Navabi, 'VHDL-Analysis and Modeling of Digital Systems', McGraw Hill.
4. Kevin Skahill, 'VHDL for Programmable Logic', Pearson Education.
5. Jr. Charles H. Roth, 'Fundamentals of Logic Design', Jaico Publishers.
6. John Wakerly, 'Digital Design, Principles and Practices', Pearson Education.

BIOMEDICAL ELECTRONICS AND INSTRUMENTATION

Subject Code: BECE1-563	L T P C 3 0 0 3	Duration: 38 Hrs.

Learning Objectives

This Course introduces general biological concepts

1. It helps students to understand importance of biological concepts in engineering fields.
2. To understand application of engineering concepts in medical instrumentation.

Learning Outcomes

Upon successful completion of the Course, students will be able to

1. Use bioinstrumentation, required in cellular or molecular biology investigations
2. Apply the concepts of engineering in different streams of biomedical field.
3. To explore and understand different biomedical instruments used in practice.
4. Understands different bio signals / potentials

UNIT-I

Biomedical Signals: Origins of Bioelectric Signals, Human body, Heart and Circulatory System, Electrodes, Transducers, ECG, EMG.

UNIT-II

Recording & Monitoring Instruments: Recording Electrodes, Physiological Transducers, Biomedical Recorders, Biomedical Recorders, Heart rate measurement, Temperature measurement, Foetal Monitoring System, Foetal Monitoring System, Foetal Monitoring System, Foetal Monitoring System, Biomedical Telemetry.

UNIT-III

Imaging System: Working with X-Rays, CT scanner, NMR, NMR, Ultrasonic System, Ultrasonic System, Ultrasonic System.

UNIT-IV

Therapeutic & Physiotherapy Equipment: Cardiac Pacemakers, Cardiac defibrillator, SW Diathermy & MW Diathermy.

Patient Safety: Electric Shock Hazards, Test Instruments, Biomedical Equipment's, Biomedical Equipment's.

Recommended Books

1. R.S. Khandpur, 'Handbook of Biomedical Instrumentation', Tata McGraw Hill.
2. Leslie Cromwell, 'Biomedical Instrumentation and Measurements' PHI.
3. T.K. Attuwood, 'Introduction to Bioinformatics', Pearson Education.
4. Joseph J. Carr & John M. Brown, 'Introduction to Biomedical Equipment Technology', Pearson Education.

MICROELECTRONICS

Subject Code: BECE1-564 **L T P C** **Duration: 38 Hrs.**
3 0 0 3

Learning Objectives

This Course introduces general biological concepts

1. It helps students to understand importance of Microelectronics.
2. To understand IC fabrication, crystal growth, epitaxy, oxidation, photolithography and etching

Learning Outcomes

Upon successful completion of the Course, students will be able to

1. Review different IC's and its fabrication steps.
2. Understand need for crystal growth and epitaxial techniques.
3. Different silicon oxidation processes.
4. Steps behind photolithography and etching technique.

UNIT-I

Introduction: Advantages of IC's, General classification of IC's (Linear/Digital IC's, Monolithic/ Hybrid IC's), Basic IC fabrication steps

UNIT-II

Crystal Growth and Epitaxy: Starting material for formation of crystal, Horizontal Bridgeman Method, Czochralski growth, Distribution of dopants, Zone refining, Silicon Float Zone process, Si-Wafer preparation, Epitaxial growth, Techniques used for epitaxial, growth (LPE, VPE, MBE)

UNIT-III

Silicon Oxidation: Thermal oxidation process (Kinetics of growth, Thin oxide growth), Effect of impurities on the oxidation rate, Pre oxidation Cleaning, Various oxidation techniques, Masking properties of SiO_2,

Photolithography and Etching, Pattern generation/Mask making, Contact and Proximity printing, Photoresist, Photolithography Process (Lift off technology, Fine line photolithography), Wet/Dry etching, Reactive Plasma etching techniques and applications

UNIT-IV

Diffusion and Ion Implantation: Basic diffusion process (Diffusion equation, Diffusion profiles), Extrinsic diffusion, Lateral Diffusion, Ion Implantation Process (Ion distribution, Ion Stopping), Implant Damage and Annealing process (Furnace and RTA),

IC Packaging, Isolation Techniques, Testing of the Chip, Wire Bonding techniques, Flip Chip technique, Various Packaging methods and Materials,

Fabrication of Monolithic Components, Fabrication of Diodes, Resistors, capacitors and inductors, Fabrication of BJT and FET, Fabrication of MOS Devices, CMOS fabrication techniques (n-well and p-well process sequences), Introduction to MEMS.

Recommended Books

1. Gray S. May and Simon M.Sze, 'Fundamental of Semiconductor Fabrication', John Wiley & Sons.
2. SZE, 'VLSI Technology', McGraw Hill Publisher.
3. Jacob and Millman, 'Microelectronics', McGraw Hill Publisher.

MICROWAVE AND ANTENNA THEORY

Subject Code: BECE1-623	L T P C 3 1 0 4	Duration: 45 Hrs.

Learning Objectives

1. To inculcate understanding of the basics required for circuit representation of RF networks.
2. To deal with the issues in waveguides and different modes.
3. To provide knowledge on the different antenna parameters and antenna types.
4. To explore designing of antenna arrays.

Learning Outcomes

Upon completion of the Course, students will be able to:

1. Explain the active & passive microwave devices & components used in Microwave communication systems.
2. Analyze the various Microwave tubes.
3. To understand various antenna parameters and different kinds of antennas.
4. To analyze different antenna arrays.

UNIT-I (10 Hrs.)

Waveguides: Introduction, comparison with transmission lines, propagation in TE & TM mode, rectangular wave guide, TEM mode in rectangular wave guide, characteristic impedance, introduction to circular waveguides and planar transmission lines.

UNIT-II (12Hrs.)

Microwave Components: Directional couplers, tees, hybrid ring, S-parameters, attenuators, cavity resonators, mixers & detectors, matched Load, phase shifter, wave meter, Ferrite devices: Isolators, circulators.

Microwave Tubes: Limitation of conventional tubes; Construction, operation and properties of Klystron amplifier, reflex Klystron, magnetron, TWT, BWO, crossed field amplifiers.

UNIT-III (13 Hrs.)

Antenna Parameters: Radiation pattern, Gain, Directive gain, Directivity, effective aperture, front-to-back ratio, antenna beam width, antenna bandwidth, antenna beam efficiency, antenna beam area or beam solid angle.

Broadband Antennas: Helical antennas, frequency independent antennas, Log - periodic antennas.

Aperture antennas, smart antennas. Long Wire antenna, folded dipole antenna, Yagi-Uda antenna, Slot antenna, Micro Strip or Patch antennas, Antenna measurements.

UNIT-IV (10 Hrs.)

Antenna Arrays: Various forms of antenna arrays, arrays of point sources, non-isotropic but similar point sources, multiplication of patterns, arrays of n-isotropic sources of equal amplitude and spacing, Dolph-Tchebysceff arrays, continuous arrays, rectangular arrays.

Recommended Books

1. Samuel Liao, ‘Microwave devices and circuits’, PHI
2. A.K. Maini, ‘Microwaves and Radar’, Khanna Publishers.
3. Balanis A. Constantine, ‘Antenna Theory, Analysis and Design’, Wiley, New York.

MICROCONTROLLER AND EMBEDDED SYSTEM

Subject Code: BECE1-624 **L T P C** **Duration: 48 Hrs.**

3 1 0 4

Learning Objectives

The student should be made to:

1. Study the Architecture of 8051 microcontroller.
2. Learn the design aspects of I/O and Memory Interfacing circuits.
3. Study about communication and bus interfacing.

Learning Outcomes

At the end of the Course, the student should be able to:

1. Design and implement 8051 microcontroller based systems.
2. Serial communication 0f 8051.
3. Interfacing with 8051.

UNIT-I (10 Hrs.)

Introduction: 8051 microcontroller, comparison of microcontroller and microprocessors, Embedded Systems, 8051 Microcontroller: Architecture and Pin Diagram, Program Counter and RAM Spaces, Data types and Directives, Flag Bits and PSW Register, Register Banks and Stack, interrupt,

UNIT-II (11 Hrs.)

Programming: Basic assembly language programming concepts Addressing Modes, Arithmetic, Logical instructions and Programming, I/O Port Programming, BCD and ASCII application programs, Single-bit instruction programming, Timers and Counter Programming, Jump and loop Instructions, Introduction of 8051 Programming in C.

UNIT-III (12 Hrs.)

Serial Communication of 8051: Basics of Communication, Overview of RS-232, UART, USB, 8051 connections to RS-232, serial communication programming, Programming of timer interrupts, Programming of External hardware interrupts, Interrupt priority.

UNIT-IV (12 Hrs.)

Interfacing with 8051: LCD and Keyboard Interfacing, interfacing with external memory and 8051 data memory space, interfacing with 8255, Sensors Interfacing and Signal Conditioning, interfacing with Stepper Motor and Servo motors, DS12887 RTC Interfacing and its programming.

Recommended Books

1. Mazidi Muhammad Ali, ‘The 8051 Microcontroller and Embedded Systems’, Pearson Publications.
2. Manish K Patel, ‘The 8051 Microcontroller Based Embedded Systems’, McGraw Hill Publications.
3. Scot MacKenzie, Raphael C.W. Phan, the 8051 Microcontroller, Pearson Publications.
4. Kenneth J. Ayala, ‘The 8051 Microcontroller’, Thomson Publishers.

LINEAR CONTROL SYSTEM

Subject Code: BECE1-625	**L T P C** **3 1 0 4**	**Duration: 45 Hrs.**

Learning Objectives

1. To introduce the elements of control system and their modelling using various Techniques.
2. To introduce methods for analysing the time response, the frequency response and the stability of systems
3. To introduce the state variable analysis method.
4. Design the compensation technique that can be used to stabilize control systems.

Learning Outcomes

Upon completion of the Course, students will be able to:

1. Perform time domain and frequency domain analysis of control systems required for stability analysis.
2. Determine and use models of physical systems in forms suitable for use in the analysis and design of control systems.
3. Express and solve system equations in state-variable form (state variable models).
4. Determine the (absolute) stability of a closed-loop control system
5. Apply root-locus technique to analyze and design control systems.

UNIT-I (10 Hrs.)

Basic Concepts: Historical review, Definitions, Classification, Relative merits and demerits of open and closed loop systems.

UNIT-II (12 Hrs.)

Mathematical Models of Control System: Linear and non-linear systems, Transfer function, Mathematical modelling of electrical, mechanical and thermal systems, Analogies, Block diagrams and signal flow graphs.

Control Components: DC servomotor, AC servomotor, Potentiometers, Synchronous, Stepper - motor.

UNIT-III (11 Hrs.)

Time and Frequency Domain Analysis: Transient and frequency response of first and second order systems, Correlation ship between time and frequency domain specifications, Steady-state errors and error constants, Concepts and applications of P, PD, PI and PID types of control.

Stability Analysis: Definition, Routh-Hurwitz criterion, Root locus techniques, Nyquist criterion, Bode plots, Relative stability, Gain margin and phase margins.

UNIT-IV (12 Hrs.)

State Variable Analysis: Introduction, Concept of State, State variables & State models, State Space representation of linear continuous time systems. State models for linear continuous –time systems, State variables and linear discrete time systems, Solution of state equations, Concept of Controllability & Observability.

Recommended Books

1. K. Ogata, 'Discrete time Control Systems', Prentice Hall International.
2. Nagrath and Gopal, 'Control System Engineering', New Age International.
3. Warwick, Kevin, 'An Introduction to Control Systems', World Scientific Publishing Co. Pvt. Ltd.
4. W.S. Levine, 'Control System Fundamentals', CRC Press.

MICROWAVE ENGINEERING LAB.

Subject Code: BECE1-626 **L T P C**
0 0 2 1

Learning Objectives

The student should be made to:

1. Know about the behaviour of microwave components.
2. Practice microwave measurement procedures.

Learning Outcomes

At the end of the Course, the student should be able to

1. Test & analyse various microwave components.
2. Analyse the radiation pattern of antenna.

EXPERIMENTS

1. Study of wave guide components.
2. To study the characteristics of reflex Klystron and determine its tuning range.
3. To measure frequency of microwave source and demonstrate relationship among guide dimensions, free space wave length and guide wavelength.
4. To measure VSWR of unknown load and determine its impedance using a smith chart.
5. To match impedance for maximum power transfer using slide screw tuner.
6. To measure VSWR, insertion losses and attenuation of a fixed and variable attenuator.
7. To measure coupling and directivity of direction couplers.
8. To measure insertion loss, isolation of a three port circulator.
9. To measure the Q of a resonant cavity.
10. To study the V-I characteristics of GUNN diode.
11. To study the radiation pattern of Horn Antenna

Note: At least 08 experiments are required to be performed.

MICROCONTROLLER LAB.

Subject Code: BECE1-627 **L T P C**
0 0 2 1

Learning Objectives

The student should be made to:

1. Introduce microcontroller concepts and features.
2. Introduce the practical concepts to control speed of DC and stepper motor.

Learning Outcomes

At the end of the Course, the student should be able to:

1. Write programs for 8051 micro controller kit.
2. Understand programs for speed control of DC motor.
3. Understanding to control the speed of stepper motor.

EXPERIMENTS

1. Study of 8051 Micro controller kits.
2. Write a program to add two numbers lying at two memory locations and display the result.
3. Write a program for multiplication of two numbers lying at memory location and display the result.
4. Write a Program to arrange 10 numbers stored in memory location in Ascending and Descending order.
5. Write a program to show the use of INT0 and INT1.
6. Write a program of Flashing LED connected to port 1 of the Micro Controller
7. Write a program to generate a Ramp waveform using DAC with micro controller.
8. Write a program to interface the ADC.
9. Write a program to control a stepper motor in direction, speed and number of steps.
10. Write a program to control the speed of DC motor.
11. Interfacing of high power devices to Micro-controller port-lines, LED, relays and LCD display

Note: At least 08 experiments are required to be performed.

NANO-SCIENCE AND NANO-TECHNOLOGY

Subject Code: BECE1-665 **L T P C** **Duration: 37 Hrs.**
3 0 0 3

Learning Objectives

1. To create awareness about nanotechnology issues.
2. To impart knowledge about carbon age and nano tubes.
3. To create awareness about Quantum computing**.**
4. To study the various characterization techniques in nano-electronics

Learning Outcomes

Students shall be able to

1. Understand the fundamentals and basics of nanotechnology.
2. Understand significance and potential opportunities to create better materials and products.
3. Describe different nano-scale devices.

UNIT-I

Basics and Scale of Nanotechnology: Introduction – Scientific revolutions – Time and length scale in structures, Definition of a nano-system, Top down and bottom up approaches – Evolution of band structures and Fermi surface – introduction to semi conducting Nanoparticles, introduction to quantum Dots, wells, wires, Dimensionality and size dependent phenomena – Fraction of surface atoms – Surface energy and surface stress.

UNIT-II

The Carbon Age and Nanotubes: New forms of carbon, Types of nanotubes, Formation of nanotubes, methods and reactants- Arcing in the presence of cobalt, Laser method, Chemical vapor deposition method, ball milling, properties of Nanotubes Electrical properties, vibrational properties, Mechanical properties, applications of Nanotubes in electronics, hydrogen storage, materials, space elevators.

UNIT-III

Characterization Techniques in Nano-electronics: Principle, construction and working: Electron microscopy (SEM and TEM), Infrared and Raman Spectroscopy, Photoemission and X-RD spectroscopy, AFMs, Magnetic force microscope.

UNIT-IV

Nano-scale Devices: Introduction: Quantum Electron Devices; High Electron Mobility Transistor, Quantum Interference Transistor, Single Electron Transistor and Carbon Nanotube Transistor, DNA Computing; Structure of DNA, Basic Operation on DNA and DNA Computer.

Recommended Books

1. C.P. Polle and F.J. Owens, 'Introduction to Nanotechnology', Willey India Pvt. Ltd.
2. Daniel Minoli, 'Nanotechnology Applications to Telecommunications and Networking' Willey India Pvt. Ltd.
3. Manasi Karkare, Nano Technology: Fundamentals and Applications', I. K. International Pvt. Ltd.
4. Lynn E. Foster, 'Nano Technology', Pearson India.

ADVANCED MICROPROCESSOR

Subject Code: BECE1-666	**L T P C** **3 0 0 3**	**Duration: 38 Hrs.**

Learning Objectives

Microprocessors and Microcontrollers are widely used in modern society with applications ranging from automatic gadgets to medical applications. The purpose of this Course is to:

1. Introduce students with the advanced technology in embedded systems.
2. The objective is to make students understand architecture and programming of embedded processors.
3. Students will able to interface various circuits with advanced processors.

Learning Outcomes

1. Students will have ability to deal with 16 bit microprocessors
2. They will be familiar with latest microprocessor
3. Students will have skills to interface any peripheral devices with different microprocessors.

UNIT-I

Microprocessor 8086: Block diagram, Architecture & Pin diagram of 8086, pipelining process, flag register. Register details of 8086, operation, different addressing modes.

UNIT-II

8086 Assembly Language Programming: 8086 flags, JUMP operations, STRING operations, CALL & RET operations, STACK operations, Instruction set of an 8086, 8086 hardware configuration, addressing memory & ports, 8086 Interrupts and interrupt responses, Interrupt system based on 8259 A**.**

UNIT-III

Interfacing with 8086 Microprocessor: Concept of programmable devices, architecture and programming of programmable I/O port timer, programmable interval timer, programmable peripheral interface, its interfacing with 8086 microprocessor.

UNIT-IV

Introduction to Advanced Microprocessors: Architectures of 80186-286-386-486, Pentium Processors, Dual core processors, Core to duo, I5 and I-7 Processors.

Recommended Books

1. Douglas V. Hall, ‘Microprocessor & Interfacing: Programming & Hardware’, Tata McGraw Hill
2. M.A. Mazidi, J.G. Mazidi, R.D. McKinlay, ‘The 8051 Micro controllers & Embedded Systems’, Indian reprint, Pearson Education.
3. Kenneth J., Ayala, ‘8051 Microcontroller: Architecture, Programming and Application’, Delmar Learning.
4. Brey, ‘Intel Micropocessors, The 8056/8055, 80186/80188, 8028, /80386, 80486, Pentium & Pentium Pro, Pentium II, III, IV: Architecture, Programming and Interfacing’, PHI.
5. MykePredko, ‘Programming and Customizing the ARM7 Microcontroller’, McGraw Hill.

IMAGE AND SPEECH PROCESSING

Subject Code: BECE1-667	**L T P C** **3 0 0 3**	**Duration: 36 Hrs.**

Learning Objectives

The student should be made to:

1. Learn digital image fundamentals.
2. Be familiar with image compression and segmentation techniques.
3. To introduce speech production and related parameters of speech.
4. To show the computation and use of techniques used in image compression and enhancement.
5. To understand different speech modeling procedures such as Markov and their implementation issues.

Learning Outcomes

Upon successful completion of this Course, students will be able to:

1. Discuss digital image and speech fundamentals.
2. Apply image enhancement and restoration techniques.
3. Model speech production system and describe the fundamentals of speech.
4. Extract and compare different speech parameters.

UNIT-I

Introduction to Image Processing: Historical background, visual perception, image formation, Elements of Storage, sampling & Quantization, Relationships between pixels-neighbors of pixel, connectivity labelling of connected components, Relations, equivalence and Transitive closure, Distance measures, Arithmetic/ Logic operation, Imaging Geometry Basic and perspective transformation stereo imaging, application of image Processing.

UNIT-II

Image Enhancement: Spatial and frequency domain methods point processing, intensity transformation, Histogram processing image substation and Averaging spatial filtering, LP, HP and homo-morphic felling, generation of spatial marks, Color image processing.

UNIT-III

Image Compression: Redundancy models, error free compression, Lossy compression, Image compression standards.

Image Segmentation: Detection of Discontinuity, Edge detection, Boundary detection, Thresholding, Regional oriented segmentation, use of motion in segmentation.

UNIT-IV

Speech Processing: Review of human speech and Acoustic theory, nature of sound, harmonics, resonance measurement, virtual display. Music theory, pitch, duration, intervals, rhythm. Human speech production, the vocal tract, the Larynx, the source filter. Speech signal processing-the phasormode, Fourier transfer, DFT, FFT. The hardware use of FIR & IIR filters. Software, Elements of speech Synthesis Speech Recognition-speech in the computer-human interface.

Recommended Books

1. Rafact Gonzalez and Richard E. Woods, 'Digital Image Processing', Pearson Education Society.
2. Keenneth R. Castleman, 'Digital Image Processing', Pearson Education Society.
3. A.K. Jain, 'Fundamental of Digital Image Processing', PHI.
4. Iain Murray, 'Speech and Audio Processing for multimedia PC's', Pearson Education Society.

OPTICAL FIBER COMMUNICATION

Subject Code: BECE1-668 **L T P C** **Duration: 48 Hrs.**
3 0 0 3

Learning Objectives

1. To Facilitate the knowledge about optical fiber sources and transmission techniques
2. To Enrich the idea of optical fiber networks algorithm such as SONET/SDH and optical CDMA.
3. To explore the trends of optical fiber measurement systems.

Learning Outcomes

Upon completion of the Course, students will be able to:

1. Discuss the various optical fiber modes, configurations and various signal degradation factors associated with optical fiber.
2. Explain the various optical sources and optical detectors and their use in the optical communication system.
3. Analyze the digital transmission and its associated parameters on system performance

UNIT-I

Introduction to Optical Communication Systems: Electromagnetic spectrum used for optical communication, block diagram of optical communication system. Basics of transmission of light rays. Advantages of optical fiber communication.

Optical Fibers: Optical fibers structures and their types, fiber characteristics: attenuation, scattering, absorption, fiber bend loss, dispersion, fiber couplers and connectors

UNIT-II

Led Light Source: Light emitting diode: recombination processes, the spectrum of recombination radiation, LED characteristics, internal quantum efficiency, external quantum efficiency, LED structure, lens coupling to fiber, behavior at high frequencies.

UNIT-III

Laser Light Source: Basic principles of laser action in semi -conductors, optical gain, lasing threshold, laser structures and characteristics, laser to fiber coupling, comparison with LED source

UNIT-IV

Avalanche and Pin Photodetectors: Principles of optical detection, quantum efficiency, responsivity, general principles of PIN photodetector, intrinsic absorption, materials and designs for PIN photodiodes, impulse and frequency response of PIN photodiodes, noise in PIN Photodiodes, multiplication process, APD Design, APD bandwidth, APD noise.

Recommended Books

1. John M. Senior, ‘Optical Fiber Communications’, PHI.
2. Gerd Keiser, ‘Optical Fiber Communications’, TMH.
3. John Gowar, ‘Optical Communication Systems’, PHI.
4. Selvarajan, Kar, Srinivas, ‘Optical fiber Communication’, TMH.

OPERATION RESEARCH

Subject Code: BECE1-669 **L T P C** **Duration: 48 Hrs.**

3 0 0 3

Learning Objectives

1. To Facilitate the knowledge about decision making systems.
2. To Enrich the idea of different models.

Learning Outcomes

Upon completion of the Course, students will be able to:

1. Identify and develop role of operations in decision making system.
2. Understand the deterministic models.
3. Use mathematical software to solve the proposed models.
4. Develop a report that describes the waiting line model and project line.
5. Understanding to the decision-making processes.

UNIT-I

Introduction: Definition, role of operations research in decision-making, applications in industry. Concept on operation research model building –Types & methods.

Linear Programming (LP): Programming definition, formulation, solution- graphical, simplex Gauss-Jordan reduction process in simplex methods, BIG-M methods computational, problems.

UNIT-II

Deterministic Model: Transportation model-balanced & unbalanced, north west rule, Vogel's Method, least cost or matrix minimal, Stepping stone method, MODI methods, degeneracy, assignment, traveling salesman, problems.

Advanced Topic of LP: Duality, PRIMAL-DUAL relations-its solution, shadow price, economic interpretation, dual-simplex, post-optimality & sensitivity analysis, problems.

UNIT-III

Waiting Line Models: Introduction, queue parameters, M/M/1 queue, performance of queuing systems, applications in industries, problems.

Project Line Models: Network diagram, event, activity, defects in network, PERT & CPM, float in network, variance and probability of completion time, project cost- direct, indirect, total, optimal project cost by crashing of network, resources levelling in project, problems.

UNIT-IV

Simulation: Introduction, design of simulation, models & experiments, model validation, process generation, time flow mechanism, Monte Carlo methods- its applications in industries, problems.

Decision Theory: Decision process, SIMON model, types of decision making environment - certainty, risk, uncertainty, decision making with utilities, problems.

Recommended Books

1. Taha, 'Operation Research', PHI, New Delhi.
2. Ackoff, Churchaman, arnoff, 'Principle of Operations Research', Oxford IBH, Delhi.
3. Gupta & Sharma, 'Operation Research', National Publishers, New Delhi.
4. Vohra, 'Quantitative Techniques', TMH, New Delhi.
5. Sharma, Gupta, 'Operation Research', Wiley Eastern, New Delhi.

WIRELESS COMMUNICATION SYSTEMS

Subject Code: BECE1-728 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

Learning Objectives

The student should be made to:

1. Know the characteristic of wireless channel
2. Learn the various cellular architectures
3. Understand the concepts behind various digital signalling schemes for fading channels
4. Be familiar the various multipath mitigation techniques
5. Understand the various multiple antenna systems

Learning Outcomes

At the end of the Course, the student should be able to:

1. Characterize wireless channels
2. Design and implement various signalling schemes for fading channels
3. Compare multipath mitigation techniques and analyse their performance
4. Design and implement systems with transmit/receive diversity and MIMO systems and analyze their performance

UNIT-I (12 Hrs.)

Introduction to Wireless Communication Systems: Evolution of mobile radio communications, examples of wireless comm. systems, paging systems, Cordless telephone systems, comparison of various wireless systems.

Modern Wireless Communication Systems: Second generation cellular networks, third generation wireless networks, wireless in local loop, wireless local area networks, Blue tooth and Personal Area networks.

UNIT-II (12 Hrs.)

Introduction to Cellular Mobile Systems: Spectrum Allocation, basic Cellular Systems, performance Criteria, Operation of cellular systems, analog cellular systems, digital Cellular Systems.

Cellular System Design Fundamentals: Frequency Reuse, channel assignment strategies, handoff Strategies, Interference and system capacity, tracking and grade off service, improving coverage and capacity.

UNIT-III (11 Hrs.)

Multiple Access Techniques for Wireless Communication: Introduction to Multiple Access, FDMA, TDMA, Spread Spectrum multiple Access, space division multiple access, packet ratio, capacity of a cellular systems.

Wireless Networking: Difference between wireless and fixed telephone networks, development of wireless networks, fixed network transmission hierarchy, traffic routing in wireless networks, wireless data services, common channel signalling, ISDN (Integrated Services Digital Networks), advanced intelligent networks.

UNIT-IV (10 Hrs.)

Intelligent Cell Concept and Application: Intelligent cell concept, applications of intelligent micro-cell Systems, in-Building Communication, CDMA cellular Radio Networks.

Recommended Books

1. Theodore S. Rappaport, ‘Wireless Communications’, Pearsons.
2. W.C.Y. Lee, ‘Mobile Cellular Telecommunication’, McGraw Hill
3. Jochen Schiller, ‘Mobile Communications’, Pearson.

DIGITAL SIGNAL PROCESSING

Subject Code: BECE1-729 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

Learning Objectives

1. To learn discrete Fourier transform and its properties
2. To know the characteristics of IIR and FIR filters learn the design of infinite and finite impulse response filters for filtering undesired signals
3. To understand Finite word length effects
4. To study the concept of Multirate and adaptive filters

Learning Outcomes

Upon completion of the Course, students will be able to

1. Apply DFT for the analysis of digital signals & systems
2. Design IIR and FIR filters
3. Characterize finite Word length effect on filters

UNIT-I (11 Hrs.)

Introduction: Signals, Systems and Signal Processing, Classification of Signals, Concept of Frequency in Continuous Time and Discrete Time Signals, Analog-to-Digital and Digital-to-Analog Conversion, Applications of Signal Processing.

Discrete Time signals and Systems: Discrete Time Signals, Discrete Time Systems, Analysis of Discrete Time Linear Time-Invariant Systems, Discrete Time Systems Described by Difference Equations, Implementation of Discrete Time systems, Correlation of Discrete Time Signals.

UNIT-II (12 Hrs.)

The Z-transform and Its Application to the Analysis of LTI Systems: The z-Transform, Properties of z-Transforms, Inversion of z-Transform, One-sided z-Transform, Analysis of Linear Time-Invariant Systems in the z-Domain.

Frequency analysis of signals and systems: Frequency Analysis of Continuous –Time Signals, Frequency Analysis of Discrete Time Signals, Properties of Fourier Transform for Discrete Time Signals. Frequency Domain Characteristics of Linear Time-Invariant Systems, Linear Time-Invariant Systems as Frequency-Selective Filters, Inverse Systems and Deconvolution.

UNIT-III (12 Hrs.)

The discrete Fourier transform: its properties and applications: Frequency Domain Sampling: The discrete Fourier Transform, Properties of the DFT, Linear Filtering Methods based on the DFT. Frequency Analysis of Signals Using the DFT.

Efficient computation of DFT: Fast Fourier transforms: Efficient Computation of DFT: FFT Algorithms, Application of FFT Algorithms, A Linear Filtering Approach to Computation of DFT. Quantization Effect in the Computation of DFT.

UNIT-IV (10 Hrs.)

Implementation of Discrete Time Systems: Structures for the realization of Discrete Time Systems, Structures for FIR Systems, Structures for IIR Systems, Representation of Numbers, Quantization of Filter Coefficients, Round off Effect in Digital Filters.

Design of Digital filters: General Considerations like causality etc., Design of FIR Filters, Design of IIR Filters from Analog Filters, Frequency Transformations, Design of Digital Filters Based on Linear Squares Method.

Sampling and Reconstruction of Signals: Sampling of Bandpass Signals, Analog-to-Digital Conversion, Digital-to-Analog Conversion.

Recommended Books

1. J.G. Proakis and D. G. Manolakis, ‘Digital Signal Processing: Principles, Algorithms and Applications’, Pearson Prentice Hall.
2. S.K. Mitra, ‘Digital Signal Processing: A Computer Based Approach’, TMH.
3. A.V. Oppenheim, R. W. Schafer and J. R. Buck, ‘Discrete-time Signal Processing’, Prentice Hall.
4. A. Widrow and S.D. Stearns, ‘Adaptive Signal Processing’, Prentice Hall.

DIGITAL SIGNAL PROCESSING LAB.

Subject Code: BECE1-730 **L T P C**
0 0 2 1

Learning Objectives

The student should be made to:

1. To implement Linear and Circular Convolution.
2. To implement FIR and IIR filters.
3. To study the architecture of DSP processor.
4. To demonstrate Finite word length effect.

Learning Outcomes

Students will be able to

1. Carry out simulation of DSP systems.
2. Demonstrate their abilities towards DSP processor based implementation of DSP systems.
3. Analyze Finite word length effect on DSP systems.
4. Demonstrate the applications of FFT to DSP.

EXPERIMENTS

1. To develop elementary signal function modules (m-files) for unit sample, unit step, exponential and unit ramp sequences.
2. Write a program in MATLAB to generate standard sequences.
3. Write a program in MATLAB to compute power density spectrum of a sequence.
4. To develop program modules based on operation on sequences like signal Shifting, signal folding, signal addition and signal multiplication.
5. Write a program in MATLAB to verify linear convolution.
6. Write a program in MATLAB to verify the circular convolution.
7. To develop program for finding magnitude and phase response of LTI system Described by system function H(z).
8. To develop program for finding response of the LTI system described by the difference equation.
9. To develop program for computing inverse Z-transform.
10. To develop program for computing DFT and IDFT.
11. To develop program for conversion of direct form realization to cascade form realization.
12. To develop program for cascade realization of IIR and FIR filters.
13. To develop program for designing FIR filter.
14. To develop program for designing IIR filter.
15. To write a MATLAB program for noise reduction using correlation and autocorrelation methods.
16. To write a MATLAB programs for pole-zero plot, amplitude, phase response and impulse response from the given transfer function of a discrete-time causal system.
17. Write a program in MATLAB to find frequency response of different types of analog filters.
18. Write a program in MATLAB to design FIR filter (LP/HP) through Window technique
    a. Using rectangular window
    b. Using triangular window

Note: At least 12 experiments are required to be performed

MINOR PROJECT

Subject Code: BECE1-732

The students are required to undergo Minor Project work and it will be evaluated by the external examiner and one internal examiner appointed by the institute/university. External examiner will be from panel of examiners. Assessment of project will be based on Quality of work, Seminar, viva-voice, report writing. Students can use different hardware and software in order to analyse and verify the results

COGNITIVE RADIO

Subject Code: BECE1-770 **L T P C** **Duration: 38 Hrs.**
3 0 0 3

Learning Objectives

The student should be made to:

1. Know the basics of the software defined radios.
2. Learn the design of the wireless networks based on the cognitive radios
3. Understand the concepts of wireless networks and next generation networks

Learning Outcomes

Upon completion of the Course, students will be able to

1. Describe the basics of the software defined radios.
2. Design the wireless networks based on the cognitive radios
3. Explain the concepts behind the wireless networks and next generation networks

UNIT-I

Spectrum Scarcity: history and background leading to cognitive radios, Software define radios (SDRs), basic architecture of SDR, power control in cognitive transceivers, Dynamic Spectrum Access, new opportunities, spectrum management.

Cognitive Radios: Scarcity problems, network protocols, standardization, security issues.

UNIT-II

Spectrum Sensing: ideal spectrum sensing, Spectrum sensing techniques: Transmission detection (Energy detection, cyclostationary detection, matched filter detection), feature based detection, interference detection, spectrum sensing in fading environment.

UNIT-III

Cooperative Sensing: importance of cooperative sensing, advantages of spectrum sensing, need of co-operations, centralized cooperative sensing, distributed spectrum sensing. Fusion rules: hard fusion, soft fusion rules.

UNIT-IV

Spectrum Management: Spectrum handoff management, spectrum mobility, spectrum sensing in ad-hoc network, spectrum sharing.

Spectrum Trading: Introduction to spectrum trading, classification to spectrum trading, radio resource pricing, brief discussion on economics theories in DSA (utility, auction theory), classification of auctions (single auctions, double auctions, concurrent, sequential).

Recommended Books

1. Bruce A. Fette, 'Cognitive Radio Technology', Elsevier Publication.
2. Ekram Hossain, Dusit Niyato, Zhu Han, 'Dynamic Spectrum Access and Management in Cognitive Radio Networks', Cambridge University Press.
3. Kwang-Cheng Chen, Ramjee Prasad, 'Cognitive radio networks', John Wiley & Sons Ltd.
4. Husey in Arslan, 'Cognitive Radio, Software Defined Radio, and Adaptive Wireless Systems', Springer.
5. Linda Doyle, 'Essentials of Cognitive Radio', Cambridge University Press.

RELATIONAL DATABASE MANAGEMENT SYSTEM

Subject Code: BECE1-771 **L T P C** **Duration: 38 Hrs.**
3 0 0 3

Learning Objectives

1. To understand the concept of database systems
2. To prepare the student to be in a position to use and design databases for different applications.

Learning Outcomes

1. Master the basic concepts and appreciate the applications of database systems.
2. Be familiar with a relational model.
3. Design principles for relational query language.

UNIT-I

Introduction to Database Systems: File Systems Versus a DBMS, Advantages of a DBMS, Describing and Storing Data in a DBMS, Database System Architecture, DBMS Layers, Data independence.

Physical Data Organization: File Organization and Indexing, Index Data Structures, Hashing, B-trees, Clustered Index, Sparse Index, Dense Index, Fixed length and Variable Length Records.

UNIT-II

Data Models: Relational Model, Network Model, Hierarchical Model, ER Model: Entities, Attributes and Entity Sets, Relationships and Relationship Sets, Constraints, Weak Entities, Class Hierarchies, Aggregation, Conceptual Database Design with the ER Model, Comparison of Models.

The Relational Model: Introduction to the Relational Model, ER to Relational Model Conversion, Integrity Constraints over Relations, Enforcing Integrity Constraints, Relational Algebra, Relational Calculus, Querying Relational Data.

UNIT-III

Relational Query Languages: SQL: Basic SQL Query, Creating Table and Views, SQL as DML, DDL and DCL, SQL Algebraic Operations, Nested Queries, Aggregate Operations, Cursors, Dynamic SQL, Integrity Constraints in SQL, Triggers and Active Database, Relational Completeness, Basic Query Optimization Strategies, Algebraic Manipulation and Equivalences.

Database Design: Functional Dependencies, reasoning about Functional Dependencies, Normal Forms, Schema Refinement, First, Second and Third Normal Forms, BCNF, Multi-valued Dependency, Join Dependency, Fourth and Fifth Normal Forms, Domain Key Normal Forms, Decompositions.

UNIT-IV

Transaction Management: ACID Properties, Serializability, Two-phase Commit Protocol, Concurrency Control, Lock Management, Lost Update Problem, Inconsistent Read Problem, Read-Write Locks, Deadlocks Handling, 2PL protocol.

Database Protection: Threats, Access Control Mechanisms, Discretionary Access Control, Grant and Revoke, Mandatory**,** Access Control, Bell LaPadula Model, Role Based Security, Firewalls, Encryption and Digital Signatures.

Recommended Books

1. Ramez Elmasri, Shamkant Navathe, ‘Fundamentals of Database Systems’, Pearson Education.
2. C.J. Date, ‘An Introduction to Database Systems’, Pearson Education.

3. Alexis Leon, Mathews Leon, 'Database Management Systems', Leon Press.
4. S.K. Singh, 'Database Systems Concepts, Design and Applications', Pearson Education.

COMPUTER ARCHITECTURE AND ORGANIZATION

Subject Code: BECE1-772 **L T P C** **Duration: 37 Hrs.**
3 0 0 3

Learning Objectives

1. To make students understand the basic structure and operation of digital computer.
2. To understand the hardware-software interface.
3. To familiarize the students with arithmetic and logic unit and implementation of fixed point and floating-point arithmetic operations.
4. To expose the students to the concept of pipelining.
5. To familiarize the students with hierarchical memory system including cache memories and virtual memory.
6. To expose the students with different ways of communicating with I/O devices and standard I/O interfaces.

Learning Outcomes

At the end of the Learning, the student should be able to:

1. Design arithmetic and logic unit.
2. Design and analysis of pipelined control units
3. Evaluate performance of memory systems.
4. Understand parallel processing architectures.

UNIT-I

Basic Principles: Boolean algebra and Logic gates, Combinational logic blocks (Adders, Multiplexers, Encoders, de-coder), Sequential logic blocks (Latches, Flip-Flops, Registers, Counters)

General System Architecture: Store program control concept, Flynn's classification of computers (SISD, MISD, MIMD); Multilevel viewpoint of a machine: digital logic, micro architecture, ISA, operating systems, high level language; structured organization; CPU, caches, main memory, secondary memory units & I/O; Performance metrics; MIPS, MFLOPS.

UNIT-II

Instruction Set Architecture: Instruction set based classification of processors (RISC, CISC, and their comparison); addressing modes: register, immediate, direct, indirect, indexed; Operations in the instruction set; Arithmetic and Logical, Data Transfer, Control Flow; Instruction set formats (fixed, variable, hybrid); Language of the machine: 8086; simulation using MSAM.

UNIT-III

Basic non pipelined CPU Architecture: CPU Architecture types (accumulator, register, stack, memory/ register) detailed data path of a typical register based CPU, Fetch-Decode-Execute cycle (typically 3 to 5 stage); microinstruction sequencing, implementation of control unit, Enhancing performance with pipelining.

Memory Hierarchy & I/O Techniques: The need for a memory hierarchy (Locality of reference principle, Memory hierarchy in practice: Cache, main memory and secondary memory, Memory parameters: access/ cycle time, cost per bit); Main memory (Semiconductor RAM & ROM organization, memory expansion, Static & dynamic memory types); Cache memory (Associative & direct mapped cache organizations.

UNIT-IV

Introduction to Parallelism: Goals of parallelism (Exploitation of concurrency, throughput enhancement); Amdahl's law; Instruction level parallelism (pipelining, super scaling –basic features); Processor level parallelism (Multiprocessor systems overview).

Computer Organization [8086]: Instruction codes, computer register, computer instructions, timing and control, instruction cycle, type of instructions, memory reference, register reference. I/O reference, Basics of Logic Design, accumulator logic, Control memory, address sequencing, micro-instruction formats, micro-program sequencer, Stack Organization, Instruction Formats, Types of interrupts; Memory Hierarchy.

Recommended Books

1. David A. Patterson and John L. Hennessy, Morgan, Kauffmann, 'Computer Organization and Design', Elsevier Publisher.
2. John P. Hayes, 'Computer Architecture and Organization', TMH.
3. William Stallings, 'Operating Systems Internals and Design Principles', Prentice-Hall Upper Saddle River, New Jersey.

SOFT COMPUTING

Subject Code: BECE1-773	**L T P C** **3 0 0 3**	**Duration: 37 Hrs.**

Learning Objectives

The student should be made to:

1. Learn the various soft computing frame works.
2. Be familiar with design of various neural networks.
3. Learn genetic programming.

Learning Outcomes

Upon completion of the Course, the student should be able to:

1. Apply various soft computing frame works.
2. Design of various neural networks.
3. Use fuzzy logic.
4. Apply genetic programming

UNIT-I

Neural Networks: Fundamentals of Neural Networks – History- Architectures- Learning methods- XOR problem-Delta rule- derivation- Backpropagation- applications- parameters in BPN- Associative memory – Hetero associative- BAM- energy function- problems-applications of associative memories- ART1- ART2- applications of adaptive networks.

UNIT-II

Fuzzy Logic: Fuzzy set theory – crisp sets – fuzzy sets – crisp relations – Fuzzy relations – Fuzzy systems- Crisp logic – predicate logic – fuzzy logic- fuzzy based systems - Defuzzification methods – applications.

UNIT-III

Genetic Algorithms: Fundamentals of GA – creation of off springs – encoding – fitness function reproduction – crossover- insertion& deletion- mutation- bitwise operators – applications.

UNIT-IV

Programming Using Matlab: Using Neural Network toolbox – Using Fuzzy Logic toolbox-Using Genetic Algorithm & directed search toolbox.

Recommended Books

1. Timothy J. Ross, 'Fuzzy Logic with Engineering Applications', Wiley publications.
2. Yagna Narayanan, 'Artificial Neural Networks', PHI
3. Bart Kosko, 'Neural Networks & Fuzzy logic', Prentice Hall
4. Simon Haykin, 'Neural Networks', Prentice Hall

VLSI DESIGN

Subject Code: BECE1-833	**L T P C** **3 1 0 4**	**Duration: 45 Hrs.**

Learning Objectives

1. In this Course, the MOS circuit realization of the various building blocks that is common to any digital VLSI circuit is studied.
2. Architectural choices and performance trade-offs involved in designing and realizing the circuits in CMOS technology are discussed.

Learning Outcomes

Upon completion of the Course, students should

1. Explain the basic CMOS circuits and the CMOS process technology.
2. Discuss the techniques of chip design using programmable devices.
3. Model the digital system using Hardware Description Language.

UNIT-I (12 Hrs.)

Introduction: Introduction to Computer-aided design tools for digital systems. Hardware description languages, Introduction to VHDL, Data objects, Classes and data types, Operators, Overloading, and Logical operators. Types of delays, Entity and Architecture Declaration Introduction to behavioural, dataflow and structural models

VHDL Statements: Assignment statements, Sequential Statements and Process, Conditional Statements, Case Statements, Array and Loops, Resolution Functions, Packages & Libraries, Concurrent Statements.

UNIT-II (11 Hrs.)

Applications of VHDL: Combinational Circuit Design such as such as Multiplexers, Encoders, Decoders, Code Converters, Comparators, and Implementation of Boolean functions etc., Sequential Circuit Design such as Shift registers, Counters etc.

UNIT-III (12 Hrs.)

Review of MOS Devices: MOS Structure, Enhancement & Depletion Transistor, Threshold Voltage, MOS device design equations MOS Transistor Models. NMOS, PMOS, CMOS.

Basic Electrical Properties and Circuit Concepts: The NMOS Inverter and Transfer Characteristics pull up and pull down ratios of NMOS, alternative forms of pull up the CMOS Inverter and transfer characteristics. CMOS Inverter Delays. Driving large Capacitive loads, Propagation delays and effect of wiring capacitance.

UNIT-IV (10 Hrs.)

Circuit Characterization and Performance Estimation: Estimation of R, C, L, Switching Characteristics-delay models. Power dissipation. Scaling of MOS circuits. Effect of device scaling on circuit performance.

Recommended Books

1. Bhasker, 'A VHDL Primmer', Prentice Hall.
2. Weste and Eshrighian, 'Principle of CMOS VLSI Design', Pearson Education.
3. D.A. Pucknell and K. Eshraghian, 'Basic VLSI Design', Prentice Hall India, New Delhi.
4. Brown and Vranesic, 'Fundamentals of Digital Logic with VHDL Design', TMH.

VLSI DESIGN LAB.

Subject Code: BECE1-834 **L T P C**
0 0 2 1

Learning Objectives

1. To learn Hardware Descriptive Language(Verilog/VHDL)
2. To learn the fundamental principles of VLSI circuit design in digital and analog domain
3. To familiarize fusing of logical modules on FPGAs
4. To provide hands on design experience with professional design (EDA) platforms.

Learning Outcomes

At the end of the Course, the student should be able to

1. Write HDL code for basic as well as advanced digital integrated circuits.
2. Import the logic modules into FPGA Boards.
3. Synthesize Place and Route the digital IPs.
4. Design, Simulate and Extract the layouts of Analog IC Blocks using EDA tools.

EXPERIMENTS

1. Design of basic Gates: AND, OR, NOT.
2. Design of universal gates
3. Design of 2:1 Mux using other basic gates
4. Design of 2 to 4 Decoder
5. Design of Half-Adder, Full Adder, Half Substractor, Full Substractor
6. Design of 3:8 Decoder
7. Design of 8:3 Priority Encoder
8. Design of 4 Bit Binary to Grey Code Converter
9. Design of 4 Bit Binary to BCD Converter using sequential statement
10. Design an 8 Bit parity generator (with for loop and Generic statements)
11. Design of 2,s Complementary for 8-bit Binary number using Generate statements

Sequential Design Exercises

12. Design of all type of Flip-Flops using (if-then-else) Sequential Constructs
13. Design of 8-Bit Shift Register with shift Right, shift Left, Load and Synchronous reset.
14. Design of Synchronous 8-bit Johnson Counter.
15. Design of Synchronous 8-Bit universal shift register (parallel-in, parallel-out) with 3- state
16. output (IC 74299)
17. Design of 4 Bit Binary to BCD Converter using sequential statement.
18. Design counters (MOD 3, MOD 5, MOD 8, MOD 16)

19. Design a decimal up/down counter that counts up from 00 to 99 or down from 99 to 00.
20. Design 3-line to 8-line decoder with address latch

Note: At least 12 experiments are required to be performed

MAJOR PROJECT

Subject Code: BECE1-835

The students are required to undergo Major Project work and it will be evaluated by the external examiner and one internal examiner appointed by the institute/university. External examiner will be from panel of examiners. Assessment of project will be based on Quality of work, Seminar, viva-voice, report writing. Students can use different hardware and software in order to analyse and verify the results.

CELLULAR AND MOBILE COMMUNICATION

Subject Code: BECE1-874 **L T P C** **Duration: 37 Hrs.**
3 0 0 3

Learning Objectives

1. To understand the radio wave propagation and interference in mobile communications.
2. To understand the basic knowledge about the generations of mobile communication.
3. To study different architectures of mobile communication and its related parameters.
4. To impart the knowledge about applications of mobile communication

Learning Outcomes

Student shall be able to

1. Understand the cellular systems
2. Analyze the concept of switching systems and base station subsystem

UNIT-I

Introduction to Cellular Mobile Systems: A basic cellular system, performance criteria, uniqueness of mobile radio environment, operation of cellular systems, planning a cellular system, analog & digital cellular systems.

Cellular Wireless Communication Systems: Second generation cellular systems: GSM specifications and Air Interface – specifications of various units, 2.5 G systems: GPRS/EDGE specifications and features. 3G Systems: UMTS & CDMA 2000 standards and specifications.

UNIT-II

Elements of Cellular Radio Systems Design: General description of the problem, concept of frequency reuse channels, co–channel interference reduction factor, desired C/I from a normal case in an Omnidirectional antenna system, cell splitting, consideration of the components of cellular systems.

Interference: Introduction to co–channel interference, real time co–channel interference, co–channel measurement design of antenna system, antenna parameter and their effects, diversity receiver in co–channel interference – different types.

UNIT-III

Cell Coverage for Signal &Traffic: General introduction, obtaining the mobile point to point mode propagation over water or flat open area, foliage loss, propagation near in distance, long distance propagation, point to point prediction model – characteristics, cell site, antenna heights and signal coverage cells, mobile to mobile propagation.

UNIT-IV

Cell Site Antennas and Mobile Antennas: Characteristics, antenna at cell site, mobile antennas, Frequency Management and Channel Assignment, Frequency management, fixed channel assignment, non–fixed channel assignment, traffic & channel assignment.

Hand Off, Dropped Calls: hand off, types of handoff and their characteristics, dropped call rates &their evaluation.

Optional Techniques: Parameters, coverage hole filler, leaky feeders, cell splitting and small cells, narrow beam concept.

Recommended Books

1. Kamilo Feher, 'Wireless and Digital Communications', PHI.
2. T.S. Rappaport, 'Wireless Communication, Principles & Practice'.
3. C.Y. Lee, 'Mobile Cellular Telecommunications', McGraw Hill.

WIRELESS SENSOR NETWORKS

Subject Code: BECE1-875	**L T P C** **3 0 0 3**	**Duration: 37 Hrs.**

Learning Objectives

1. This Course introduces advances in wireless, sensor networks.
2. Wireless Sensor Networks provide opportunities even outside their usual application domain of environmental monitoring.
3. To track all activities, and check for errors that might occur in the process of handling and distributing goods.

Learning Outcomes

At the end of the Course the student shall be able to:

1. Understand the existing applications of wireless sensor actuator networks.
2. Understand the elements of distributed computing and network protocol design and will learn to apply these principles in the context of wireless sensor networks.
3. Identify the various hardware, software platforms that exist for sensor networks.

UNIT-I

Introduction to Wireless Sensor Networks: Constraints and Challenges of sensor networks, Emerging technologies for wireless sensor networks, Node architecture, Hardware components overview, Energy consumption of Sensor nodes, Dynamic energy and power management on System level, some examples of Sensor nodes, Optimization goals and figures of merit, QOS, Energy Efficiency, scalability, robustness Advantages of sensor networks, Sensor network applications.

UNIT-II

Topology Control: Location driven, Geographic Adaptive Fidelity (GAF), Geographic Random Forwarding (GeRaF), GEAR, Connectivity driven, SPAN, ASCENT.

UNIT-III

WSN Sensors: Physical Layer Design, Transceiver Design, MAC Protocols for WSN, Low Duty Cycle Protocols &Wakeup Concepts, S-MAC, Mediation Device Protocol, Wakeup Radio

Concepts, Address & Name management, Assignment of MAC Addresses, Routing Protocols, Energy Efficient Routing, Geographic Routing.

UNIT-IV

WSN Platforms &Tools: Sensor Node Hardware, Berkeley Motes, Programming Challenges, Node-level software platforms, Node level Simulators, State-centric programming.

Recommended Books

1. Holger Karl & Andreas Willig, 'Protocols & Architectures for Wireless Sensor Networks', John Wiley & Sons.
2. Waltenegus Dargie and Christian Poellabauer, 'Fundamentals of Wireless Sensor Networks Theory and Practice', John Wiley and Sons.
3. Holger Karl and Andreas Willig, 'Protocols and Architectures for Wireless Sensor Networks', John Wiley and Sons.

INFORMATION THEORY AND CODING

Subject Code: BECE1-876	**L T P C** **3 0 0 3**	**Duration: 37 Hrs.**

Learning Objectives

1. To aware the students about the information theory.
2. To provide the basic concepts of channel capacity.
3. To impart knowledge about linear block codes.
4. To study convolution and BCH codes.

Learning Outcomes

At the end of the Course the student shall be able to:

1. Understand concepts of entropy, mutual information and divergence.
2. Apply and analyze the principles of channel capacity.
3. Use various types of check metrics, linear and cyclic codes.
4. Understand working principle of BCH and convolution codes.

UNIT-I

Information Theory: Definition of Information, Entropy, Mutual Information, Properties of Mutual Information, Fundamental Inequality, I.T. Inequality, Divergence, Properties of Divergence, Divergence Inequality, Relationship between entropy and mutual information, Chain Rules for entropy, relative entropy and mutual information.

UNIT-II

Channel Capacity: Uniform Dispersive Channel, Uniform Focusing Channel, Strongly Symmetric Channel, Binary Symmetric Channel, Binary Erasure Channel. Channel Capacity of the all these channels, Channel Coding Theorem, Shannon-Hartley Theorem.

Data Compression: Kraft inequality, Huffman codes, Shannon-Fano coding, Arithmetic Coding.

UNIT-III

Linear Block Codes: Systematic linear codes and optimum decoding for the binary symmetric channel; Generator and Parity Check matrices, Syndrome decoding on symmetric channels; Hamming codes; Weight enumerators and the MacWilliams identities; Perfect codes. Cyclic Codes, BCH codes

UNIT-IV

Decoding of BCH Codes: Berlekamp's decoding algorithm, Massey's minimum shift register synthesis technique and its relation to Berlekamp's algorithm. A fast Berlekamp - Massey algorithm.

Convolution Codes: Viterbi decoding algorithm, Turbo Codes, Concatenated Codes.

Recommended Books

1. Arijit Saha, 'Information Theory, Coding & Cryptography', Pearson Education.
2. Ranjan Bose, 'Information Theory, Coding and Cryptography', Tata Mc-Graw Hill.
3. Thomas M. Cover, Joy A. Thomas, 'Elements of Information Theory', Wiley India Pvt.
4. J. Mary Jones, 'Information and Coding Theory', Springer.

OPERATING SYSTEMS

Subject Code: BECE1-877 **L T P C** **Duration: 36 Hrs.**
3 0 0 3

Learning Objectives

1. General understanding of structure of modern computers
2. Purpose, structure and functions of operating systems
3. Illustration of key Operating system aspects by example

Learning Outcomes

By the end of the Course you should be able to:

1. Describe the general architecture of computers
2. Describe, contrast and compare differing structures for operating systems
3. Understand and analyze theory and implementation of: processes,
4. Resource control (concurrency etc.), physical and virtual memory, scheduling, I/O and files

UNIT-I

Operating System Concepts an Introduction: What is an OS, Need of OS, Different views of an OS, Evolution of OS, Batch Processing, Multiprocessing, Multiprogramming, Time Sharing, Real Time Systems, Network OS, Parallel Processing, Distributed Processing.

Operating System Structures: OS services, System Calls, System Structures, Layered Architecture of an OS.

Introduction to process: Concept of process, Process states and their transitions, PCB, Process Scheduling, Operations on process: Process creation and termination, Threads: User level and kernel level threads.

UNIT-II

CPU scheduling: Introduction, CPU scheduler, Scheduling criteria, Scheduling algorithms: FCFS, SJF, Priority scheduling, RR scheduling, Multilevel queue scheduling, Multilevel feedback queue scheduling

Process Synchronization: Co-operating process, Concurrency, Semaphores

Deadlocks: Introduction, Deadlock characteristics, Recognition methods, Dealing with deadlocks, Deadlock prevention, avoidance, detection and deadlock recovery.

UNIT-III

Memory Management Basics: Introduction, Logical vs physical address space, Program relocation & management techniques, Continuous storage allocation, Fixed partition contiguous storage allocation, Variable partition CSA, Non-contiguous storage allocation, paging, segmentation.

Virtual Memory: Introduction, Swapping, Demand paging, Pure demand paging FIFO, Optimal,

File System Interface & implementation: File concepts, File naming, File attributes, File access methods, Directory structure.

UNIT-IV

Device Mgmt & Storage Structure: I/O subsystems, I/O channels, Secondary storage, Disk structure, Disk scheduling, FIFO, Shortest seek time first SSTF scan, C-SCAN, Look &C-look Disk scheduling algo's.

Protection & Security Introduction: Introduction, Goals of protection, Access rights, Access matrix, Security & its goals, Authentication, Passwords, Encryption, Viruses, worms, Dealing with viruses.

Case Study: UNIX &WIN NT

Recommended Books

1. Peter Galvin, 'Operating Systems Concepts', Addison wessly.
2. Ekta Walia, 'Operating systems Concepts', Khanna Publisher.

SATELLITE COMMUNICATION

Subject Code: BECE1-878 **L T P C** **Duration: 37 Hrs.**

3 0 0 3

Learning Objectives

1. To introduce various aspects in the design of systems for satellite communication.
2. Students will be able to understand link design for satellite communication.
3. To provide the knowledge of various multiple access techniques.

Learning Outcomes: Students will be:

1. Able to learn the dynamics of the satellite.
2. Able to understand the communication satellite design.
3. Able to understand how analog and digital technologies are used for satellite communication networks.
4. Able to learn the design of satellite links.
5. Able to study the design of Earth station and tracking of the satellites.

UNIT-I

Introduction: Origin of Satellite Communication, Current state of Satellite Communication, Advantages of Satellite Communication, Active & Passive satellite, Orbital aspects of Satellite Communication, System Performance. Communication Satellite Link Design - Introduction, general link design equation, system noise temperature, C/N & G/T ratio, atmospheric & ionosphere effects on link design, complete link design, interference effects on complete link design, earth station parameters.

UNIT-II

Satellite analog & digital communication: Baseband analog (voice) signal, FDMA techniques, S/N ration, SCPC & CSSB systems, digital baseband signals & modulation techniques.

Multiple Access Techniques TDMA frame structure, burst structure, frame efficiency, super frame, frame acquisition & synchronization, TDMA vs FDMA, burst time plan, beam hopping, satellite switched, Erlang call congestion formula, demand assignment ctrl, DA-FDMA system, DATDMA.

UNIT-III

Laser & Satellite Communication Link analysis, optical satellite link Transmitter & Receiver, Satellite, beam acquisition, tracking & pointing, cable chaanel frequency, head end equation, distribution of signal, n/w specifications and architecture, optical fibre CATV system.

UNIT-IV

Satellite Applications Satellite TV, telephone services via satellite, data Communication services, satellites for earth observation, weather forecast, military appliances, scientific studies.

Recommended Books

1. Timothy Pratt, ‘Satellite Communication’, John Wiley & Sons.
2. D.C. Aggarwal, ‘Satellite Communication’, Khanna Publisher.

B.Tech. CSE (3rd SEM.)
TOTAL CONTACT HRS. = 25, TOTAL CREDITS = 23

Course		**Contact Hrs.**			**Marks**			**Credits**
Code	**Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
BCSE1-302	Data Structures	3	1	0	40	60	100	4
BCSE1-303	Object Oriented Programming Using C++	3	0	0	40	60	100	3
BCSE1-304	Digital Circuits & Logical Design	3	0	0	40	60	100	3
BCSE1-305	Computer Architecture & Organization	3	0	0	40	60	100	3
BCSE1-306	Discrete Structures	3	1	0	40	60	100	4
BCSE1-307	Data Structures Laboratory	0	0	2	60	40	100	1
BCSE1-308	Object Oriented Programming Using C++ Laboratory	0	0	2	60	40	100	1
BCSE1-309	Digital Circuit & Logical Design Laboratory	0	0	2	60	40	100	1
BSOS0-F91	Soft Skills-I	0	0	2	60	40	100	1
BCSE1-310	Training-I	-	-	-	60	40	100	2
Total 5 Theory & 4 Lab. Courses		**15**	**2**	**08**	**500**	**500**	**1000**	**23**

B.Tech. CSE (4th SEM.)
TOTAL CONTACT HRS. = 28, TOTAL CREDITS = 22

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Course		**Contact Hrs.**			**Marks**			**Credits**
Code	**Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
BCSE1-411	Operating System	3	0	0	40	60	100	3
BCSE1-412	Database Management Systems-I	3	0	0	40	60	100	3
BCSE1-413	Computer Networks-I	3	0	0	40	60	100	3
BCSE1-414	Design & Analysis Of Algorithms	3	1	0	40	60	100	4
BCSE1-415	Microprocessors & Assembly Languages	3	0	0	40	60	100	3
BCSE1-416	Database Management Systems-I Laboratory	0	0	4	60	40	100	2
BCSE1-417	Computer Networks-I Laboratory	0	0	2	60	40	100	1
BCSE1-418	Design & Analysis of Algorithms Laboratory	0	0	2	60	40	100	1
BCSE1-419	Microprocessors & Assembly Languages Laboratory	0	0	2	60	40	100	1
BSOS0-F92	Soft Skills- II	0	0	2	60	40	100	1
Total 5 Theory & 5 Lab. Courses		**15**	**1**	**12**	**500**	**500**	**1000**	**22**

B.Tech. CSE (5th SEM.)
TOTAL CONTACT HRS. = 23, TOTAL CREDITS = 23

Course		**Contact Hrs.**			**Marks**			**Credits**
Code	**Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
BCSE1-520	Computer Networks-II	3	0	0	40	60	100	3
BCSE1-521	Automata Theory	3	1	0	40	60	100	4
BCSE1-522	JAVA Programming	3	1	0	40	60	100	4
Departmental Elective-I		3	0	0	40	60	100	3
BCSE1-556	Enterprise Resource Planning							
BCSE1-557	Digital Marketing							
BCSE1-558	Computer Graphics							
Open Elective –I		3	0	0	60	40	100	3
BCSE1-523	Computer Networks-II Laboratory	0	0	2	60	40	100	1
BCSE1-524	JAVA Programming Laboratory	0	0	2	60	40	100	1
BSOS0-F93	Soft Skills-III	0	0	2	60	40	100	1
BCSE1-525	Training II	-	-	-	40	60	100	3
Total 5 Theory & 3 Lab. Courses		**15**	**2**	**06**	**440**	**460**	**900**	**23**

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B.Tech. CSE (6th SEM.)
TOTAL CONTACT HRS. = 24, TOTAL CREDITS = 22

Course		**Contact Hrs.**			**Marks**			**Credits**
Code	**Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
BCSE1-626	Software Engineering	**3**	**1**	**0**	**40**	**60**	**100**	**4**
BCSE1-627	Compiler Design	**3**	**1**	**0**	**40**	**60**	**100**	**4**
Department Elective-II		**3**	**1**	**0**	**40**	**60**	**100**	**4**
BCSE1-659	Mobile app development							
BCSE1-660	Distributed Computing							
BCSE1-661	Multimedia & Virtual Reality							
Departmental Elective-III		**3**	**1**	**0**	**40**	**60**	**100**	**4**
BCSE1-662	Web Technologies							
BCSE1-663	Cryptography & Network Security							
BCSE1-664	Data Mining & Warehousing							
Open Elective-II		**3**	**0**	**0**	**40**	**60**	**100**	**3**
BCSE1-628	Software Engineering Laboratory	**0**	**0**	**2**	**60**	**40**	**100**	**1**
BCSE1-629	Web Engineering Laboratory	**0**	**0**	**2**	**60**	**40**	**100**	**1**
BSOS0-F93	Soft Skills-III	**0**	**0**	**2**	**40**	**60**	**100**	**1**
Total 5 Theory & 2 Lab. Courses		**16**	**4**	**4**	**360**	**440**	**800**	**22**

B. Tech. CSE (7th SEM.)
TOTAL CONTACT HRS. = 27, TOTAL CREDITS = 25

Course		Contact Hrs.			Marks			Credits
Code	**Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
BCSE1-730	Database Management Systems-II	**3**	**1**	**0**	**40**	**60**	**100**	**4**
BCSE1-731	Object Oriented Analysis And Design Using UML	**3**	**1**	**0**	**40**	**60**	**100**	**4**
Departmental Elective-IV		**3**	**1**	**0**	**40**	**60**	**100**	**4**
BCSE1-765	Linux & Unix Systems							
BCSE1-766	Artificial Intelligence							
BCSE1-767	Software Testing & Quality Assurance							
Open Elective-III		**3**	**0**	**0**	**40**	**60**	**100**	**3**
BCSE1-732	Database Management Systems-II Laboratory	**0**	**0**	**2**	**60**	**40**	**100**	**1**
BCSE1-733	Object Oriented Analysis And Design Using UML Laboratory	**0**	**0**	**2**	**60**	**40**	**100**	**1**
BCSE1-734	Training-III	**-**	**-**	**-**	**40**	**60**	**100**	**4**
BCSE1-735	Project-I	**-**	**-**	**8**	**40**	**60**	**100**	**4**
Total 4 Theory & 3 Lab. Courses		**12**	**3**	**12**	**360**	**440**	**800**	**25**

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B. Tech. CSE (8th SEM.)

TOTAL CONTACT HRS. = 22, TOTAL CREDITS = 15

Course		Contact Hrs.			Marks			Credits
Code	**Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
BCSE1-836	Cloud Computing & Bigdata	**3**	**1**	**0**	**40**	**60**	**100**	**4**
Departmental Elective-V								
BCSE1-868	Scripting Languages	**3**	**1**	**0**	**40**	**60**	**100**	**4**
BCSE1-869	Software Project Management							
BCSE1-870	Wireless Sensor Network							
BCSE1-837	Cloud Computing & Bigdata Laboratory	**0**	**0**	**2**	**60**	**40**	**100**	**1**
BCSE1-838	Project-II	**0**	**0**	**12**	**40**	**60**	**100**	**6**
Total 2 Theory & 2 Lab. Courses		**6**	**2**	**14**	**180**	**220**	**400**	**15**

Total Credits = 25 + 25 + 23 + 22 + 23 + 22 + 25 + 15 = 180

DATA STRUCTURES

Subject Code- BCSE1-302 **L T P C** **Duration – 45 Hrs.**
3 1 0 4

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LEARNING OBJECTIVES

To learn the concepts of data structure and algorithms and its implementation. The course has the main ingredients required for a computer science graduate and has all the necessary topics for assessment of data structures and algorithms.

LEARNING OUTCOMES

CO1 Able to comprehend the basic concepts of memory management, data structure, Algorithms and Asymptotic notation.

CO2 Understand and implement linear data structures such as arrays, linked lists, stacks and Queues.

CO3 Understand the concepts of non-linear data structures such as graphs, trees and heaps.

CO4 Able to describe and implement hashing, Searching and Sorting Techniques

UNIT-I (11 Hrs.)

Introduction: Data Structures and data types, Efficient use of memory, Recursion, operations on data structures, time and space complexity of algorithms, Asymptotic Notations.

Arrays: Linear and multi-dimensional arrays and their representation in memory, operations on arrays, sparse matrices and their storage.

UNIT-II (12 Hrs.)

Linked Lists: Singly linked lists, operations on link list, linked stacks and queues, polynomial addition, sparse matrices, doubly linked lists and dynamic storage management, circular linked list,

Stacks and Queues: Concepts of stack and queues, memory representations, operations on stacks and queues, application of stacks such as parenthesis checker, evaluation of postfix expressions, conversion from infix to postfix representation, implementing recursive functions, deque, priority queue, applications of queues. Garbage collection,

UNIT-III (11 Hrs.)

Trees: Basic terminology, sequential and linked representations of trees, traversing a binary tree using recursive and non-recursive procedures, inserting a node, deleting a node, brief introduction to threaded binary trees, AVL trees and B-trees. Representing a heap in memory, operations on heaps, application of heap in implementing priority queue and heap sort algorithm.

Graphs: Basic terminologies, representation of graphs (adjacency matrix, adjacency list), traversal of a graph (breadth-first search and depth-first search), and applications of graphs. Dijkstra's algorithm for shortest path, Minimal Spanning tree.

UNIT-IV (11 Hrs.)

Hashing & Hash Tables: Comparing direct address tables with hash tables, hash functions, concept of collision and its resolution using open addressing and separate chaining, double hashing, rehashing

Searching & Sorting: Searching an element using linear search and binary search techniques, Sorting arrays using bubble sort, selection sort, insertion sort, quick sort, merge sort, heap sort, shell sort and radix sort, complexities of searching & sorting algorithms.

RECOMMENDED BOOKS:

1. Tenenbaum, Augenstein, & Langsam, 'Data Structures using C and C++', 2nd Edn., Prentice Hall of India, **2009**.
2. Seymour Lipschutz, 'Data Structures, Schaum's Outline Series', 1st Edn., Tata McGraw

Hill, **2005**.
3. R.S. Salaria, 'Data Structures & Algorithms Using C++', 3rd Edn., Khanna Book Publishing Co. (P) Ltd, **2012.**
4. Kruse, 'Data Structures & Program Design', 3rd Edn., Prentice Hall of India, **1994.**
5. Michael T. Goodrich, Roberto Tamassia, & David Mount, 'Data Structures and Algorithms in C++', 2nd Edn., Wiley India, **2016**.
6. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein, 'Introduction to Algorithms', 3rd Edn., PHI Learning Pvt. Ltd-New Delhi, **2009**.
7. Ellis Horowitz, Sartaj Sahni, & Dinesh Mehta, 'Fundamentals of Data Structures in C++', 2nd Edn., Orient Longman, **2008**.
8. Malik, 'Data Structures using C++', 2nd Edn., Cengage Learning, **2012**.

OBJECT ORIENTED PROGRAMMING USING C++

Subject Code- BCSE1-303	**L T P C** **3 0 0 3**	**Duration: 36 Hrs.**

LEARNING OBJECTIVES

To introduce the principles and paradigms of Object Oriented Programming Language for design and implement the Object Oriented System

LEARNING OUTCOMES

CO1 To introduce the basic concepts of object oriented programming language and its representation

CO2 To allocate dynamic memory, access private members of class and the behavior of inheritance and its implementation.

CO3 To introduce polymorphism, interface design and overloading of operator.

CO4 To handle backup system using file, general purpose template and handling of raised exception during programming

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UNIT-I

Introduction to C++, C++ Standard Library, Illustrative Simple C++ Programs. Header Files, Namespaces, Application of object oriented programming.

Object Oriented Concepts, Introduction to Objects and Object Oriented Programming, Encapsulation, Polymorphism, Overloading, Inheritance, Abstract Classes, Accessifier (public/ protected/ private), Class Scope and Accessing Class Members, Controlling Access Function, Constant, Class Member, Structure and Class.

UNIT-II

Friend Function and Friend Classes, This Pointer, Dynamic Memory Allocation and Deallocation (New and Delete), Static Class Members, Constructors, parameter Constructors and Copy Constructors, Deconstructors,

Introduction of inheritance, Types of Inheritance, Overriding Base Class Members in a Derived Class, Public, Protected and Private Inheritance, Effect of Constructors and Deconstructors of Base Class in Derived Classes.

UNIT-III

Polymorphism, Pointer to Derived class, Virtual Functions, Pure Virtual Function, Abstract Base Classes, Static and Dynamic Binding, Virtual Deconstructors.

Fundamentals of Operator Overloading, Rules for Operators Overloading, Implementation of Operator Overloading Like <<, >> Unary Operators, Binary Operators.

UNIT-IV

Text Streams and binary stream, Sequential and Random Access File, Stream Input/ Output Classes, Stream Manipulators.

Basics of C++ Exception Handling, Try, Throw, Catch, multiple catch, Re-throwing an Exception, Exception specifications.

Templates: Function Templates, Overloading Template Functions, Class Template, Class Templates and Non- Type Template arguments.

RECOMMENDED BOOKS:

1. Robert Lafore, 'Object Oriented Programming in Turbo C++', 2nd Edn., The WAITE Group Press, **1994**.
2. Herbert shield, 'The Complete Reference C ++', 4th Edn., Tata McGraw Hill, **2003**.
3. Shukla, 'Object Oriented Programming in C++', Wiley India, **2008**.
4. H.M. Deitel and P.J. Deitel, 'C++ How to Program', 2nd Edn., Prentice Hall, **1998**.
5. D. Ravichandran, 'Programming with C++', 3rd Ed., Tata McGraw Hill, **2003**.
6. Bjarne Stroustrup, 'The C++ Programming Language', 4th Edn., Addison Wesley, **2013**.
7. R.S. Salaria, 'Mastering Object-Oriented Programming with C++', Salaria Publishing House, **2016**.

DIGITAL CIRCUITS & LOGICAL DESIGN

Subject Code- BCSE1-304 **L T P C** **Duration: 36 Hrs.**
3 0 0 3

LEARNING OBJECTIVES

To learn the basic methods for the design of digital circuits and provide the fundamental concepts used in the design of digital systems.

LEARNING OUTCOMES

CO1 To represent numerical values and perform number conversions between different number systems. Also acquire knowledge of Boolean algebra and minimization methods for designing combinational Systems.

CO2 Study and analyze the basic logic gates and various logic families. To Analyze and Design digital combinational circuits.

CO3 Analyze and design flip-flops and latches and design sequential systems composed of standard sequential modules, such as counters and registers.

CO4 To acquire Knowledge of the nomenclature and technology in the area of memory devices and about various analog and digital signals with their conversion techniques.

UNIT-I

Number Systems: Binary, Octal, Decimal, Hexadecimal. Number base conversions, 1's, 2's, rth's complements, signed Binary numbers. Binary Arithmetic, Binary codes: Weighted BCD, Gray code, Excess 3 code, ASCII – conversion from one code to another.

Boolean Algebra: Boolean postulates and laws – De-Morgan's Theorem, Principle of Duality, Boolean expression Boolean function, Minimization of Boolean expressions – Sum of Products (SOP), Product of Sums (POS), Minterm, Maxterm, Canonical forms, Conversion between canonical forms, Karnaugh map Minimization, Quine-McCluskeymethod - Don't care conditions.

UNIT-II

Logic GATES: AND, OR, NOT, NAND, NOR, Exclusive-OR and Exclusive-NOR. Implementations of Logic Functions using gates, NAND-NOR implementations. Study of logic families like RTL, DTL, DCTL, TTL, MOS, CMOS, ECL and their characteristics.

Combinational Circuits: Design procedure – Adders, Subtractors, Serial adder/ Subtractor, Parallel adder/ Subtractor Carry look ahead adder, BCD adder, Magnitude Comparator, Multiplexer/ Demultiplexer, encoder/decoder, parity checker, code converters. Implementation of combinational logic using MUX.

UNIT-III

Sequential Circuits: Flip flops SR, JK, T, D and Master slave, Excitation table, Edge triggering, Level Triggering, Realization of one flip flop using other flip flops. Asynchronous/Ripple counters, Synchronous counters, Modulo-n counter, Ring Counters, Design of Synchronous counters: state diagram, Circuit implementation, Shift registers.

UNIT-IV

Memory Devices: Classification of memories, RAM organization, Write operation, Read operation, Memory cycle. Static RAM Cell-Bipolar, RAM cell, MOSFET RAM cell, Dynamic RAM cell. ROM organization, PROM, EPROM, EEPROM, Field Programmable Gate Arrays (FPGA)

Signal Conversions: Analog & Digital signals. A/D and D/A conversion techniques (Weighted type, R-2R Ladder type, Counter Type, Dual Slope type, Successive Approximation type).

RECOMMENDED BOOKS

1. Thomas L. Floyd, 'Digital Fundamentals', 11th Rev Edn., Pearson Education, Inc, New Delhi, **2014**.
2. Morris Mano, 'Digital Design', Prentice Hall of India Pvt. Ltd, **2001**.
3. Donald P. Leach and Albert Paul Malvino, 'Digital Principles and Applications', 5th Edn., Tata McGraw Hill Publishing Company Limited, New Delhi, **2003**.
4. R.P. Jain, 'Modern Digital Electronics', 3rd Edn., Tata McGraw–Hill Publishing Company Limited, New Delhi, **2003**.
5. Ronald J. Tocci, Neal S. Widmer, Gregory L. Moss, 'Digital System-Principles and Applications', 10th Edn., Pearson Education, **2009.**
6. Subrata Ghosal, 'Digital Electronics', 1st Edn., Cengage Learning, **2012**.

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COMPUTER ARCHITECTURE & ORGANISATION

Subject Code- BCSE1-305 **L T P C** **Duration: 36 Hrs.**
3 0 0 3

LEARNING OBJECTIVES

To have a thorough understanding of the basic structure, operation of a digital computer and study the different ways of communicating with I/O devices and standard I/O interfaces, the hierarchical memory system including cache memories and virtual memory.

LEARNING OUTCOMES

CO1 Ability to understand how computer hardware has evolved to meet the needs of multiprocessing systems, Instruction Set Architecture: Instruction format, types, various addressing modes, the basic components and design of the CPU: the ALU and control unit.

CO2 Understand the memory organization: SRAM, DRAM, concepts on cache memory, Memory Interleaving, Associative memory, Virtual memory organization.

CO3 Ability to understand the parallelism both in terms of a single processor and multiple processors.

CO4 Understand the I/O Organization: Basics of I/O, Memory-mapped I/O & I/O mapped I/O, types of I/O transfer: Program controlled I/O, Interrupt-driven I/O, DMA.

UNIT-I (11 Hrs.)

General System Architecture: Store program control concept, Flynn's classification of computers (SISD, MISD, MIMD); Multilevel viewpoint of a machine: digital logic, micro architecture, ISA, operating systems, high level language; structured organization; CPU, caches, main memory, secondary memory units & I/O; Performance metrics; MIPS, MFLOPS.

Instruction Set Architecture: Instruction set based classification of processors (RISC, CISC, and their comparison); addressing modes: register, immediate, direct, indirect, indexed; Operations in the instruction set; Arithmetic and Logical, Data Transfer, Machine Control Flow.

UNIT-II (12 Hrs.)

Basic non pipelined CPU Architecture: CPU Architecture types (accumulator, register, stack, memory/ register) detailed data path of a typical register based CPU, Fetch-Decode-Execute cycle (typically 3 to 5 stage); microinstruction sequencing, implementation of control unit, Enhancing performance with pipelining. Hardwired control design method, Micro programmed control unit.

UNIT-III (11 Hrs.)

Memory Hierarchy & I/O Techniques: The need for a memory hierarchy (Locality of reference principle, Memory hierarchy in practice: Cache, main memory and secondary memory, Memory parameters: access/ cycle time, cost per bit); Main memory (Semiconductor RAM & ROM organization, memory expansion, Static & dynamic memory types); Cache memory (Associative & direct mapped cache organizations. Allocation & replacement polices, segments, pages & file organization, virtual memory.

UNIT-IV (11 Hrs.)

Introduction to Parallelism: Goals of parallelism (Exploitation of concurrency, throughput enhancement); Amdahl’s law; Instruction level parallelism (pipelining, super scaling –basic features); Processor level parallelism (Multiprocessor systems overview).

Computer Organization [80x86]: Instruction codes, computer register, computer instructions, timing and control, instruction cycle, type of instructions, memory reference, register reference. I/O reference, Basics of Logic Design, accumulator logic, Control memory, address sequencing, micro-instruction formats, micro-program sequencer, Stack Organization, Instruction Formats, Types of interrupts; Memory Hierarchy. Programmed I/O, DMA & Interrupts.

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RECOMMENDED BOOKS

1. David A. Patterson and John L. Hennessy, ‘Computer Organization and Design’, 2nd Edn., Morgan Kauffmann Publishers, **1997**.
2. John P. Hayes, ‘Computer Architecture and Organization’, 3rd Edn., TMH, **1998**.
3. William Stallings, ‘Operating Systems Internals and Design Principles’, 4th Edn., Prentice-Hall Upper Saddle River, New Jersey, **2001**.
4. Carl Hamacher and Zvonko Vranesic, ‘Computer Organization’, 5th Edn., SafwatZaky, **2002**.
5. A.S. Tanenbaum, ‘Structured Computer Organisation’, 4th Edn., Prentice-Hall of India, Eastern Economic Edition, **1999**.
6. W. Stallings, ‘Computer Organisation & Architecture: Designing for Performance’, 4th Edn., Prentice-Hall International Edition, **1996**.
7. M. Mano, ‘Computer Architecture & Organisation’, Prentice-Hall, **1990**.
8. Nicholas Carter, ‘Computer Architecture’, T.M.H., **2002**.

DISCRETE STRUCTURES

Subject Code- BCSE1-306 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

LEARNING OBJECTIVES

To learn the ability to distinguish between the tractability and intractability of a given computational problem. To be able to devise fast and practical algorithms for real-life problems using the algorithm design techniques and principles learned in this course.

LEARNING OUTCOME

CO1 To study various fundamental concepts of Set Theory and Logics.
CO2 To study the Functions and Combinatorics.
CO3 To study and understand the Relations, diagraphs and
CO4 To study the Algebraic Structures.

UNIT-I (11 Hrs.)

Sets, relations and functions: Introduction, Combination of Sets, ordered pairs, proofs of general identities of sets, relations, operations on relations, properties of relations and functions, Hashing Functions, equivalence relations, compatibility relations, partial order relations.

Basic Logic: Propositional logic, Logical connectives, Truth tables, Normal forms (conjunctive and disjunctive), Validity of well-formed formula, Propositional inference rules (concepts of modus ponens and modus tollens), Predicate logic, Universal and existential quantification, Limitations of propositional and predicate logic.

UNIT-II (10 Hrs.)

Combinatorial Mathematics: Basic counting principles Permutations and combinations Inclusion and Exclusion Principle Recurrence relations, Generating Function, Application.

UNIT-III (12 Hrs.)

Probability Distributions: Probability, Bayes theorem, Discrete & Continuous probability distributions, Moment generating function, Probability generating function, Properties and applications of Binomial, Poisson and normal distributions.

Graph Theory: Graph- Directed and undirected, Eulerian chains and cycles, Hamiltonian chains and cycles Trees, Chromatic number Connectivity, Graph coloring, Plane and connected graphs, Isomorphism and Homomorphism. Applications.

UNIT-IV (12 Hrs.)

Monoids and Groups: Groups Semigroups and monoids Cyclic semigraphs and submonoids, Subgroups and Cosets. Congruence relations on semigroups. Morphisms. Normal subgroups. Dihedral groups.

Rings and Boolean Algebra: Rings, Subrings, morphism of rings ideals and quotient rings. Euclidean domains Integral domains and fields Boolean Algebra direct product morphisms Boolean sub-algebra Boolean Rings Application of Boolean algebra (Logic Implications, Logic Gates, Karnaugh map)

RECOMMENDED BOOKS

1. Lipschutz, 'Discrete Mathematics (Schaum Series)', 3rd Edn., McGraw Hill, **2009**.
2. Alan Doerr and Kenneth Levarseur, 'Applied Discrete Structures for Computer Science', Galgotia Publications, **2009**.
3. N. Ch SN Iyengar, V.M. Chandrasekaran, 'Discrete Mathematics', 1st Edn., Vikas Publication House, **2003**.
4. S. Santha, 'Discrete Mathematics and Graph Theory', 1st Edn., Cengage Learning.

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5. Kenneth H. Rosen, 'Discrete Mathematics and its Applications', 7th Edn., McGraw Hill, **2008**.
6. C.L. Liu, 'Elements of Discrete Mathematics', 4th Edn., McGraw Hill, **2012**.
7. Satinder Bal Gupta, 'Discrete Mathematics and Structures', 4th Edn., Laxmi Publications, **2008**.

DATA STRUCTURES LAB.

Subject Code- BCSE1-307 **L T P C**
0 0 2 1

LEARNING OUTCOMES

CO1 To introduce the basic concepts of Data structure, basic data types, searching and sorting based on array data types.

CO2 To introduce the structured data types like Stacks and Queue and its basic operation's implementation

CO3 To introduces dynamic implementation of linked list

CO4 To introduce the concepts of Tree and graph and implementation of traversal algorithms.

PRACTICALS

1. Write a program for Linear search methods.
2. Write a program for Binary search methods.
3. Write a program for insertion sort, selection sort and bubble sort.
4. Write a program to implement Stack and its operation.
5. Write a program for quick sort.
6. Write a program for merge sort.
7. Write a program to implement Queue and its operation.
8. Write a program to implement Circular Queue and its operation.
9. Write a program to implement singly linked list for the following operations: Create, Display, searching, traversing and deletion.
10. Write a program to implement doubly linked list for the following operations: Create, Display, inserting, counting, searching, traversing and deletion.
11. Write a program to implement circular linked list for the following operations: Create, Display, inserting, counting, searching, traversing and deletion.
12. Write a program to implement insertion, deletion and traversing in B tree

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OBJECT ORIENTED PROGRAMMING USING C++ LAB.

Subject Code- BCSE1-308 **L T P C**
0 0 2 1

PRACTICALS

1. Classes and Objects- Write a program that uses a class where the member functions are defined inside a class.
2. Classes and Objects- Write a program that uses a class where the member functions are defined outside a class.
3. Classes and Objects- Write a program to demonstrate the use of static data members.
4. Classes and Objects- Write a program to demonstrate the use of const data members.
5. Constructors and Destructors- Write a program to demonstrate the use of zero argument and parameterized constructors.
6. Constructors and Destructors- Write a program to demonstrate the use of dynamic constructor.

7. Constructors and Destructors- Write a program to demonstrate the use of explicit constructor.
8. Initializer Lists- Write a program to demonstrate the use of initializer list.
9. Operator Overloading- Write a program to demonstrate the overloading of increment and decrement operators.
10. Operator Overloading- Write a program to demonstrate the overloading of binary arithmetic operators.
11. Operator Overloading- Write a program to demonstrate the overloading of memory management operators.
12. Typecasting- Write a program to demonstrate the typecasting of basic type to class type.
13. Typecasting- Write a program to demonstrate the typecasting of class type to basic type.
14. Typecasting- Write a program to demonstrate the typecasting of class type to class type.
15. Inheritance- Write a program to demonstrate the multilevel inheritance

DIGITAL CIRCUIT & LOGICAL DESIGN LAB.

Subject Code- BCSE1-309 **L T P C**
0 0 2 1

LEARNING OUTCOMES

CO1 To Familiarization with Digital Trainer Kit and associated equipment.
CO2 To Study and design of TTL gates
CO3 To learn the formal procedures for the analysis and design of combinational circuits.
CO4 To learn the formal procedures for the analysis and design of sequential circuits
PRACTICALS: Implementation all experiments with help of Bread- Board.

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1. Study of Logic Gates: Truth-table verification of OR, AND, NOT, XOR, NAND and NOR gates; Realization of OR, AND, NOT and XOR functions using universal gates.
2. Half Adder / Full Adder: Realization using basic and XOR gates. 13 13 Punjab Technical University B. Tech. Computer Science Engineering (CSE)
3. Half Subtractor / Full Subtractor: Realization using NAND gates.
4. 4-Bit Binary-to-Gray & Gray-to-Binary Code Converter: Realization using XOR gates.
5. 4-Bit and 8-Bit Comparator: Implementation using IC7485 magnitude comparator chips.
6. Multiplexer: Truth-table verification and realization of Half adder and Full adder using IC74153 chip.
7. Demultiplexer: Truth-table verification and realization of Half subtractor and Full subtractor using IC74139 chip.
8. Flip Flops: Truth-table verification of JK Master Slave FF, T-type and D-type FF using IC7476 chip.
9. Asynchronous Counter: Realization of 4-bit up counter and Mod-N counter using IC7490 & IC7493 chip.
10. Synchronous Counter: Realization of 4-bit up/down counter and Mod-N counter using IC74192 & IC74193 chip.
11. Shift Register: Study of shift right, SIPO, SISO, PIPO, PISO & Shift left operations using IC7495 chip.
12. DAC Operation: Study of 8-bit DAC (IC 08/0800 chip), obtain staircase waveform using IC7493 chip.
13. ADC Operations: Study of 8-bit ADC.

OPERATING SYSTEMS

Subject Code: BCSE1-411 **L T P C** **Duration: 38 Hrs.**
3 0 0 3

LEARNING OBJECTIVES

To understand the services and design of Operating Systems. To understand the organization of file systems and process scheduling and memory management

LEARNING OUTCOMES

CO1 Understanding operating system functions, Role of operating system, different structures and views of Operating system.

CO2 Process management CPU scheduling, Scheduling Algorithms, PCB, Process synchronization, Deadlocks, Prevention, Detection and Recovery.

CO3 Memory Management Overlays, Memory management policies, Fragmentation and its types, Portioned memory managements, Paging, Segmentation, Ned of Virtual memories, Page replacement Algorithms, Concept of Thrashing.

CO4 Device Management, I/O system and secondary storage structure, Device management policies, Role of I/O traffic controller File Management File System Architecture, Layered Architecture, Physical and Logical File Systems, Protection and Security. Brief study to multiprocessor and distributed operating systems.

UNIT-I

Introductory Concepts: Operating System functions and characteristics, historical evolution of operating systems, Real time systems, Distributed systems, Methodologies for implementation of O/S service, system calls, system programs, interrupt mechanisms.

Processes: Processes model, process states, process hierarchies, implementation of processes, data structures used such as process table, PCB creation of processes, context switching, exit of processes. Interprocess communication: Race conditions, critical sections, problems of mutual exclusion, Peterson's solution, producer-consumer problem, semaphores, counters, monitors, message passing.

UNIT-II

Process Scheduling: objective, preemptive vs non- preemptive scheduling, comparative assessment of different algorithms such as round robin, priority bases scheduling, FCFS, SJF, multiple queues with feedback.

Deadlocks: conditions, modeling, detection and recovery, deadlock avoidance, deadlock prevention.

Memory Management: Multiprogramming with fixed partition, variable partitions, virtual partitions, virtual memory, paging, demand paging design and implementation issues in paging such as page tables, inverted page tables, page replacement algorithms, page fault handling, working set model, local vs global allocation, page size, segmentation and paging.

UNIT-III

File Systems: File type, attributes, access and security, file operations, directory structures, path names, directory operations, implementation of file systems, implementation of file and file operations calls, implementation of directories, sharing of files, disk space management, block allocation, free space management, logical file system, physical file system.

Device Management: Techniques for device management, dedicated devices, shred devices, virtual devices, device characteristics -hardware considerations: input and output devices, storage devices, independent device operation, buffering, multiple paths, device allocation considerations.

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UNIT-IV

Distributed Systems: Introduction to II/W and S/W concepts in distributed systems, Network operating systems and NFS, NFS architecture and protocol, client- server model, distributed file systems, RPC- Basic operations, parameter passing, RPC semantics in presence of failures threads and thread packages.

Case Studies: LINUX / UNIX Operating System and Windows based operating systems. Recent trends in operating system

RECOMMENDED BOOKS

1. J.L. Peterson & Silberschatz, 'Operating System Concepts', 4th Edn., Addison Wesley, **1994**.
2. Brinch, Hansen, 'Operating System Principles', PHI, **2001**.
3. A.S. Tenanbaum, 'Operating System', PHI.
4. Dhamdhere, 'Systems Programming & Operating Systems', Tata McGraw-Hill Education, **1999**.
5. Gary Nutt, 'Operating Systems Concepts', 3rd Edn., Pearson/Addison Wesley, **2004**.
6. William Stallings, 'Operating System', 5th Edn., Pearson Education India, **2005**.

DATABASE MANAGEMENT SYSTEMS-I

Subject Code- BCSE1-412 **L T P C** **Duration: 45 Hrs.**
3 0 0 3

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LEARNING OBJECTIVES

To familiarize the students with Data Base Management system

LEARNING OUTCOMES

CO1 To provide introduction to database systems and various models.
CO2 To provide introduction to relational model and SQL
CO3 To understand about Query Processing and Transaction Processing.
CO4 To learn the concept of failure recovery and concurrency control

UNIT-I (11 Hrs.)

Introduction to Database Systems: File Systems Versus a DBMS, Advantages of a DBMS, Describing and Storing Data in a DBMS, Database System Architecture, DBMS Layers, Data independence.

Data Models: Relational Model, Network Model, Hierarchical Model, ER Model: Entities, Attributes and Entity Sets, Relationships and Relationship Sets, Constraints, Weak Entities, Class Hierarchies, Aggregation, Conceptual Database Design with the ER Model, Comparison of Models.

UNIT-II (12 Hrs.)

The Relational Model: Introduction to the Relational Model, ER to Relational Model Conversion, Integrity Constraints over Relations, Enforcing Integrity Constraints, Relational Algebra, Relational Calculus, Querying Relational Data

Relational Query Languages: SQL: Basic SQL Query, Creating Table and Views, SQL as DML, DDL and DCL, SQL Algebraic Operations, Nested Queries, Aggregate Operations, Integrity Constraints in SQL.

UNIT-III (11 Hrs.)

Database Design: Functional Dependencies, Reasoning about Functional Dependencies, Normal Forms, Schema Refinement, 1NF, 2NF, 3NF, BCNF, 4NF, 5NF, Domain Key Normal Forms.

Transaction and Concurrency Management: ACID Properties, Serializability, Two-phase Commit Protocol, 2PL protocol, Lost Update Problem, Inconsistent Read Problem. Concurrency Control, Lock Management, Read-Write Locks, Deadlocks Handling.

UNIT-IV (11 Hrs.)

Physical Data Organization: File Organization and Indexing, Index Data Structures, Hashing, B-trees, Clustered Index, Sparse Index, Dense Index, Fixed length and Variable Length Records.

Database Protection: Threats, Access Control Mechanisms: Discretionary Access Control, Mandatory Access Control, Grant and Revoke, Role Based Security, Encryption and Digital Signatures.

RECOMMENDED BOOKS:

1. Abraham Silberschatz, Henry F. Korth, S. Sudarshan, 'Database System Concepts', 6th Edn., Tata McGraw-Hill, **2011**.
2. Ramez Elmasri, ShamkantNavathe, 'Fundamentals of Database Systems', 5th Edn., Pearson Education, **2010**.
3. C.J. Date, 'An Introduction to Database Systems', Pearson Education, 8th Edn., **2006**.
4. Alexis Leon, Mathews Leon, 'Database Management Systems', Leon Press, 1st Edn., **2008.**
5. S.K. Singh, 'Database Systems Concepts, Design and Applications', 2nd Edn., Pearson Education, **2011**.
6. Raghu Ramakrishnan, Johannes Gehrke, 'Database Management Systems', 3rd Edn., Tata McGraw-Hill, **2014.**

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COMPUTER NETWORKS-I

Subject Code- BCSE1-413 **L T P C** **Duration: 38 Hrs.**
3 0 0 3

LEARNING OBJECTIVES

This course introduces students to computer networks and concentrates on building a firm foundation for understanding Data Communications and Computer Networks. It is based around the OSI Reference Model which deals with the major issues in the bottom four (Physical, Data Link, Network and Transport) layers of the model. They are also introduced to the areas of Network Security and Mobile Communications.

LEARNING OUTCOMES

CO1 to provide knowledge about various types of networking, networks and network topologies. Also acquire knowledge about concepts of OSI reference model and real world protocol suite such as TCP/IP.

CO2 Outline the basic network configurations, various Multiplexing and Switching Techniques.

CO3 Analyse, specify and design the Addressing Schemes and routing strategies for an IP based networking infrastructure

CO4 Operations of TCP/UDP, FTP, HTTP, SMTP, SNMP and Security and protection issues etc.

UNIT-1

Introduction to Computer Networks: Data Communication System and its components, Data Flow, Computer network and its goals, Types of computer networks: LAN, MAN, WAN, Wireless and wired networks, broadcast and point to point networks, Network topologies, Network software: concept of layers, protocols, interfaces and services, ISO-OSI reference model, TCP/IP reference model.

UNIT-II

Physical Layer: Concept of Analog & Digital Signal, Bandwidth, Transmission Impairments: Attenuation, Distortion, Noise, Data rate limits: Nyquist formula, Shannon Formula, Multiplexing: Frequency Division, Time Division, Wavelength Division, Introduction to Transmission Media: Twisted pair, Coaxial cable, Fiber optics, Wireless transmission (radio, microwave, infrared), Switching: Circuit Switching, Message Switching, Packet Switching & their comparisons.

Data Link Layer: Framing, Error detection and correction codes: checksum, CRC, hamming code, Data link protocols for noisy and noiseless channels, Sliding Window Protocols: Stop & Wait ARQ, Go-back-N ARQ, Selective repeat ARQ, Data link protocols: HDLC and PPP.

UNIT-III

Medium Access Sub-Layer: Static and dynamic channel allocation, Random Access: ALOHA, CSMA protocols, Controlled Access: Polling, Token Passing, IEEE 802.3 frame format, Ethernet cabling, Manchester Encoding, collision detection in 802.3, Binary exponential back off algorithm.

Network Layer: Design issues, IPv4 classful and classless addressing, subnetting, IPv6, Routing algorithms: distance vector and link state routing, Congestion control: Principles of Congestion Control, Congestion prevention policies, Leaky bucket and token bucket algorithms

UNIT-IV

Transport Layer: Elements of transport protocols: addressing, connection establishment and release, flow control and buffering, multiplexing and de-multiplexing, crash recovery, introduction to TCP/UDP protocols and their comparison, Sockets.

Application Layer: World Wide Web (WWW), Domain Name System (DNS), E-mail, File Transfer Protocol (FTP), SMTP, POP, HTTP, Introduction to Network security

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RECOMMENDED BOOKS:

1. Andrew S. Tanenbaum, 'Computer Networks', 4th Edn., Pearson Education, **2002**.
2. Behrouz A. Forouzan, 'Data Communication & Networking', 4th Edn., Tata McGraw Hill, **2006**.
3. James F. Kurose and Keith W. Ross, 'Computer Networking', 3rd Edn., Pearson Education, **2012**.
4. W. Stallings, 'Data & Computer Communications', 9th Edn., PHI, **2014**.
5. Douglas E. Comer, 'Internetworking with TCP/IP', Volume-I, 2nd Edn., Prentice Hall, India, **1996**.
6. Greg Tomsho, 'Guide to Networking Essentials', 6th Ed.., Cengage Learning, **2011**.
7. Michael W. Graves, 'Handbook of Networking', Cengage Learning.

DESIGN & ANALYSIS OF ALGORITHMS

Subject Code- BCSE1-414 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

LEARNING OBJECTIVES: To learn the ability to distinguish between the tractability and intractability of a given computational problem. To be able to devise fast and practical algorithms for real-life problems using the algorithm design techniques and principles learned in this course.

LEARNING OUTCOMES

CO1 Basic ability to analyze algorithms and to determine algorithm correctness and time efficiency class.

CO2 Ability to apply and implement learned algorithm design techniques and data structures to solve problems.

CO3 Differentiate between various algorithms for sorting, searching, and selection and know the concepts of tractable and intractable problems and the classes P, NP and NP-complete problems.

CO4 Analysis of Geometric algorithms (range searching, convex hulls, segment intersections, closest pairs) Know various Text pattern matching, tries, KMP Algorithm.

UNIT-I (11 Hrs.)

Introduction: Algorithms and its Properties, Time and space complexity of an algorithm. Comparing the performance of different algorithms for the same problem. Different orders of growth. Asymptotic notation. Polynomial vs. Exponential running time.

Basic Algorithm Design Techniques. Divide-and-conquer, greedy, Backtracking, Branch and Bound, dynamic programming and randomization. Overall technique with example, problems and algorithms illustrating the use of these techniques.

UNIT-II (12 Hrs.)

Graph Algorithms. Graph traversal: breadth-first search (BFS) and depth-first search (DFS). Applications of BFS and DFS. Topological sort. Shortest paths in graphs: Dijkstra and Bellman-Ford (Single source shortest path, And All pair shortest path (Floyd Warshal algorithm). Minimum spanning Trees: Prim's and Kruskal Algorithm.

UNIT-III (11 Hrs.)

Sorting and searching. Binary search in an ordered array. Sorting algorithms such as Merge sort, Quick sort, Heap sort, Radix Sort, and Bubble sort with analysis of their running times. Lower bound on sorting, searching and Merging, Median and order statistics.

NP-completeness. Definition of class P, NP. NP-hard and NP-complete problems. 3SAT is NP-complete. Proving a problem to be NP-complete using polynomial-time reductions. Examples of NP-complete problems. Approximation algorithms for various NP-complete problems: TSP, Hamiltonian Cycle, Knapsack.

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UNIT-IV (11 Hrs.)

Advanced topics. Pattern matching algorithms: Knuth-Morris-Pratt algorithm, Brute Force. Algorithms in Computational Geometry: Convex hulls: Jarvin March and Graham Scan. Integer and polynomial arithmetic. Matrix multiplication: Strassen's algorithm.

RECOMMENDED BOOKS:

1. J. Kleinberg and E. Tardos, 'Algorithm Design', 1st Edn., Pearson Publications, **2005**.
2. H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein, Introduction to Algorithms, 3rd Edn., The MIT Press Ltd, **2009**.
3. S. Dasgupta, C.H. Papadimitriou, and U.V. Vazirani, 'Algorithms', McGraw-Hill Education, **2006**.
4. Michael T. Goodrich and Roberto Tamassia, 'Algorithm Design: Foundations, Analysis, and Internet Examples', 1st Edn., Wiley India Pvt Ltd, **2006**.
5. V. Aho, J.E. Hopcroft, and J.D. Ullman, 'The Design and Analysis of Computer Algorithms', 1st Edn., Pearson India, **1974**.
6. Donald Knuth, 'The Art of Computer Programming', Volumes 1, 2, and 3, 2nd Edn., Addison-Wesley Professional, **1998**.

MICROPROCESSORS & ASSEMBLY LANGUAGES

Subject Code- BCSE1-415	L T P C 3 0 0 3	Duration: 37 Hrs.

LEARNING OBJECTIVES

The course is intended to give students good understanding of internal architectural details and functioning of microprocessors.

LEARNING OUTCOMES

CO1 To study and differentiate microprocessors, microcomputers and microcontrollers.

CO2 To understand the detailed architecture of 8085 and learn assembly language programming using the instruction set of 8085.

CO3 To study the interfacing of microprocessors with memory and I/O devices.

CO4 To give an overview of higher order microprocessors and know about the various applications of microprocessors using the interfaces

UNIT-I

Introduction: Introduction to Microprocessors, Microcomputers, Microcontrollers, history and classification of microprocessors, recent microprocessors.

UNIT-II

Microprocessor Architecture: 8085 microprocessor Architecture. Bus structure, I/O, Memory & Instruction execution sequence & Data Flow, Instruction cycle. System buses, concept of address Bus, Data Bus & Control Bus, Synchronous & Asynchronous buses.

Instruction Set & Assembly Languages Programming: Introduction, instruction & data formats, addressing modes, status flags, 8085 instructions, Data transfer operations, Arithmetic operations, Logical operations, Branch operations.

UNIT-III

I/O and Memory Interfaces: Interfacing of memory chips, memory mapped and isolated I/O structure**,** Data transfer modes: Programmable, interrupt initiated and DMA, Interfacing of I/O devices, Serial & parallel interface, Detail study of 8251 I/O Processor & 8255 programmable peripheral interfaces.

UNIT-IV

Basic Architecture of Higher Order Microprocessors: Basic introduction to 8086 family, pin description and architecture of 8086.

Microprocessor Applications: Interfacing of keyboards and seven segment LED display, Microprocessor controlled temperature system (MCTS), Study of traffic light system, stepper motor controller, differentiate microprocessors, microcomputers and microcontrollers using their applications.

RECOMMENDED BOOKS

1. Ramesh Gaonkar, '8085 Microprocessor', 5th Edn., PHI Publications, **2002**.
2. Daniel Tabak, 'Advanced Microprocessors', 2nd Edn., McGraw- Hill, Inc., **1995**.
3. Douglas V. Hall, 'Microprocessors and Interfacing: Programming and Hardware', Tata McGraw Hill, **1986**.
4. Charles M. Gilmore, 'Microprocessors: Principles and Applications', McGraw Hill, 2nd Edn., **1995**.
5. Ayala Kenneth, 'The 8086 Microprocessor Programming and Interfacing', 1st Edn., Cengage Learning, **2007.**

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DATABASE MANAGEMENT SYSTEMS-I LAB.

Subject Code- BCSE1-416 **L T P C**
0 0 4 2

LEARNING OUTCOMES

CO1 To understand basic DDL, DML, DCL commands
CO2 To understand the SQL queries using SQL operators
CO3 To understand the concept of relational algebra, date and group functions
CO4 To learn view, cursors and triggers.

PRACTICALS

1. Write the queries for Data Definition Language (DDL) in RDBMS.
2. Write the queries for Data Manipulation Language (DML) in RDBMS.
3. Write the queries for Data Control Language (DCL) in RDBMS.
4. Write SQL queries using logical operations (=,etc)
5. Write SQL queries using SQL operators
6. Write SQL query using character, number, date and group functions
7. Write SQL queries for relational algebra
8. Write SQL queries for extracting data from more than one table
9. Write SQL queries for sub queries, nested queries
10. Concepts for ROLL BACK, COMMIT & CHECK POINTS
11. Case studies on normalization

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COMPUTER NETWORKS-I LAB.

Subject Code- BCSE1-417 **L T P C**
0 0 2 1

PRACTICALS

1. Write specifications of latest desktops and laptops.
2. Familiarization with Networking Components and devices: LAN Adapters, Hubs, Switches, Routers etc.
3. Familiarization with Transmission media and Tools: Co-axial cable, UTP Cable, Crimping Tool, Connectors etc.
4. Preparing straight and cross cables.
5. Study of various LAN topologies and their creation using network devices, cables and computers.
6. Configuration of TCP/IP Protocols in Windows and Linux.
7. Implementation of file and printer sharing.
8. Designing and implementing Class A, B, C Networks
9. Subnet planning and its implementation
10. Installation of ftp server and client

DESIGN & ANALYSIS OF ALGORITHM LAB.

Subject Code- BCSE1-417 **L T P C**
0 0 2 1

LEARNING OBJECTIVES

To get a first-hand experience of implementing well-known algorithms in a high-level language. To be able to compare the practical performance of different algorithms for the same problem.

PRACTICALS

1. Code and analyze to compute the greatest common divisor (GCD) of two numbers.
2. Code and analyze to find the median element in an array of integers.
3. Code and analyze to find the majority element in an array of integers.
4. Code and analyze to sort an array of integers using Heap sort.
5. Code and analyze to sort an array of integers using Merge sort.
6. Code and analyze to sort an array of integers using Quick sort.
7. Code and analyze Knapsack problem using dynamic programming
8. Code and analyze to find the shortest path for single source shortest path using dynamic programming.
9. Code and analyze to find the shortest path for All pair shortest path using dynamic programming.
10. Code and analyze to do a depth-first search (DFS) on an undirected graph. Implementing an application of DFS such as to find the topological sort of a directed acyclic graph.
11. Code and analyze to do a breadth-first search (BFS) on an undirected graph. Implementing an application of BFS such as (i) to find connected components of an undirected graph, OR (ii) to check whether a given graph is bipartite.
12. Code and analyze to find the minimum spanning tree in a weighted, undirected graph.
13. Code and analyze to find all occurrences of a pattern P in a given string S using KMP Method
14. Code and analyze to compute the convex hull of a set of points in the plane.

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MICROPROCESSORS AND ASSEMBLY LANGUAGES LAB.

Subject Code- BCSE1-419 **L T P C**
0 0 2 1

LEARNING OUTCOMES

CO1 Understanding different steps to develop program such as Problem definition, Analysis, Design of logic, Coding, Testing, Maintenance

CO2 To be able to apply different logics to solve given problem.

CO3 To be able to write program using different implementations for the same problem

CO4 Use of programming language constructs in program implementation

PRACTICALS

1. Introduction to 8085 kit.
2. Addition of two 8-bit numbers, sum 8-bit.
3. Subtraction of two 8-bit numbers.
4. Find 1's complement of 8-bit number.
5. Find 2's complement of 8-bit number.
6. Shift an 8-bit no. by one bit.
7. Find Largest of two 8-bit numbers.

8. Find Largest among an array of ten numbers (8-bit).
9. Sum of series of 8-bit numbers.
10. Introduction to 8086 kit.
11. Addition of two 16-bit numbers, sum 16-bit.
12. Subtraction of two 16-bit numbers.
13. Find 1's complement of 16-bit number.
14. Find 2's complement of 16-bit number.

COMPUTER NETWORKS-II

Subject Code: BCSE1- 520 **L T P C** **Duration: 39 Hrs.**
3 0 0 3

LEARNING OBJECTIVES

The objective of this course is offer good understanding of the concepts of network security, IPv6, wireless communication systems, Ad-hoc / Cellular Networks and various emerging network technologies.

LEARNING OUTCOME

CO1: Able to define the Fundamentals of network security, Characteristics of IPv6 and their addressing format and schemes.

CO2: Acquire the Knowledge about various concepts of IPSec and able to explain about various concepts of Ad-hoc and Cellular Networks.

CO3: Acquire the Knowledge about wireless communication systems and their generations with different Technologies.

CO4: Able to explain about Third Generation Networks, their Technologies, wireless System Design and their various strategies.

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UNIT-I

Fundamental of Network Security: Introduction to Network Security, Security Attacks, Network Based Attacks, Security Services and Mechanisms, Network Security Model.

Basics of IPv6: Features in IPv6, Addressing Structure, Addressing Modes in IPv6 and their Schemes, Header Format of IPv6, Extension Header, IPv4 vs IPv6, Transition Strategies from IPv4 to IPv6.

UNIT-II

IPsec: overview of IPsec and their Modes, Authentication header (AH), Encapsulating Security Payload (ESP), Services provided by IPSec, Security Association, Internet Key Exchange (IKE): History, Photuris, Simple Key-management for Internet protocols (SKIP), IKE phases, IKE encoding.

Adhoc Networks: Features, advantages and applications, Cellular Networks, Adhoc versus Cellular networks, Network architecture, Challenges and Issues in MANETS, Protocols: MAC protocols, Routing protocols, Technologies.

UNIT-III

Wireless Communication Systems: Evolution, Examples of Wireless Communication Systems, Wireless Communication System Generations and their Comparison, different Generation Standard Technologies, 2G Cellular networks, Evolution for 2.5G TDMA Standards, An approach to Fourth Generation Systems.

UNIT-IV

3G Wireless Networks: 3G Standards and Networks, 3G Cellular System- UMTS, Wireless local loop (WLL), Local Multipoint Distribution Service (LMDS), Multichannel Multipoint Distributed Service(MMDS), Wireless local Area Networks (WLANs), Bluetooth and Personal Area Networks.

Wireless System Design: Introduction, Frequency reuse, Co- Channel Interference, Channel assignment strategies, handoff strategies, interference and system capacity, improving coverage and capacity in cellular systems.

RECOMMENDED BOOKS:

1. Sunil kumar S. Manvi, Mahabaleshwar S. Kakkasageri, 'Wireless and Mobile Networks: Concepts and Protocols', 2nd Edn., Wiley, **2016.**
2. Mayank Dave, 'Computer Networks', 1st Edn., Cengage Learning, **2012**.
3. Theodore S. Rappaport, 'Wireless Communication: Principles and Practices', 2nd Edn., Pearson Education, **2001**.
4. Charlie Kaufman, Radio Perlman, Mike Speciner, 'Network Security', 2nd Edn., PHI, **2002**.
5. Michael A. Gallo & William M. Hancock, 'Computer Communications and Networking Technologies', 2nd Edn., Cengage Learning / Thomson Brooks / Cole, **2002**.
6. S. Keshav, 'An Engineering Approach to Computer Networking', 1st Edn., Pearson Education, **2002**.

AUTOMATA THEORY

Subject Code BCSE1-521	**L T P C** **3 1 0 4**	**Duration: 45 Hrs.**

LEARNING OBJECTIVES

The student should be made to understand various computing models like Finite State Machine, Pushdown Automata, and Turing Machine, learn types of Grammar, develop abstract models of computing machines and reasoning about what they can and cannot compute efficiently.

LEARNING OUTCOMES

After learning the course, the students should be able to:

CO1 Design Finite State Machine.

CO2 Explain Regular Expressions and Construct Grammar and Languages.

CO3 Define the CFLs and can design Pushdown Automata.

CO4 Define and Design the Turing Machine. Also explain the decidability and Un-decidability of various problems.

UNIT-I (11 Hrs.)

Basics of Strings and Alphabets.

Finite Automata, DFA, NDFA, Transition System, Equivalence of DFA and NDFA, Design of DFA. Minimization, Limitations and Applications of FA. Automata with Output, Mealy and Moore Machine. Equivalence of Mealy and Moore Machine.

UNIT-II (12 Hrs.)

Regular Expressions, Formal Definition, Operators used in RE, Precedence of operators in RE and Building RE. Arden's Theorem, Identities for RE. Equivalence of RE and FA. Equivalence of Two RE's. Equivalence of Two FA's. Pumping Lemma for Regular sets.

Grammar, Formal Definition. Construction of Grammar and languages. Chomsky classification.

UNIT-III (11 Hrs.)

Context Free Languages, Definition, Derivation Tress, Ambiguity in CFGs and Simplification of CFG. Normal Forms, CNF, GNF. Pumping Lemma for CFL.

Pushdown Automata, Formal Definition, NDPDA, DPDA, Design of PDA, and Equivalence of CFL and PDA. LR(k) Grammars and its properties.

UNIT-IV (11 Hrs.)

Turing Machines, Formal Definition and Design. Variations of TM, Halting problem, PCP. Decidability and Recursively Enumerable Languages.

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RECOMMENDED BOOKS:

1. K.L.P. Mishra and N. Chandrasekaran, 'Theory of Computer Science', 3rd Edn., PHI Learning Private Limited, **2011**.
2. Peter Linz, 'An Introduction to Formal Languages and Automata', 3rd Edn., Narosa Publishers, **1998**.
3. John E. Hopcroft, Rajeev Motwani, Jeffrey D. Ullman, 'Introduction to Automata Theory, Languages and Computation', 3rd Edn., Pearson Education, **2008**.
4. M. Sipser, 'Introduction to the Theory of Computation', 3rd Edn., Cengage Learning, **2012.**
5. K.V.N. Sunitha, N. Kalyani, 'Formal Languages and Automata Theory', 1st Edn., McGraw-Hill, **2010**.
6. G.E. Revesz, 'Introduction to Formal Languages', Dover Publications, **2016.**
7. M.A. Harrison, 'Introduction to Formal Language Theory', Addison-Wesley, **1978**.
8. R.K. Shukla, 'Theory of Computation', 1st Edn., Cengage Learning, **2009.**

JAVA PROGRAMMING

Subject Code BCSE1-522	**L T P C** **3 1 0 4**	**Duration: 45 Hrs.**

LEARNING OBJECTIVES

To learn the basic and advanced concepts of Java Programming language. The course enables student to experience the working environment required for programming in Java language and enhances their programming skills.

LEARNING OUTCOMES

CO1: To learn the basics of Java and to understand the implementation of Classes and Inheritance with respect to Java.

C02: To describe the concept of handling of exceptions and multithreading.

C03: To understand how to implement I/O, Applets and Graphics in Java

C04: To comprehend the advanced topics of Java Programming

UNIT-I (11 Hrs.)

Introduction to Java: Features of Java, difference between Java and C++, JVM, Bytecode, data types, variables, arrays, Type Conversion and Casting.

Classes and Inheritance: Class Fundamentals, methods, constructors, garbage collection, this keyword, Overloading constructors, Nested and Inner classes. Basics and types of inheritance, Method Overriding, Abstract Classes, final keyword, packages and interfaces.

UNIT-II (12 Hrs.)

Exception Handling: Basics, Exception Types, uncaught exceptions, try and catch, throwing exceptions.

Introduction to Multithreading: Java thread model, thread priorities, synchronization, interthread communication, creating, suspending, resuming and stopping threads.

UNIT-III (11 Hrs.)

I/O: Input/Output, stream classes, reading and writing files.

Applets and Graphics: Applet basics, Applet class, Applet initialization and termination, event handling, keyboard and mouse events, AWT class, Layout managers, panels, canvases, Frame windows, drawing lines, rectangles, ellipses.

UNIT-IV (11 Hrs.)

Advance Concepts: JDBC Connectivity, Introduction to Java Beans, Java Swings, Java Server Pages.

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RECOMMENDED BOOKS:

1. Patrick Naughton & Herbert Schildt, 'The Complete Reference Java 2', 5th Edn., Tata McGraw Hill, **2002**.
2. Balagurusamy, 'Programming in JAVA', BPB Publications, **2006**.
3. Deitel and Deitel, 'Java: How to Program', 10th Edn., Pearson Education, **2014**

ENTERPRISE RESOURCE PLANNING

Subject Code: BCSE1-556 **L T P C** **Duration: 37 Hrs.**
3 0 0 3

Learning Objectives:

To learn the concepts of Enterprise resource Planning. The course has all the required contents that are necessary for a graduate to understand the different strategies of an organization.

Learning Outcomes

CO1: To understand the concepts of ERP and its related technologies.
CO2: To understand the implementation of ERP in an organization.
CO3: To have a deep understanding of different business modules of an organization.
CO4: To have a basic understanding of applications of ERP and various ERP software's.

UNIT I

ERP AND TECHNOLOGY: Introduction, Related Technologies, Business Intelligence, E-Commerce and E-Business, Business Process Reengineering, Data Warehousing, Data Mining, OLAP, Product life Cycle management, SCM, CRM

UNIT II

ERP IMPLEMENTATION: Implementation Challenges, Strategies, Life Cycle, Methodologies Package selection, Project Teams, Vendors and Consultants, Data Migration, Project management

UNIT III

ERP IN ACTION & BUSINESS MODULES: Operation and Maintenance, Business Modules, Finance, Manufacturing, Human Resources, Plant maintenance, Materials Management, Quality management, Marketing, Sales, Distribution and service.

UNIT IV

ERP Application: Enterprise Application Integration, ERP II, Total quality management
ERP CASE STUDY: SAP AG, JD Edwards.

Recommended Books

1. Alexis Leon, 'ERP DEMYSTIFIED', 2nd Edn., Tata McGraw Hill, **2008**.
2. Mary Sumner, 'Enterprise Resource Planning', Pearson Education, **2007**.
3. Jim Mazzullo, 'SAP R/3 for Everyone', 2nd Edn., Pearson, **2007**.
4. Jose Antonio Fernandz, 'The SAP R /3 Handbook', Tata McGraw Hill, **2000**.
5. Biao Fu, 'SAP BW: A Step-by-Step Guide', 1st Edn., Pearson Education, **2003**.

DIGITAL MARKETING

Subject Code BCSE1-557 **L T P C** **Duration: 39 Hrs.**
3 0 0 3

LEARNING OBJECTIVES: To truly harness the potential of digital marketing and effectively leverage its impact on consumers, we need to have strong foundations in Digital Marketing.

LEARNING OUTCOMES:

CO1: To appreciate and understand Digital Marketing Concept.

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CO2: To apply SEO, Web Analytics and Social Media Marketing.
CO3: To Understand Email Marketing and Display Marketing.
CO4: Knowledge of Mobile Marketing, Wordpress, online Reputation Management.

UNIT-I

Business, Marketing & e-marketing: What is digital marketing? Advantages of digital medium over other media, Digital medium in today's marketing plan.

Search marketing: Basics of search marketing: organic & paid search results, Overview of Google AdWords, Keyword research and analysis, Tracking the success of SEM, Search Engine Optimization techniques, Keyword density, On-page & Off-page optimization, Word Stemming, Ranking & Ranking Factors, Google penguin.

UNIT-II

Web Analytics: Digital measurement landscape, Introduction to Google Analytics, Interpreting the data in Google Analytics.

Social Media Marketing: Different social media channels, Social media for various businesses: B2C & B2B, Measuring social media ROI, Content marketing: Storytelling in social media, Facebook Marketing, LinkedIn Marketing, Twitter Marketing. Google Plus,

UNIT-III

Email Marketing: The basics of email marketing, The concept of A/B testing & its use in email marketing.

Display Marketing: Different kinds of display marketing, The display marketing ecosystem, Retargeting & dynamic retargeting

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UNIT IV

Mobile Marketing: Different kinds of mobile marketing, The mobile marketing ecosystem, Mobile App Marketing, Wordpress, Online Reputation Management, Reports and Managements, Website Monetization.

Recommended Books:

1. James T. McClave, P. George Benson and Terry Sincich, ‘Statistics for Business and Economics’, 12th Edn., Pearson, **2012**.
2. Mark Jeffery, ‘Data-Driven Marketing: The 15 Metrics Everyone in Marketing Should Know’, 1st Edn., Wiley, **2010**.
3. Weblinks: SEOMoz.org , mashable.com, http://www.convinceandconvert.com, ClickZ.com, eMarketer, forrester.com, contentmarketinginstitute.com, adage.com, adweek.com.

COMPUTER GRAPHICS

Subject Code BCSE1-558	L T P C 3 0 0 3	Duration: 38 Hrs.

LEARNING OBJECTIVES

Understanding the fundamental graphical operations and the implementation on computer, get a glimpse of recent advances in computer graphics, understanding user interface issues that make the computer easy for the novice to use.

LEARNING OUTCOMES

After learning the course, the students should be able to:

CO1: Able to learn about the basics of graphics, its applications, uses and Knowledge to draw different shapes in graphics on computer.

CO2: Ability to apply different 2-D and 3-D transformations on an object.

CO3: Learn clipping operations and various object filling techniques, different projections techniques. Various hidden surface removal.

CO4: Knowledge of Rendering techniques, Fractals and different colour models.

UNIT-I

Introduction: Computer Graphics and its applications, Elements of a Graphics, Graphics Systems: Video Display Devices, Raster Scan Systems, Random Scan Systems, Input devices.

Basic Raster Graphics: Scan conversion- Point plot technique, Line drawing, Circle generating and Ellipse generating algorithms.

UNIT II

Two-dimensional Geometric Transformations: Basic Transformations-Translation, Rotation and Scaling, Matrix Representation and Homogeneous Coordinates, Composite Transformations, Reflection and Shearing transformations.

Elementary 3D Graphics: Matrix Representation of 3D transformations, Plane projections and its types, Vanishing points, Specification of a 3D view.

UNIT III

Clipping: Window to viewport transformation, Clipping Operations- Point Clipping, Line Clipping, Polygon Clipping and Text Clipping.

Filling Techniques: Scan line algorithms, Boundary-fill algorithm, Flood-fill algorithm.

Visibility: Image and object precision, Hidden edge/surface removal or visible edge/surface determination techniques; z buffer algorithms, Depth sort algorithm, Scan line algorithm and Floating horizon technique.

UNIT IV

Color Models: Properties of Light, Intuitive Color Concepts, RGB Color Model, CMY Color Model, HLS and HSV Color Models, Conversion between RGB and CMY color Models, Conversion between HSV and RGB color models, Color Selection and Applications.

Advance Topics: Introduction of Rendering, Fractals, Gourard and Phong shading.

RECOMMENDED BOOKS:

1. Donald Hearn and M. Pauline Baker, **‘**Computer Graphics’, 4th Edn.**,** PHI/Pearson Education, **2010**.
2. Zhigand Xiang, Roy Plastock, Schaum’s Outlines, **‘**Computer Graphics**’**, 2nd Edn., Tata Mc-Graw Hill, **2001**.
3. C. Foley, Van Dam, Feiner and Hughes, ‘Computer Graphics Principles & Practice’, 3rd Edn., Pearson Education**, 2013.**
4. Roy A. Plastock, Gordon Kalley, ‘Computer Graphics’, 1st Edn., Schaum’s Outline Series, **1986**.

COMPUTER NETWORKS –II LAB.

Subject Code BCSE1-523 **L T P C**
0 0 2 1

Practical to be performed in lab

1. To detect and remove spyware, malware, viruses, worms etc. from the computer and implementing proper measures to secure it.
2. To use utilities like Ping, tracert, Nslookup, Netstat, Nmap, Cain & Abel, Sqlmap, etc.
3. To use any one open source packet capture software like Wireshark to capture, filter, inspect packets and capture passwords.
4. To implement IPSec using CISCO Packet Tracer.
5. To configure Adhoc networks.
6. To install and use a PTT application on Smartphones.
7. To Simulate a Wireless Local Area Network using CISCO Packet Tracer
8. To install and configure wireless access points.

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9. To connect multiple devices using Bluetooth and PAN.
10. To Configure VoIP in CISCO Packet Tracer.

JAVA PROGRAMMING LAB.

Subject Code: BCSE1-524 **L T P C**
0 0 2 1

Practical to be performed in lab.

1. Write a Java Program to define a class, describe its constructor, overload the Constructors and instantiate its object
2. Write a Java Program to define a class, define instance methods for setting and Retrieving values of instance variables and instantiate its object
3. Write a Java Program to define a class, define instance methods and overload them and use them for dynamic method invocation
4. Write a Java Program to demonstrate use of sub class
5. Write a Java Program to demonstrate use of nested class
6. Write a Java Program to implement array of objects.
7. Write a Java program to practice using String class and its methods
8. Write a Java Program to implement inheritance and demonstrate use of method overriding
9. Write a Java Program to implement multilevel inheritance by applying various access controls to its data members and methods.
10. Write a program to demonstrate use of implementing interfaces.
11. Write a program to demonstrate use of extending interfaces
12. Write a Java program to implement the concept of importing classes from user defined package and creating packages.
13. Write a program to implement the concept of threading by extending Thread Class
14. Write a program to implement the concept of threading by implementing Runnable Interface
15. Write a program to implement the concept of Exception Handling using predefined exception.
16. Write a program to implement the concept of Exception Handling by creating user defined exceptions.
17. Write a program using Applet to display a message in the Applet.
18. Write a program using Applet for configuring Applets by passing parameters
19. Write a Java Program to demonstrate Keyboard event
20. Write a Java Program to demonstrate Mouse events
21. Write programs for using Graphics class i) to display basic shapes and fill them ii) draw different items using basic shapes iii) set background and foreground colors.

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SOFTWARE ENGINEERING

Subject Code: BCSE1-626 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

LEARNING OBJECTIVES:

To enable the students to learn the principles and methodologies followed to develop a good software.

LEARNING OUTCOMES:

CO1: To study how software engineering principles evolve and to analyze the various software models that can be followed to develop a software.

CO2: To understand the software analysis and design step of software development.
CO3: To study coding, testing and reliability of a software.
CO4: To highlight the various management activities and related terms of a software.

UNIT-I (11 Hrs.)

Introduction: Evolution and impact of Software engineering, Software crisis, Principles of Software Engineering, Feasibility study

Software Life Cycle Models: Waterfall, prototyping, Evolutionary, and Spiral models, Comparison of software models.

UNIT-II (12 Hrs.)

Scheduling and Planning: Management Activities, Project planning and control, cost estimation, project scheduling using PERT and GANTT charts.

Requirement Analysis: Functional and Non-functional requirements, Requirements gathering, Requirements analysis and specification.

UNIT-III (11 Hrs.)

Software Design: Basic principles of software design, modularity, cohesion, coupling and layering, function-oriented software design: DFD and Structure chart, object modeling using UML, Object-oriented software development, Design specifications, Design metrics, Verification and validation, User Interface design.

Coding: Coding standards and Code review techniques, Coding styles, Coding metrics.

Software Testing: Fundamentals of testing, Types of software testing, White-box, and black-box testing, test case design techniques, mutation testing, Testing metrics.

UNIT-IV (11 Hrs.)

Reliability: Software reliability metrics, reliability growth modeling.

Software Quality Management: Risk Management, Quality management, ISO and SEI CMMI, Six Sigma, Computer aided software engineering, Software maintenance, Software Configuration Management, Component-based software developments

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RECOMMENDED BOOKS:

1. Pressman, 'Software Engineering: A Practitioner's Approach', 3rd Edn., TMH, **2004**
2. Flecher and Hunt, 'Software Engineering and CASE: Bridging and Culture Gap', **2000**.
3. Shepperd, 'Software Engineering, Metrics', Vol.-1 (EN), McMillan, **1999.**
4. Robert S. Arnold, 'Software Re–engineering', IEEE Computer Society, **1994**.
5. Pankaj Jalote, 'An Integrated Approach to Software Engineering', 3rd Edn., Narosa Publishers, **2006**.
6. Ghezzi, Cario, 'Fundamentals of Software Engineering', 2nd Edn., PHI, **2002**.
7. Sommerville, Ian, 'Software Engineering', 7th Edn., Pearson Education, **2004**.
8. Watts Humphrey, 'Managing Software Process', 2nd Edn., Pearson Education, **2003**.
9. James F. Peters and Witold Pedrycz, 'Software Engineering – An Engineering Approach', 1st Edn., Wiley, **2010**.
10. Mouratidis and Giorgini, 'Integrating Security and Software Engineering–Advances and Future', IGP.

COMPILER DESIGN

Subject Code: BCSE1-627 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

LEARNING OBJECTIVES: To make the student to understand the process involved in a compiler, create an overall view of various types of translators, linkers, loaders, and phases of a compiler, understand what is syntax analysis, various types of parsers especially the top down approach, awareness among students the various types of bottom up parsers, understand the syntax analysis and, intermediate code generation, type checking, the role of symbol table and its organization, Code generation, machine independent code optimization and instruction scheduling.

LEARNING OUTCOMES:

CO1: To introduce the major concept areas of language translation and compiler design.

CO2: To develop an awareness of the function and complexity of compilers.

CO3: To provide practical, hands on experience in compiler design

CO4: Identify the similarities and differences among various parsing techniques and grammar transformation techniques

UNIT-I (11 Hrs.)

Compiler Structure: analysis-synthesis model of compilation, various phases of a compiler, tool based approach to compiler construction.

Lexical analysis: interface with input, parser and symbol table, token, lexeme and patterns. Difficulties in lexical analysis. Error reporting. Implementation. Regular definition, Transition diagrams, LEX.

UNIT-II (12 Hrs.)

Syntax Analysis: CFGs, ambiguity, associativity, precedence, top down parsing, recursive descent parsing, transformation on the grammars, predictive parsing, bottom up parsing, operator precedence grammars, LR parsers (SLR, LALR, LR), YACC.

Syntax directed definitions: inherited and synthesized attributes, dependency graph, evaluation order, bottom up and top down evaluation of attributes, L- and S-attributed definitions.

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UNIT-III (11 Hrs.)

Type Checking: type system, type expressions, structural and name equivalence of types, type conversion, overloaded functions and operators, polymorphic functions.

Run Time System: storage organization, activation tree, activation record, parameter passing, symbol table, dynamic storage allocation.

UNIT-IV (11 Hrs.)

Intermediate Code Generation: Intermediate representations, translation of declarations, assignments, control flow, boolean expressions and procedure calls. Implementation issues.

Code Generation and Instruction Selection: issues, basic blocks and flow graphs, register allocation, code generation, dag representation of programs, code generation from dags, peep hole optimization, code generator generators, specifications of machine.

RECOMMENDED BOOKS

1. V. Aho, R. Sethi, and J. Softec, D. Ullman, ‘Compilers: Principles, Techniques and Tools’, 2nd Edn., Addison-Wesley, **2006**.
2. Fischer and R. LeBlanc, ‘Crafting a Compiler’, Benjamin Cummings, **2009.**
3. C. Fischer and R. LeBlanc, ‘Crafting a Compiler in C’, Benjamin Cummings, **1991**.
4. C. Holub, ‘Compiler Design in C’, Prentice-Hall Inc., **1993**.
5. ‘Modern Compiler Implementation in C: Basic Design’, Cambridge Press, **2004**.
6. ‘Modern Compiler Implementation in Java: Basic Design’, 2nd Edn., Cambridge Press, **2002**.
7. Fraser and Hanson. A Retargetable C, ‘Compiler: Design and Implementation’, Addison-Wesley, **1995**.

MOBILE APP DEVELOPMENT

Subject Code: BCSE1-659 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

LEARNING OBJECTIVES: This course teaches students how to build mobile apps for Android, iOS, and Windows 8, the trinity that is today's mobile operating platforms.

LEARNING OUTCOMES:

CO1: To be familiar with the Architecture of various Mobile Application Platform.
CO2: Ability to work on Android using various forms and menus.
CO3: Knowledge to publish your developed Mobile Application.
CO4: Using SQLite for connection to database type facilities.

UNIT-I (11 Hrs.)

Characteristics of mobile applications. Architecture and working of Android, iOS and Windows phone8 operating system. User-interface design for mobile applications and managing application data. Integrating cloud services, networking, OS and hardware into mobile-applications. Addressing enterprise requirements in mobile applications: performance, scalability, modifiability, availability and security.

UNIT-II (12 Hrs.)

Introduction to Android Development Environment, What Is Android? Advantages and Future of Android, Frameworks, Tools and Android SDK. Installing Java, Android Studio, SDK Manager Components and updating its platforms, AVD Manager, Understanding Java SE and the Dalvik Virtual Machine. The Directory Structure of an Android Project, Common Default Resources Folders, The Values Folder, Leveraging Android XML.

User Interface Widgets: Text controls, Button controls, Toggle buttons, Images. Notification and Toast: Parameters on Intents, Pending intents, Status bar notifications, Toast notifications. Menus & Dialogs: Localization, Options menu, Context menu; Alert dialog, Custom dialog, Dialog as Activity.

Lists: Using string arrays, Creating lists, Custom lists. Location and Maps: Google maps, Using GPS to find current location

UNIT-III (11 Hrs.)

Application Development in Android: App Components (Intents and Intent Filters, activities, services, Content Providers, App Widgets, Processes and Threads), App resources, App Manifest and User interface, Action Bar, Content Sharing, Multi-Platform Designs, Animation and graphics, computation, Media and Camera, Location and sensors, Connectivity, Text and Input, Data Storage, Administration and Web Apps.

Publishing Your App: Preparing for publishing, Signing and preparing the graphics, publishing to the Android Market.

UNIT-IV (11 Hrs.)

Introducing SQLite: SQLite Open Helper and creating a database, Opening and closing a database Cursors and its types, Working with cursors Inserts, updates, and deletes.

Database Connectivity: SQLite Data Types, Content Values, Adding, Updating and Deleting Content, Content provider: introduction, Query providers.

Recommended Books

1. Jeffmcwherter, Scott Go Well, ‘Professional Mobile Application Development’, 1st Edn., Wiley, **2012**.
2. Belen Cruz, Zapata, ‘Android Studio Application Development’, 2nd Edn., Packt Publishing, **2016**.
3. Reto Meier, ‘Professional Android 4 Application Development’, Wrox Publication, **2012**.

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4. Onur Cinar, ‘Beginning Android 4’, 1st Ed., Apress Publication, **2012.**
5. David Mark, ‘Beginning iPhone Development with Swift’, Apress Publication, **2014**.
6. Android Developer Site: http://developer.android.com/index.html

DISTRIBUTED COMPUTING

Subject Code: BCSE1-660 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

Learning Objectives:
To provide knowledge on principles and practice underlying in the design of distributed systems.
CO1: To understand the basic concepts of distributed computing.
CO2: To have a deep understanding of remote method invocation.
CO3: To understand the peer to peer services and file systems.
CO4: To understand the concept of synchronization and replication.

UNIT-I (11 Hrs.)

INTRODUCTION: Introduction, Examples of Distributed Systems, Trends in Distributed Systems, Focus on resource sharing, Challenges. Case study: World Wide Web.

COMMUNICATION IN DISTRIBUTED SYSTEM: System Model, Inter process Communication, the API for internet protocols, External data representation and Multicast communication.

Network virtualization: Overlay networks. Case study: MPI.

UNIT-I2 (11 Hrs.)

REMOTE METHOD INVOCATION AND OBJECTS- Remote Invocation, Introduction, Request reply protocols, Remote procedure call, Remote method invocation.

Case study: Java RMI - Group communication, Publish-subscribe systems, Message queues, shared memory approaches, Distributed objects, CORBA- from objects to components

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UNIT-III (11 Hrs.)

PEER TO PEER SERVICES AND FILE SYSTEM- Peer-to-peer Systems, Introduction, Napster and its legacy, Peer-to-peer, Middleware, Routing overlays. Overlay case studies: Pastry, Tapestry, Distributed File Systems, Introduction - File service architecture, Andrew File system. 192 CS-Engg&Tech-SRM-2013

UNIT-IV (11 Hrs.)

SYNCHRONIZATION AND REPLICATION- Introduction, Clocks, events and process states, synchronizing physical clocks, Logical time and logical clocks, Global states, Coordination and Agreement, Introduction, distributed mutual exclusion, Elections, Transactions and Concurrency Control, Transactions -Nested transactions, Locks, Optimistic concurrency control, Timestamp ordering -Distributed deadlocks, Replication, Case study - Coda

Recommended Books

1. George Coulouris, Jean Dollimore, Tim Kindberg, ‘Distributed Systems Concepts and Design’,5th Ed., Addison Wesley, **2011**.
2. Tanenbaum A.S., Van Steen M., ‘Distributed Systems: Principles and Paradigms’, 2nd Edn., Pearson Education, **2016.**
3. Liu M.L., ‘Distributed Computing, Principles and Applications’, 1st Edn., Pearson Education, **2004**.

MULTIMEDIA & VIRTUAL REALITY

Subject Code: BCSE1-661	**L T P C** **3 1 0 4**	**Duration: 45 Hrs.**

LEARNING OBJECTIVES

Multimedia is the combined use of text, graphics, sound, animation, and video. A primary objective is to teach how to develop multimedia programs. Another objective is to demonstrate how still images, sound, and video can be digitized on the computer.

LEARNING E OUTCOMES

CO1: Able to learn about different types of media, its applications, uses and Knowledge of authoring system.

CO2: Ability to learn different compression techniques.

CO3: Knowledge of multimedia information management.

CO4: Knowledge of Virtual reality systems.

UNIT-I (11 Hrs.)

INTRODUCTION: Concept of Non-Temporal and Temporal Media. Basic Characteristics of Non-Temporal Media; Images, Graphics, Text. Basic Characteristics of Temporal Media: Video, Audio, and Animation. Hypertext and Hypermedia. Presentations: Synchronization, Events, Scripts and Interactivity, Introduction to Authoring Systems.

UNIT II (12 Hrs.)

COMPRESSION TECHNIQUES: Sampling, quantization, pixel, resolution**,** Basic concepts of Compression, Run length Coding, Huffman Coding, JPEG, JPEG Compression, Introduction to MP3-Audio Compression Standard.

UNIT III (10 Hrs.)

MULTIMEDIA INFORMATION MANAGEMENT: Introduction to Multimedia storage devices, Data organization on Hard Disk, CD, CD-DVD, optical disks, USB drives, Architecture of multimedia system, Introduction to Content Based Information Retrieval.

UNIT IV (12 Hrs.)

VIRTUAL REALITY: Introduction to Virtual Reality and Virtual Reality Systems, Related Technologies: Teleoperation and Augmented Reality Systems Interface to the Virtual World-Input; Head and hand trackers, data globes, hap tic input devices. Interface to the Virtual World- Output, Stereo display, head-mounted display, auto-stereoscopic displays, holographic displays, hap tic and force feedback. VRML Programming; Modeling objects and virtual environments Domain Dependent applications: Medical, Visualization, Entertainment, etc.

Recommended Books:

1. Andleigh and Thakarar, 'Multimedia System Design', PHI, **2010.**
2. David Hillman, 'Multimedia Technology & Application', Galgotia Publications, **1998**.
3. Steinmetz, 'Multimedia Computing Communication and Application', 1st Edn., Pearson Edn, **2002**.
4. John Vince, 'Virtual Reality Systems', 1st Edn., Pearson Education, **2007**.
5. D.P. Mukherjee, 'Fundamentals of Computer Graphics and Multimedia', 1st Edn., PHI, **2009.**

WEB TECHNOLOGIES

Subject Code: BCSE1-662	**L T P C** **3 1 0 4**	**Duration: 45 Hrs.**

LEARNING OBJECTIVES: On completion of this course, a student will be familiar with client server architecture and able to develop a web application using java technologies. Students will gain the skills and project-based experience needed for entry into web application and development careers.

LEARNING OUTCOMES:

CO1: To understand the tools and description of java scripts

CO2: To XML and the study of Java beans and introduction to EJB'S

CO3: To understand Java servelet HTTP package and security issues.

CO4: To understand JSP Application Development and database programming using JDBC

UNIT-I (11 Hrs.)

HTML Common Tags- List, Tables, images, forms, Frames; Cascading Style sheets; Introduction to Java Scripts, Objects in Java Script, Dynamic HTML with Java Script

UNIT-II (12 Hrs.)

Web Servers and Servlets: Tomcat web server, Introduction to Servelets: Lifecycle of a Serverlet, JSDK, The Servelet API, The javax.servelet Package, Reading Servelet parameters, Reading Initialization parameters. The javax.servelet HTTP package, Handling Http Request & Responses, Using Cookies-Session Tracking, Security Issues,

UNIT-III (11 Hrs.)

Introduction to JSP: The Problem with Servelet. The Anatomy of a JSP Page, JSP Processing. JSP Application Design with MVC Setting Up and JSP Environment: Installing the Java Software Development Kit, Tomcat Server & Testing Tomcat

JSP Application Development: Generating Dynamic Content, Using Scripting Elements Implicit JSP Objects, Conditional Processing – Displaying Values Using an Expression to Set an Attribute, Declaring Variables and Methods

UNIT-IV (11 Hrs.)

Error Handling: Debugging Sharing Data Between JSP pages, Requests, and Users Passing Control and Date between Pages – Sharing Session

Database Access: Database Programming using JDBC, Studying Javax.sql.* package, Accessing a Database from a JSP Page, Application – Specific Database Actions.

RECOMMENDED BOOKS:

1. Chris Bates, 'Web Programming, Building Internet Applications', 3rd Edn., WILEY, **2006.**
2. Patrick Naughton, Herbert Schildt, 'The complete Reference Java 2', 5th Edn., TMH, **2002.**
3. Hans Bergsten, 'Java Server Pages', 3rd Ed., SPD O'Reilly, **2003.**
4. Sebesta, 'Programming World Wide Web', 4th Edn., Pearson, **2008**.
5. Marty Hall, Larry Brown, 'Core Servlets and Java Server Pages Vol. 1: Core Technologies', 2nd Edn., Pearson, **2003.**
6. Dietel, Niet, 'Internet and World Wide Web – How to Program', 5th Edn., PHI/Pearson Education, **2011.**
7. Murach, 'Murach's Beginning JAVA JDK 5', SPD, **2005.**
8. Wang, 'An Introduction to web Design and Programming', 1st Edn., Cengage Learning, **2003.**
9. Craig D. Knuckles, 'Web Applications Technologies Concepts-Knuckles', 2nd Edn., John Wiley, **2006**.
10. Jon Duckett, 'Beginning Web Programming', 1st Edn., WROX, **2007.**

CRYPTOGRAPHY & NETWORK SECURITY

Subject Code: BCSE1-663 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

LEARNING OBJECTIVES

The main objective of this course is to make student able to understand the basic concepts, services, threats and principles in network security, various security services and mechanisms in the network protocol stack.

LEARNING OUTCOMES

CO1 To understand security trends.
CO2 To implement various cryptographic algorithms.
CO3 To explain the hash function.
CO4 To understand the network security and system level security used.

UNIT-I (10 Hrs.)

Security trends, Attacks and services, Classical crypto systems, Different types of ciphers, LFSR sequences, Basic Number theory, Congruence, Chinese Remainder theorem, Modular exponentiation, Fermat and Euler's theorem, Legendre and Jacobi symbols, Finite fields, continued fractions.

UNIT-II (12 Hrs.)

Simple DES, Differential crypto analysis, DES – Modes of operation, Triple DES, AES, RC4, RSA, Attacks – Primality test – factoring.

UNIT-III (11 Hrs.)

Discrete Logarithms, Computing discrete logs, Diffie-Hellman key exchange, ElGamal Public key cryptosystems, Hash functions, Secure Hash, Birthday attacks, MD5, Digital signatures, RSA, ElGamal DSA.

UNIT-IV (12 Hrs.)

Authentication applications – Kerberos, X.509, PKI – Electronic Mail security – PGP, S/MIME – IP security – Web Security – SSL, TLS, SET. Intruders, Malicious software, viruses and related threats, Firewalls, Security Standards.

RECOMMENDED BOOKS:

1. Wade Trappe, Lawrence C Washington, 'Introduction to Cryptography with Coding Theory', 2nd Edn., Pearson, **2007**.
2. William Stallings, 'Cryptography and Network Security Principles and Practices', 4th Edn., Pearson/PHI, **2006**.
3. W. Mao, 'Modern Cryptography – Theory and Practice', 2nd Edn., Pearson Education, **2007**.
4. Charles P. Pfleeger, Shari Lawrence Pfleeger, 'Security in Computing', 3rd Edn., Prentice Hall of India, **2006**.
5. Behrouz Forouzan, 'Cryptography & Network Security', 2nd Edn., McGraw-Hill, **2011.**

DATA MINING AND WARE HOUSING

Subject Code: BCSE1-664 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

LEARNING OBJECTIVES: Data warehousing and data mining are two major areas of exploration for knowledge discovery in databases. The course aims to cover powerful data mining techniques including clustering, association rules, and classification. It then teaches

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high volume data processing mechanisms by building warehouse schemas such as snowflake, and star. OLAP query retrieval techniques are also introduced.

LEARNING OUTCOMES:

CO1: To introduce the basic concepts of Data Warehouse and Data Mining techniques.

CO2: To process raw data to make it suitable for various data mining algorithms.

CO3: To discover interesting patterns, analyze supervised and unsupervised models and estimate the accuracy of the algorithms

CO4: Apply the techniques of clustering, classification, association finding, feature selection and visualization to real world data

UNIT-I (11 Hrs.)

Data Warehousing: Introduction, ETL, Data warehouses– design guidelines for data warehouse implementation, Multidimensional Models; OLAP- introduction, Characteristics, Architecture, Multidimensional view and data cube, Data cube operations, data cube computation.

Review of the Basic Data Analytic Methods using R: Introduction to R –look at the data, Analyzing and Exploring the Data, Statistics for Model Building and Evaluation.

UNIT-II (12 Hrs.)

Data Mining: Introduction, association rules mining, Naive algorithm, Apriori algorithm, direct hashing and pruning (DHP), Dynamic Item set counting (DIC), Mining frequent pattern without candidate generation (FP, growth), performance evaluation of algorithms,

UNIT-III (11 Hrs.)

Classification: Introduction, decision tree, tree induction algorithms – split algorithm based on information theory, split algorithm based on Gini index; naïve Bayes method; estimating predictive accuracy of classification method;

UNIT-IV (11 Hrs.)

Cluster Analysis: Introduction, partitional methods, hierarchical methods, density based methods, dealing with large databases, cluster software; Search engines: Characteristics of Search engines, Search Engine Functionality, Search Engine Architecture, Ranking of web pages, The search engine history, Enterprise Search, Enterprise Search Engine Software.

Web Data Mining: Web Terminology and Characteristics, Locality and Hierarchy in the web, Web Content Mining, Web Usage Mining, Web Structure Mining, Web mining Software.

Recommended Books:

1. Carlo Vercellis, 'Business Intelligence: Data Mining and Optimization for Decision Making', 1st Edn., WILEY, **2009**.
2. J. Han, M. Kamber and J. Pei, 'Data Mining Concepts and Techniques', 3rd Edn., Morgan Kaufmann Publishers, **2011**.
3. V. Pudi, P.R. Krishana, 'Data Mining', 1st Edn., Oxford University Press, **2009**.
4. P. Adriaans, D. Zantinge, 'Data Mining', 1st Edn., Pearson Education Press, **1996**.
5. P. Pooniah, 'Data Warehousing Fundamentals', 1st Edn., Willey Interscience Publication, **2001**.

SOFTWARE ENGINEERING LAB.

Subject Code: BCSE1-628 **L T P C**
0 0 2 1

Perform the following on any project discussed with subject teacher:

1. Study and usage of OpenProj or similar software to plan, schedule and track the progress of a project.
2. Preparation of Software Requirement Specification Document.

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3. Study and usage of any Design phase CASE tool.
4. To draw DFDs, ER Diagrams
5. Prepare Structure charts.
6. Prepare UML Diagrams.
7. Design Test cases for black box and White Box testing.
8. Testing of a web site

Suggested Tools - Visual Paradigm, Rational Software Architect. Visio, Argo UML, Rational Application Developer etc. platforms.

WEB ENGINEERING LAB.

Subject Code: BCSE1-629 **L T P C**
0 0 2 1

Practical to be performed in Lab:

1. Write a program in JSP which take student enrolment number as input and displays the following details:
   a) Name and Address of the student
   b) Course and Branch of the Student
   c) College to which student is enrolled
2. Write a program that maintains a counter for the number of the times it has accessed since it loads.
3. Write a program to display the grade of the student by inputting the marks of five students.
4. Write a JSP program to create a webpage to display your personal details such as name, address, area of interest. This page should also display a background image, current date and time. Also provide a link JSP. After clicking on this link any JSP tutorial available on Internet should be opened.
5. Create a user details page. The page should have First Name, Last Name, and Email address fields. On clicking the submit button, a new Web page should display the details entered by the user. Hint: Use getAttribute to display the user details.
6. Make a JSP page that makes a bulleted list with a random number of entries in the list, each of which is a random int.
7. Make a JSP page that always displays the same page content, but uses a background color of green, red, blue, or yellow, randomly chosen for each request. Make sure your page does not use the JSP-Styles style sheet, since that style sheet overrides the background color.
8. Develop any GUI that performs the SQL operations like insert, delete, update and retrieval.

DATABASE MANAGEMENT SYSTEMS-II

Subject Code: BCSE1-730 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

Learning Objectives: This course offers a good understanding of advanced database concepts and technologies. It prepares the student to be in a position to use and design databases for a variety of applications.

Learning Outcomes:

CO1: To understand database system concept and architecture and implement PL/SQL
CO2: To understand query processing and transaction control
CO3: To understand object oriented, relational, distributed databases.
CO4: To understand backup and recovery concepts.

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UNIT-I (11 Hrs.)

Introduction to Database Systems: Database System Concepts and Architecture, Data Independence.

Introduction to PLSQL: Basics of PL/SQL, control structures, sequences, functions, stored procedures, cursors, triggers.

UNIT-II (12 Hrs.)

Query Processing and Optimization: Query Processing, Syntax Analyzer, Query Decomposition, Query Optimization, Heuristic Query Optimization, Cost Estimation, Cost Functions for Select, Join, Query Evaluation Plans.

Transaction Processing and Concurrency Control: Transaction Processing Concepts, Concurrency Control Techniques: Two-phase Locking, Timestamp Ordering, Multiversion, Validation, Multiple Granularity Locking.

UNIT-III (11 Hrs.)

Object Oriented and Object Relational Databases: Object Oriented Concepts, Object Oriented Data Model, Object Definition Language, Object Query Language, Object Relational Systems, SQL3, ORDBMS Design.

Distributed Databases: Distributed Database Concepts, Advantages and Disadvantages, Types of Distributed Database Systems, Data Fragmentation, Replication and Allocation Techniques for Distributed Database Design, Five Level Schema Architecture, Query Processing, Concurrency Control and Recovery in Distributed Databases.

UNIT-IV (11 Hrs.)

Backup and Recovery: Types of Database Failures, Types of Database Recovery, Recovery Techniques: Deferred Update, Immediate Update, Shadow Paging, Checkpoints, Buffer Management.

Enterprise Database Products: Enterprise Database Products, Familiarity with IBM DB2 Universal Database, Oracle, Microsoft SQL Server, MySQL, their features.

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RECOMMENDED BOOKS

1. Ramez Elmasri, Shamkant Navathe, 'Fundamentals of Database Systems', 6th Edn., Pearson, **2010**
2. Raghu Ramakrishnan, Johannes Gehrke, 'Database Management Systems', 5th Edn., Tata McGraw-Hill, **2006**
3. C.J. Date, 'An Introduction to Database Systems', 8th Edn., Pearson Education, **2003**.
4. Alexis Leon, Mathews Leon, 'Database Management Systems',1st Edn., Leon Press, **2008**.
5. Abraham Silberschatz, Henry F. Korth, S. Sudarshan, 'Database System Concepts', 6th Edn., Tata McGraw-Hill, **2011**.
6. S.K. Singh, 'Database Systems Concepts, Design and Applications', Pearson Education, **2009.**
7. Chris Eaton, Paul Zikopoulos, 'Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data', McGraw-Hill Osborne, **2012**

OBJECT ORIENTED ANALYSIS AND DESIGN USING UML

Subject Code: BCSE1-731	**L T P C** **3 1 0 4**	**Duration 45 Hrs.**

LEARNING OBJECTIVES: This course delves into the processes of both object-oriented analysis and object-oriented design using UML as the notation language.

LEARNING OUTCOMES:

CO1: Understanding the history and goals of UML.

CO2: Use of functional, non-functional requirements along with Use Case Modeling.

CO3: Knowledge of Modeling Classes and Dependencies.
CO4: Ability to know interfaces, components and Sequence Diagrams.

UNIT–I (11 Hrs.)

UML: History of UML, Goals of UML, nature & purpose of models, UML views & diagrams – static, design, use case, state machine, activity, interaction deployment, model management, profile; relationships in UML – association, dependency, generalization, realization; UML extensibility mechanisms – constraints, stereotypes, tagged values. Unified Process (UP): UP structure, phases of UP

UNIT–II (12 Hrs.)

Requirements: Meta Model, Workflow, Functional and Non-functional Requirements; Requirement Attributes, Finding Requirements.

Use Case Modeling: Finding Actors and Use Cases, Use Case Scenario – main flow, branching within a flow, repletion within a flow, modeling alternative flows; relationships among actors and use cases; use case diagrams

UNIT–III (11 Hrs.)

Analysis: Meta Model, Workflows, Finding Analysis Classes – using noun/verb analysis, CRC analysis, using RUP stereotypes - entity, boundary and control; Modeling Classes – Association (role name, multiplicity, navigability, association classes, qualified association) dependencies (usage, abstraction, permission), class generalization, generalization sets, power types.

Use Case Realization – Class diagrams, interaction diagram, sequence diagrams, collaboration diagrams, Activity Diagrams.

UNIT–IV (11 Hrs.)

Design: Meta Model, Workflow, design classes – well-formed design classes, inheritance, nested classes, aggregation and composition, designing with interfaces and components; state machine – state chart diagrams.

Implementation: Deployment diagrams.

Recommended Books:

1. Jim Arlow, Ila Neustadt, ‘UML 2 and the Unified Process – Practical Object Oriented Analysis and Design’, Pearson Education, Addison Wesley, 2nd Edn., **2005**.
2. Bernd Bruegge, Allen H. Dutoit, ‘Object Oriented Software Engineering using UML’, Pearson Education, 3rd Edn.., **2009**.
3. Blaha M., Rumbaugh J., ‘Object-Oriented Modeling and Design with UML’, Pearson Education, 2nd ed., **2005.**
4. Timothy C. Lethbridge, Robert Laganiere, ‘Object Oriented Software Engineering’, Tata McGraw-Hill, 1st ed., **2008**
5. Booch G., Rumbaugh J., Jacobson I., ‘The Unified Modeling Language User Guide’, Addison Wesley, 2 ed., **2005**
6. Satzinger, Jackson, Burd, ‘Object-Oriented Analysis & Design with the Unified Process’, Cengage Learning, 1st ed., **2005**

LINUX & UNIX SYSTEMS

Subject Code: BCSE1-765	**L T P C** **3 1 0 4**	**Duration: 45 Hrs.**

LEARNING OBJECTIVES: This course will prepare students to develop software in and for Linux/UNIX environments. Topics to be covered include basic operating system concepts, effective command line usage.

LEARNING OUTCOMES:

CO1: Understanding the basic set of commands and utilities in Linux/UNIX systems.

CO2: To learn the important Linux/UNIX library functions and system calls.

CO3: To install and use different services in UNIX/LINUX like operating systems.

CO4: To obtain a foundation for different applications in Unix/Linux type of operating system.

UNIT-I (11 Hrs.)

Linux Startup: User accounts, accessing Linux - starting and shutting processes, logging in and Logging out, Command line, simple commands

Shell Programming: Unix file system: Linux/Unix files, i-nodes and structure and file system related commands, Shell as command processor, shell variables, creating command substitution, scripts, functions, conditionals, loops, customizing environment

UNIT-II (11 Hrs.)

Regular Expressions and Filters: Introducing regular expressions patterns, syntax, character classes, quantifiers, introduction to egrep, sed, programming with awk and perl.

Domain Name Server (DNS): Host name resolution; domain name hierarchy; DNS zones; configuration of master, slave and caching DNS servers with BIND 9

UNIT-III (11 Hrs.)

Networking: Basic concepts of networking: Network packets, TCP/IP protocol suit, Address resolution protocol (ARP); IP addresses and network mask; subnets and routing; IPV4 and Network classes; ports. Configuring Linux machine on the network; arp, ipconfig and netstat commands. Network services and tools; telnet, rsh, ftp, rcp, ssh, rsync, inetd.conf; opening and closing ports.

Network File System (NFS): File system sharing or the network; remote procedure calls (R P C) services; NFS server and client sides; NFS installation & configuration; and statistic mount and auto mount configuration; when trouble shooting NFS; security and optimization Network information service (NIS) Centralized authentication systems; sharing user and host information or the network; NIS server and client sides and configuration; compatibility mode; net group; security issues.

UNIT-IV (11 Hrs.)

Integrating Linux and Windows: Elements of windows networking; Net BIOS SMB, CIFS protocols; domain controller; Samba server on Linux for centralized window logon; file sharing and printing, samba client; samba installation and configuration; Unix and windows password. Dual Boot: running windows and Linux on the same PC; GRUB and NT Boot loaders; accessing windows files systems from Linux and vice versa.

Light Weight Directory Access Protocol (LDAP)

Overview of Unix authentication and naming service; introduction to LDAP: Domain component (DC); organizational Unit (OU); common names (CN); Schemas; IDIF format; services; polls and commands; server and client sides; Open LDAP installation and configuration; LDAP applications. Shell scripting, syntax of brash; looping; case statement; function; command substitution; awk, grep, sed. Startup and Run Levels. Scheduled jobs. Boot up and login process sequence; run levels; startup scripts; scheduling jobs with at and cron

Recommended Books

1. John Goerzen, 'Linux Programming Bible', 1st Edn., Wiley, **2000**.
2. Sumitabha Das, 'Your Unix - The Ultimate Guide', 2nd Edn., TMH, **2004**.
3. Mathew, 'Professional Linux Programming', Vol. 1 & 2, Wrox-Shroff, **2001**.
4. Welsh & Kaufmann, 'Running Linux', 4th Edn., O'Reiley & Associates, **2000**.

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5. Richard L. Peterson, 'Red Hat Linux 9 – Bell & Duff', Pearson Complete Reference Red Hat Linux', TMH.
6. Tery Dawson, Gregor N. Purdy, Tony Bautts, 'Linux N/W Administration Guide', 3rd Edn., OREILLY, **2007**
7. Christopher Negus, 'Red Hat Linux 9 Bible', Pap//cdr ed., WILEY Publishing, **2003.**
8. Patrick Volker Ding, Kevin Richard, Eric Foster, 'Linux Configuration & Installation', 4th Edn., Johnson BPB Publication.

ARTIFICIAL INTELLIGENCE

Subject Code: BCSE1-766 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

LEARNING OBJECTIVES: This course will introduce the basic principles in artificial intelligence research. It will cover simple representation schemes, problem solving paradigms, constraint propagation, and search strategies. Areas of application such as knowledge representation, natural language processing, expert systems, vision and robotics will be explored

LEARNING OUTCOMES:

CO1: Understand the concept of Artificial intelligence, problem solving and various types of search strategies.

CO2: Understand the concept of Knowledge base, knowledge representation, AI languages & tools and various planning techniques.

CO3: Identify uncertainty and understand fuzzy logic concept to handle uncertainty.

CO4: Understand the learning of AI agents and various learning methods it also includes neural network and includes the communication of AI agents and natural language processing.

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UNIT-I (11 Hrs.)

Introduction: History of AI - Intelligent agents – AI and Applications - Problem spaces and search - Heuristic Search techniques – Best-first search – Informal search strategies-A* algorithm, Iterative deepening A*(IDA), small memory A*(SMA). Game Playing: Minimax search procedure - Adding alpha-beta cutoffs

UNIT-II (12 Hrs.)

Knowledge Representation: Approaches and issues in knowledge representation Knowledge - Based Agent- Propositional Logic – Predicate logic –Reasoning, AI languages Prolog, Lisp.

UNIT-III (11 Hrs.)

Reasoning under uncertainty: Implementation- Basic probability notation - Bayes rule – Certainty factors and rule based systems - Bayesian networks, Fuzzy Logic.

UNIT IV (11 Hrs.)

Planning and Learning: Basic representation of plans - conditional planning - Multi-Agent planning. Forms of learning - inductive learning - Reinforcement Learning - learning decision trees - Neural Networks. Communication: Natural language processing, Formal Grammar, Parsing

RECOMMENDED BOOKS

1. Elaine Rich, Kevin Knight and Shivashankar B.Nair, 'Artificial Intelligence', 3rd Edn., Tata McGraw-Hill, **2009**.
2. Stuart J. Russell and Peter Norvig, 'Artificial Intelligence: A Modern Approach', Pearson Education Asia, 2nd Edn., **2003**.
3. N.P. Padhy, 'Artificial Intelligence and Intelligent System', Oxford University Press, 2nd Edn., **2005**.

4. Rajendra Akerkar, 'Introduction to Artificial Intelligence', Prentice-Hall of India, **2005**.
5. Patrick Henry Winston, 'Artificial Intelligence', Pearson Education Inc., 3rd Edn., **2001**.
6. Eugene Charniak and Drew Mc Dermott, 'Introduction to Artificial Intelligence', Addison-Wesley, ISE Reprint, **1998**.
7. Nils J. Nilsson, 'Artificial Intelligence - A New Synthesis', Harcourt Asia Pvt. Ltd., Morgan Kaufmann, **1988**.

SOFTWARE TESTING & QUALITY ASSURANCE

Subject Code: BCSE1-767 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

LEARNING OBJECTIVES

This courses discusses the general topic of defining software quality attributes and deploying techniques to ensure that these quality attributes are met.

Special focus is placed on functional quality attributes, such as correctness, reliability, safety, security, etc.

LEARNING OUTCOMES

After learning the course, the students should be able to:

CO1 To understand the basics of software quality and learn various metrics of software quality.
CO2 Describe different approaches to testing software applications.
CO3 To introduce concepts behind designing of test cases
CO4 To learn the procedure of debugging a given software

UNIT-I (11 Hrs.)

Software Quality: Quality Concepts, Quality Movement, Software Quality Assurance, Software Reviews, Formal Technical Reviews, Formal Approaches to SQA, Statistical Software Quality Assurance, Software Reliability, Reliability metrics, Reliability Growth Modelling, The SQA Plan.

UNIT II (12 Hrs.)

Software Quality Management: Quality Metrics, Risk Management, Quality management, The ISO 9000 Quality Standards and SEI CMMI, Six Sigma, Computer aided software engineering, Software maintenance, Software Configuration Management, Component-based software development.

UNIT III (11 Hrs.)

Testing Fundamentals: Testing Fundamentals, Unit Testing, Test cases design Techniques, White Box Testing and Black Box Testing, Integration Testing, System and acceptance testing, Testing of Object Oriented Systems, Usability and Accessibility Testing.

UNIT IV (11 Hrs.)

Test Planning, Management, Execution and Reporting.

Software Test Automation, Testing Metrics and Measurements.

Recommended Books

1. Roger S Pressman, 'Software Engineering Concepts and Practices', 7th Edn., TMG, **2009.**
2. Srinivasan Desikan, Gopalaswamy Ramesh, 'Software Testing', Pearson Education, **2006**.
3. Louis Tamres, 'Introducing Software Testing', 1st Edn., Addison Wesley Publications,
4. Ron Patten, 'Software Testing', SAMS Techmedia, Indian Edition, **2001**.
5. Mordechai Ben-Menachem, Gary S Marliss, 'Software Quality-Producing Practical, Consistent Software', Thomson Learning, **2003**.
6. Kshirsager Naik and Priyadarshini Tripathi, 'Software Testing and Quality Assurance', Wiley, **2008.**

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7. Nageswara Rao Pusuluri, 'Software Testing Concepts and Tools', Dream Tech. Press, **2006.**
8. M.G. Limaye, 'Software Testing Principles, Techniques and tools', 1st Edn., McGraw Hills, **2009.**
9. Aditya P. Mathur, 'Foundations of Software Testing', 2nd Edn., Pearson Education, **2013.**
10. William E Perry, 'Effective Methods for Software Testing', 3rd ed., Wiley, **2006**.
11. K.V.K.K. Prasad, 'Software Testing Tools', Dream Tech, **2004.**
12. M G Limaye, "Software Testing – Principles, Techniques and Tools", McGraw Hill, **2011**.
13. Kshirasagar Naik, Priyadarshi Tripathy, 'Software Testing and Quality Assurance Theory and Practice', John Wiley & Sons, Inc., Publication, **2009.**
14. G. Gordon Schulmeyer, 'Handbook of Software Quality Assurance', 4th Edn., Artech House, **2008**.
15. William E. Lewis, 'Software Testing and Continuous Quality Improvement', 2nd Edn. AUERBACH PUBLICATIONS, **2005.**

DATABASE MANAGEMENT –II LAB.

Subject Code: BCSE1-732 **L T P C**
0 0 2 1

PRACTICALS

1. Write pl/sql blocks using different control structures
2. Create simple and complex views
3. Study and Implement stored procedures
4. Study and Implement functions
5. Create sequences
6. Create cursors
7. implement different types of triggers
8. Server administration of any database management software
9. Study and usage of open source data mining tool: Weka

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OBJECT ORIENTED ANALYSIS AND DESIGN USING UML LAB.

Subject Code BCSE1-733 **L T P C**
0 0 2 1

Practical to be performed in lab

1. To develop a problem statement.
2. Develop an IEEE standard SRS document.
3. Identify Use Cases and develop the Use Case model.
4. Identify the business activities and develop an UML Activity diagram.
5. Identity the conceptual classes and develop a domain model with UML Class diagram.
6. Using the identified scenarios find the interaction between objects and represent them using UML Interaction diagrams.
7. Draw the Sequence Diagram.
8. Draw the Collaboration Diagram.
9. Draw the State Chart diagram.
10. Draw Component and Deployment diagrams.

CLOUD COMPUTING & BIG DATA

Subject Code: BCSE1-836 **L T P C** **Duration: 45 Hrs.**

3 1 0 4

LEARNING OBJECTIVES: This course will help you in learning Big data with Cloud technology to understand what is cloud storage, Big data in the cloud, characteristics of cloud computing, cloud computing services and cloud hosting, cloud data storage and deployment models, cloud computing companies and cloud service providers, cloud infrastructure, advantages of cloud computing and issues with cloud computing.

LEARNING OUTCOMES:

CO1: Ability to learn basics of Big data, Hadoop and Map Reduce

CO2: Able to learn the basics of Hive, HQL, HBase schema design, PIG and NoSQL.

CO3: Understand various basic concepts related to cloud computing technologies, architecture and concept of different cloud models: IaaS, PaaS, SaaS. Cloud virtualization, cloud storage, data management and data visualization.

CO4: Understand different cloud programming platforms & tools and familiar with application development and deployment using cloud platforms.

UNIT-I (11 Hrs.)

Big Data – Introduction, its importance, 5v's, Security Challenges, need for Big data analytics and its applications.

Hadoop - Apache Hadoop Architecture, Hadoop YARN, Comparison of Traditional system & Hadoop Ecosystem, Installation steps of Hadoop (1.x), Moving Data in and out of Hadoop, need for Record Reader and Record writer, understanding inputs and outputs file format of Map Reduce.

UNIT-II (12 Hrs.)

Hive - Introduction to Hive, Hive Architecture and Installation, HQL vs SQL, Introduction to PIG, NoSQL.

UNIT-III (11 Hrs.)

Cloud Computing Fundamentals: Introduction to Cloud Computing, private, public and hybrid cloud. Cloud types: IaaS, PaaS, SaaS. Benefits and challenges of cloud computing, public vs private clouds, Role of virtualization in enabling the cloud; Benefits and challenges to Cloud architecture.

UNIT-IV (11 Hrs.)

Cloud Applications, Cloud Services Management: Reliability, availability and security of services deployed from the cloud. Performance and scalability of services, tools and technologies used to manage cloud services deployment, computing infrastructures available for implementing cloud based services.

RECOMMENDED BOOKS

1. Chris Eaton, Dirk deroos et al., 'Understanding Big data', 1st Ed., McGraw Hill, **2015**.
2. Tom White, 'HADOOP: The definitive Guide', 4th Ed., O Reilly, **2015**.
3. Gautam Shroff, 'Enterprise Cloud Computing Technology Architecture Applications', 1st Ed., Cambridge University Press, **2010**.
4. Toby Velte, Anthony Velte, Robert Elsenpeter, 'Cloud Computing, A Practical Approach', 1st Ed., Mcgraw Hill Education, **2009**.
5. Thomas Erl, ' Big Data Fundamentals', 1st ed., Pearson Education, **2016**
6. Srinivasan, ' Cloud Computing', 1st ed., Pearson Education, **2016.**

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SCRIPTING LANGUAGES

Subject Code: BCSE1-868	L T P C 3 1 0 4	Duration: 45 Hrs.

LEARNING OBJECTIVES: This course will make student learn about various scripting languages which are required web and software development

LEARNING OUTCOMES:

CO1: Ability to understand the different scripting languages.
CO2: Understand the basic and advanced concepts of perl programming.
CO3: Understanding of python especially the object oriented concepts.
CO4: Working knowledge of Python UI and its connectivity to database.

UNIT-I (11 Hrs.)

Introduction to PERL and Scripting: Scripts and Programs, Origin of Scripting, Scripting Today, Characteristics of Scripting Languages, Uses for Scripting Languages, Web Scripting, and the universe of Scripting Languages. PERL- Names and Values, Variables, Scalar Expressions, Control Structures, arrays, list, hashes, strings, pattern and regular expressions, subroutines.

UNIT –II (12 Hrs.)

Advanced Perl: Finer points of looping, pack and unpack, file system, eval, data structures, packages, modules, objects, interfacing to the operating system, Creating Internet ware applications, Dirty Hands Internet Programming, security Issues.

UNIT-III (11 Hrs.)

Python: Introduction to Python language, Datatypes, Numbers, Sequences, None, Boolean Variable, Reference Expression, Numeric and Sequence Operators, List Print Statement, Basic flow statements like if statement, for and while loops with continue, break and pass statement, and Classes, Strings and Regular expressions, Built-in-functions and Methods, Modules in python, Exception Handling, File and Text operations

UNIT-IV (11 Hrs.)

Tkinter and Events: Introduction Widget: Introduction Commonly used Simple Widgets: Button, Check button, Entry, Label, List box, Radio button, Scrollbar Container Widgets: Frame, Menus Text Widget Event Object Binding Callbacks to Events, Events names: Keyboard events, Mouse events Event-Related Methods Other Callback-related methods
Working with Database: Database API 2.0: Introduction Exception classes, Thread Safety, and Parameter Style Factory Functions Type Description Attributes Connection: Function and Objects Cursor Objects DBAPI-Compliant Modules

RECOMMENDED BOOKS

1. David Barron, 'The World of Scripting Languages', Wiley Publications, **2000**.
2. Steve Holden and David Beazley, 'Python Web Programming', New Riders Publications.
3. Deitel & Deitel, 'Perl How to Program', Pearson, Pap/Cdr Edn., **2001**
4. M. Lutz, 'Programming Python', 4th Edn., SPD.
5. Randal L. Schwartz, Tom Phoenix, brian d foyLearning Perl, 5th Ed., O'Reilly Media
6. David Till, 'Teach Yourself Perl 5 in 21 Days'.
7. James Tisdall, 'Beginning Perl for Bioinformatics', O Reilly Publications.
8. Rex A. Dawyer, 'Genomic Perl', 1875 7th Edn., Cambridge University Press, **2002.**
9. Chun, 'Core Python Programming', 2nd Edn., Prentice Hall, **2006.**
10. M. Dawson, 'Guide to Programming with Python',1st Edn., Cengage Learning, **2007**.
11. Larry Wall, T. Christiansen and J. Orwant, 'Programming Perl',5th Edn., O'Reilly, SPD, **2000**.

12. J.R. Flynt, 'Perl Power', Cengage Learning.
13. V. Vaswani, 'PHP Programming Solutions', 1st Edn., TMH, **2007.**
14. Vernon L. Ceder, 'The Quick Python Book', 2nd Edn., Manning Publications, **2010**.
15. Alex Martelli, 'Python in a Nutshell', o'reilly Publications, 3rd Edn., **2010**.

SOFTWARE PROJECT MANAGEMENT

Subject Code: BCSE1-869 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

LEARNING OBJECTIVES:

It gives an in depth knowledge of software project management and project planning. It also covers the Step Wise framework in project planning

LEARNING OUTCOMES (COs)

CO1	Apply the basics of Software Project Management in order to manage and deliver qualified product and plan the activities within time schedules with CPM and PERT Analysis.
CO2	For managing the quality of product and managing the risk involved
CO3	Managing team and measuring and tracking the planning
CO4	Configuration management and project monitoring and control

UNIT-I (11 Hrs.)

Project Planning: Characteristics of a software project, Software scope and feasibility, resources, the SPM plan.

Software Project Estimation: Size/scope estimation, Decomposition techniques, WBS. Effort estimation: Sizing, Function point, LOC, FP vs LOC. Schedule estimation: GANTT Charts, Activity networks, PERT/CPM networks. Cost estimation: Models: COCOMO-I, COCOMO-II.

UNIT-II (12 Hrs.)

Quality Planning: Quality control, Quality assurance, Formal Technical Reviews, The SQA Plan, ISO and CMM standards.

Risk Management: Reactive vs proactive Risk strategies, Risk projection, Risk Refinement, Risk Monitoring, Monitoring and management, RMMM plan.

UNIT-III (11 Hrs.)

Measurement and Tracking Planning: Earned Value Analysis.

Team Management: Team structures: hierarchical, Egoless, chief programmer, mixed; Team software Process; Resource levelling, Building a team: Skill sets.

UNIT-IV (11 Hrs.)

Configuration Management: Baselines, Configurable items, SCM repository, SCM process, version control change control, configuration audit**.**

Project Monitoring and Control: Audits and Reviews.

Recommended Books

1. Bob Hughes and Mike Cotterell, 'Software Project Management', 5th Edn., Tata McGraw Hill, **2009.**
2. Roger Pressman, 'A Practitioner's Guide to Software Engineering', 8th Edn., Tata McGraw Hill, **2014.**
3. 'Head First PMP: A Brain Friendly Guide to Passing the Project Management Professional Exam', **2013.**

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WIRELESS SENSOR NETWORKS

Subject Code: BCSE1-870 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

LEARNING OBJECTIVES: The objective of this course is to make the students to Understand the basic WSN technology and supporting protocols, with emphasis placed on standardization basic sensor systems and provide a survey of sensor technology

LEARNING OUTCOMES:

CO1: Able to explain about basic concepts of wireless sensor networks. Also acquire knowledge about architecture of sensor networks.

CO2: Acquire knowledge about MAC Protocols for Wireless Sensor Networks, and various routing protocols for networking sensors.

CO3: Able to explain about Topology Control, Clustering, Time Synchronization, Localization and Positioning, Sensor Tasking and Control.

CO4: Acquire knowledge about Security challenges.

UNIT-I (11 Hrs.)

Overview of wireless sensor networks: Challenges for Wireless Sensor Networks, Single-Node Architecture - Hardware Components, Energy Consumption of Sensor Nodes- Radio Energy Consumption Model, Operating Systems and Execution Environments, Applications of WSN, Computational models, Performance metrics

UNIT II (12 Hrs.)

Networking sensors: Physical Layer and Transceiver Design Considerations, MAC Protocols for Wireless Sensor Networks, Low Duty Cycle Protocols And Wakeup Concepts - S-MAC, The Mediation Device Protocol, Wakeup Radio Concepts, Address and Name Management, Assignment of MAC Addresses, Routing Protocols- Energy-Efficient Routing, Geographic Routing.

UNIT-III (11 Hrs.)

Infrastructure establishment: Sensor deployment mechanisms- uniform random deployment, grid deployment, Time Synchronization- Introduction, Protocol based on sender- receiver synchronization, Issues of coverage, Node discovery protocols, Localization Schemes, Network clustering, Topology Control.

UNIT IV (11 Hrs.)

Security challenges, Threat and attack models, Quality of service provisioning, Supporting fault tolerant operation

RECOMMENDED BOOKS:

1. Holger Karl & Andreas Willig, 'Protocols And Architectures for Wireless Sensor Networks' , John Wiley, **2005.**
2. Feng Zhao & Leonidas J. Guibas, 'Wireless Sensor Networks- An Information Processing Approach', Elsevier, **2007**.
3. Kazem Sohraby, Daniel Minoli, & Taieb Znati, 'Wireless Sensor Networks-Technology, Protocols, And Applications', John Wiley, **2007**.
4. Anna Hac, 'Wireless Sensor Network Designs', John Wiley, **2003**.

CLOUD COMPUTING & BIGDATA LAB.

Subject Code: BCSE1-837 **L T P C**
0 0 2 1

Practical to be performed in lab

1. (i) Perform setting up and Installing Hadoop in its three operating modes: • Standalone, • Pseudo distributed, • Fully distributed.
   (ii) Use web based tools to monitor your Hadoop setup.
2. Implement the following file management tasks in Hadoop:
   a. Adding files and directories
   b. Retrieving files
   c. Deleting files
   Hint: A typical Hadoop workflow creates data files (such as log files) elsewhere and copies them into HDFS using one of the above command line utilities.
4. Run a basic Word Count Map Reduce program to understand Map Reduce Paradigm.
5. ***Use Eucalyptus or Open Nebula or equivalent to set up the cloud and demonstrate:***
   a) Find procedure to run the virtual machine of different configuration. Check how many virtual machines can be utilized at particular time.

Find procedure to attach virtual block to the virtual machine and check whether it holds the data even after the

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B. TECH. CIVIL ENGINEERING

Total Contact Hours = 24 Total Marks = 900 Total Credits = 23

SEMESTER 3rd		Contact Hrs			Marks			Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
BCIE1-301	Strength of Materials	3	1	0	40	60	100	4
BCIE1-302	Fluid Mechanics	3	1	0	40	60	100	4
BCIE1-303	Irrigation Engineering-I	3	1	0	40	60	100	4
BCIE1-304	Building Materials	3	1	0	40	60	100	4
BCIE1-305	Rock Mechanics & Engineering Geology	2	0	0	40	60	100	2
BSOS0-F91	Soft Skills-I	0	0	2	60	40	100	1
BCIE1-306	Fluid Mechanics Lab.	0	0	2	60	40	100	1
BCIE1-307	Strength of Materials Lab.	0	0	2	60	40	100	1
BCIE1-308	Workshop Training	-	-	-	60	40	100	2
Total	**Total 5 Theory & 3 Lab. Courses**	**14**	**4**	**6**	**440**	**460**	**900**	**23**

Total Contact Hours = 25 Total Marks = 800 Total Credits = 22

SEMESTER 4th		Contact Hrs			Marks			Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
BCIE1-409	Structural Analysis-I	3	1	0	40	60	100	4
BCIE1-410	Survey	3	1	0	40	60	100	4
BCIE1-411	Irrigation Engineering-II	3	1	0	40	60	100	4
BCIE1-412	Environmental Engineering-I	3	1	0	40	60	100	4
BCIE1-413	Construction Machinery & Works Management	3	0	0	40	60	100	3
BSOS0-F92	Soft Skills-II	0	0	2	60	40	100	1
BCIE1-414	Structural Analysis Lab.	0	0	2	60	40	100	1
BCIE1-415	Survey Lab.	0	0	2	60	40	100	1
Total	**Total 5 Theory & 2 Lab. Courses**	**15**	**4**	**6**	**380**	**420**	**800**	**22**

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STRENGTH OF MATERIALS

Subject Code: BCIE1-301	**L T P C**	**Contact Hrs.: 45**
	3 1 0 4	

Unit-I

1. Simple Stresses and Strains: Introduction, stress-strain curves for elastic materials, different types of stresses and strains, elastic limit, Hookes' Law, Young's modulus of elasticity, Bulk modulus, modulus of rigidity, Lateral strain, Elongation due to self-weight bars of tapering sections, bars of varying sections, equivalent area of composite sections, temperature stresses, relation between elastic constants. Volumetric strain.

2. Complex Stress: Introduction, rectangular block subjected to normal stresses along and across two planes, combination of normal and tangential stresses, pure shear, principal stresses and Principal planes, Mohrs Circle, Principal strains, Computation of Principal stresses from Principal strains.

Unit-II

3. Bending moment & shear force diagrams: Introduction, Types of beams, supports and loading, sign conventions for bending moments and shear forces, Shear force and Bending moment diagrams for simply supported, cantilever and overhanging beams for different types of loading. Relationship between Bending moment, Shear Force and loading Graphical method of plotting Bending Moment & Shear Force Diagrams.

4. Bending and Shear Stresses: Introduction, Assumption made in theory of simple bending, derivation of basic equation, determination of stresses in simple sections, built up sections and composite sections. (flitched Beams), Introduction to theory of unsymmetrical bending beams of uniform strength, variation of shear stress across depth of various beam sections.

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Unit-III

5. Torsion: Introduction, torsion of shafts and springs, derivation of basic torsion equation, Power transmitted, sections subjected to combined bending and torsion, Principal stresses, equivalent Bending Moment & Torque, Helical spring, analysis of closed Coil helical spring.

6. Strain Energy: Introduction, Strain Energy due to axial Loads, Bending shear and Torsional stress, Impact load, strain energy due to Principal stress & strains, theories of failure.

Unit-IV

7. Deflection of Beams: Derivation of basic equation of elastic curve, deflection in beams with different end conditions and different loadings by double integration method, Macaulay's method.

8. Columns and Struts: Introduction, Euler's buckling loads for columns with different end conditions, limitations of Euler's formula, column carrying eccentric loads, laterally loaded columns, empirical formula.

Recommended Books:

1. Ferdinand P. Beer, E. Russell Johnston Jr., John T. Dewolf and David F. Mazurek, 'Mechanics of Materials (In SI Units)'.
2. D.K. Singh, 'Mechanics of Solids', Pearson Education, **2002**.

Reference Books:

1. Stephen H. Crandall, Norman C. Dahl and Thomas J. Lardner, 'An Introduction to the Mechanics of Solids', McGraw-Hill International Editions.
2. Egor P. Popov, 'Engineering Mechanics of Solids', Prentice-Hall of India.

FLUID MECHANICS

Subject Code: BCIE1-302 **L T P C** **Contact Hrs.: 45**
3 1 0 4

1. **Fluid and their Properties:** Ideal and real fluids, Continuum concept of fluid: density, specific weight and relative density, viscosity and its dependence on temperature, surface tension and capillarity, vapour pressure and cavitation, compressibility band bulk modulus, Newtonian and non-Newtonian fluids.
2. **Fluid Statics:** Concept of pressure, Pascal's law, Action of fluid pressure on plane (horizontal, vertical and inclined) submerged surface, resultant force and centre of pressure, force on a curved surface due to hydrostatic pressure, Buoyancy and flotation, stability of floating and submerged bodies, Meta centric height and its determination.
3. **Fluid Kinematics:** Classification of fluid flows, velocity and acceleration of fluid particle, local and convective acceleration, normal & tangential acceleration streamline, path line and streak line, flow rate and discharge mean velocity continuity equation in Cartesian co-ordinates, stream & velocity potential functions.
4. **Fluid Dynamics:** Euler's equation, Bernoulli's equation and steady flow energy equation, kinetic energy and momentum correction factors, flow along a curved streamline, free and forced vortex motions.
5. **Dimensional Analysis and Similitude:** Fundamental and derived units and dimensions, dimensional homogeneity, Rayleigh's and Buckingham's Pi method for dimensional analysis, dimension less number and their significance, geometric, kinematic and dynamic similarity, model studies, Flow Measurement in Manometers, Pitot tubes, Venturimeter and orifice meters, orifices, mouthpieces, notches **(Rectangular and V-notches)** and weirs **(Sharp crested Weirs)**.
6. **Laminar& Turbulent Flow:** Flow through circular section pipe, flow between parallel plates, stokes law, Transition from laminar to turbulent, Critical velocity and critical Reynolds Number Turbulent flows and flow losses in pipes, Darcy equation minor head losses in pipe fittings, hydraulic and energy gradient lines, Effects of turbulent flow in pipes.
7. **Uniform flow in open Channels:** Flow classifications, basic resistance equation for open channel flow, Chezy, Manning, Bazin and Kutter formulae, Variation of roughness coefficient, conveyance and normal depth, Velocity Distribution, Most efficient flow sections, rectangular, trapezoidal and circular.
8. **Energy principles and critical flow:** Energy and specific energy in an open channel, critical depth for rectangular and trapezoidal channels, Alternate depths, applications of specific energy to transitions and Broads crested weirs, Momentum and specific force in open channel flow, sequent depths.

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Recommended Books:

1. P.N. Modi and S.M. Seth, 'Hydraulics & Fluid Mechanics', Standard Publication.
2. S. Subraminayam, 'Flow in Open Channels', Tata McGraw Hill.
3. Robert N. Fox & Alan T. Macnold, 'Introduction to Fluid Mechanics'.
4. R.K. Bansal, 'Fluid Mechanics', Laxmi Publications.
5. Jagdish Lal, 'Fluid Mechanics', Metropolitan Book Co. (P) Ltd.

IRRIGATION ENGINEERING –I

Subject Code: BCIE1-303 **L T P C** **Contact Hrs.: 45**
3 1 0 4

Unit-I

INTRODUCTION: Importance of Irrigation Engineering, purposes of Irrigation, objectives of Irrigation, Benefits of Irrigation, Advantages of various techniques of irrigation- - Furrow Irrigation, Boarder strip Irrigation, Basin Irrigation, Sprinkler Irrigation, Drip Irrigation.

METHODS OF IRRIGATION: Advantages and disadvantages of irrigation, water requirements of crops, factors affecting water requirement, consumptive use of water, water depth or delta, Duty of water, Base Period, relation between delta, duty and base period, Soil crop relation-ship and soil fertility.

Unit-II

CANAL IRRIGATION: Classifications of canals, canal alignment, Inundation canals, Bandhara irrigation, advantages and disadvantages, Silt Theories-Kennedy's theory, Lacey's theory, Drawbacks in Kennedy's & Lacey's theories, comparison of Lacey's and Kennedy's theories, Design of unlined canals based on Kennedy & Lacey's theories.

LINED CANALS: Types of lining, selection of type of lining, Economics of lining, maintenance of lined canals, silt removal, strengthening of channel banks, measurement of discharge in channels, design of lined canals, methods of providing drainage behind lining

Unit-III

LOSSES IN CANALS, WATER LOGGING AND DRAINAGE: Losses in canals Evaporation and seepage, water logging, causes and ill effects of water logging anti water logging measures. Drainage of land, classification of drains - surface and subsurface drains, Design considerations for surface drains, Advantages and maintenance of tile drains.

INVESTIGATION AND PREPARATION OF IRRIGATION PROJECTS: Classification of project, Project preparation-investigations, Design of works and drawings, concept of multi - purpose projects, Major, Medium and minor projects, planning of an irrigation project, Economics & financing of irrigation works. Documentation of project report.

Unit-IV

TUBE - WELL IRRIGATION: Types of tube wells - strainer type, cavity type and slotted type. Type of strainers, Aquifer, porosity, uniformity coefficient, specific yield & specific retention, coefficients of permeability, transmissibility and storage. Yield or discharge of a tube well, Assumptions, Theim's & Dupuit’s formulae, Limitations of Theim's and Dupuit's formulae. Interference of tube wells with canal or adjoining tube-wells, causes of failure of tubewells, optimum capacity, Duty and delta of a tube well. Rehabilitation of tube well.

RIVER TRAINING WORKS: Objectives, classification of river-training works, Design of Guide Banks. Groynes or spurs - Their design and classification ISI. Recommendations of Approach embankments and afflux embankments, pitched Islands, Natural cut-offs and Artificial cut-offs and design Considerations.

Recommended Books:

1. S.K. Sharma, ‘Principles & Practice of Irrigation Engg.’, S. Chand, Ltd.
2. B.C. Punmia, Pande B.B. Lal, ‘Irrigation & Water Power Engg.’, Laxmi Publications (P) Ltd.
3. Bharat Singh, ‘Fundamentals of Irrigation Engg.’, Nem Chand & Bros.
4. S.R. Sahasrabudhe, ‘Irrigation Engg. & Hydraulic Structure’, S.K. Kataria & Sons.

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5. Varshney, Gupta & Gupta, ‘Irrigation Engg. & Hydraulic Structure’, Nem Chand and Brothers.
6. Santosh Kumar Garg, ‘Irrigation Engg. & Hydraulic Structure’, Khanna Publishers.

BUILDING MATERIALS

Subject Code: BCIE1-304 **L T P C** **Contact Hrs.: 45**
3 1 0 4

Unit - I

Building Stones: General, Uses of stones, natural bed of stones, qualities of a good building stone, deterioration of stones, preservation of stones, artificial stones, common building stones of India and their uses.

Bricks: General, Composition of good brick earth, Harmful ingredients in brick earth, qualities of good bricks, tests for bricks, classification of bricks.

Timber: Definition, classification of trees, structure of a tree, felling of trees, seasoning of timber, storage of timber, market forms of timber.

Unit - II

Lime: General, some definitions calcination, Hydraulicity, setting, slacking, sources of lime, classification of limes, uses of lime, tests for lime stones.

Cement: Constituents of Cement, Manufacture of Portland cement

Concrete: Introduction, Constituents of concrete, batching of materials, Manufacturing process of cement concrete, workability and factors affecting it, Methods to determine workability, segregation and bleeding of concrete, Strength of concrete and factors affecting it.

Miscellaneous Materials: Paints, Distempering, Glass, Plastics.

Unit - III

Foundation and Walls: Definition, types of foundations, Types of walls and thickness considerations.

Brick and Stone Masonry: Terms used, Types of bonds & their merits and demerits, rubble and ashlars joints in stone masonry, cement concrete hollow blocks and their advantages and disadvantage.

Damp Proofing: Sources, causes and bad effects of dampness, preventive measures for dampness in buildings.

Unit - IV

Roofs: Terms used, Classification of roofs and roof trusses, Different roof covering materials.

Plastering and Pointing: Objects, Methods of plastering, Materials and types, Defects in plastering, special material for plastered surface, distempering white washing and colour washing.

Floors: General, Types of floors used in building & and their suitability, factors for selecting suitable floor for building.

Recommended Books:

1. Rangwala, ‘Building Materials’.
2. S.P. Bindra, K.R. Arora, ‘Building Construction’.
3. M.S. Shetty, ‘Concrete Technology’.
4. B.C. Punmia, ‘Building construction’.
5. Parbin Singh, ‘Building Materials’.

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6. Sushil Kumar, ‘Building Construction’.

ROCK MECHANICS & ENGINEERING GEOLOGY

Subject Code: BCIE1-305 **L T P C** **Contact Hrs.: 26**
2 0 0 2

UNIT-I

1. **General Geology:** Importance of Engg. Geology applied to Civil Engg. Practices, Weathering, Definition- types and effect, Geological works of rivers, wind, glaciers as agents of erosion, transportation and deposition.
2. **Rocks & Minerals:** Minerals, their identification, igneous, sedimentary & metamorphic rocks. Classification of rocks for engineering purposes, Rock quality designation (RQD).

UNIT-II

3. **Structural Geology:** Brief idea about stratification, apparent dip, true dip, strike and in Conformities, Folds, faults & joints: definition, classification relation to engineering operations.
4. **Engineering Geology:** Geological considerations in the Engg. Projects like tunnels, highways, foundation, dams, reservoirs. Earthquake: Definition, terminology, earthquake waves, intensity, recording of earthquake.

UNIT-III

5. **Engineering properties of rocks and laboratory measurement:** Uniaxial compression test, tensile tests, permeability test, shear tests, size and shape of specimen rate of testing. Confining pressure, stress strain curves of typical rocks. Strength of intact and fissured rocks, effect of anisotropy, effect of saturation and temperature.
6. **In-situ determination of Engineering Properties of Rock masses:** Necessity of in-situ tests, uniaxial load tests in tunnels and open excavations, cable tests, flat jack test, shear test, pressure tunnel test, Simple methods of determining in situ stresses, bore hole test.

UNIT-IV

7. **Improvement in Properties of Rock Masses**: Pressure grouting for dams and tunnels, Rock reinforcement, rock bolting.

Recommended Books:

1. Richard E. Goodman, ‘Introduction to Rock Mechanics’.
2. I.W. Farmar, ‘Engineering Behaviour of Rocks’.
3. C. Jaager, ‘Rock Mechanics and Engineering’.
4. Jaager and Cook, ‘Fundamentals of Rock Mechanics’.
5. D.S. Arora, ‘Engineering Geology’.
6. Parbin Singh, ‘Engineering Geology’.
7. B.P. Verma, ‘Rock Mechanics for Engineering’.

FLUID MECHANICS LAB.

Subject Code: BCIEI-306 **L T P C**
0 0 2 1

1. To determine the meta-centric height of a floating vessel under loaded and unloaded conditions.

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2. To study the flow through a variable area duct and verify Bernoulii's energy equation.
3. To determine the coefficient of discharge for an obstruction flow meter (venturimeter/orifice meter)
4. To determine the discharge coefficient for a Vee notch or rectangular notch.
5. To determine the coefficient of discharge for Broad crested weir.
6. To determine the hydraulic coefficients for flow through an orifice.
7. To determine the friction coefficient for pipes of different diameter.
8. To determine the head loss in a pipe line due to sudden expansion/sudden contraction/ bend.
9. To determine the velocity distribution for pipe line flow with a pitot static probe.

Recommended Books:

1. John J. Bloomer, 'Practical Fluid Mechanics for Engineering Applications (Mechanical Engineering), Marcel Dekker.
2. S. Sarabjit Singh, 'Fluid Mechanics Practical Manual'.
3. Baljit Kapoor, 'Fluid Mechanics Manual'.

STRENGTH OF MATERIAL LAB.

Subject Code: BCIE1-307 **L T P C**
0 0 2 1

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Experiments on **Material Behaviour:** Tests for Impact, Hardness, Torsion, Stiffness, Tensile Strength, Bending and Compression tests, Columns & Struts.

1. To determine Tensile Strength of Mild Steel.
2. To determine Torsional Strength of Mild Steel and Cast Iron.
3. To determine Impact Strength of Mild Steel – Izod's and Charpy tests.
4. To determine Brinell and Vicker's Hardness numbers of Mild Steel.
5. To determine the Rockwell Hardness number of metals.
6. To determine the Fatigue Strength of Mild Steel.
7. To determine experimentally the value of modulus of elasticity of the beam material using deflections formula for simply supported and cantilever beams.
8. To study the behavior of the given material on UTM.
9. Study of behavior of columns and struts with different end conditions.

Recommended Books:

1. Timoshenko and D.H. Young, 'Elements of Strength of Materials', Van Nostrand Reinhold Company, New York.
2. Seely and Sindh, 'Advanced Mechanics of Materials'.
3. S. Ramamarutham, 'Strength of Materials', Dhanpat Rai and Sons.
4. IS: 1608-1972-Method for Testing of Steel Products.
5. IS: 1521-1972-Method for Tensile Testing of Steel Wire.
6. IS: 1717-1971-Method for Simple Torsion Testing of Steel Wire.
7. IS: 524-1969-Method of Test for determining Shear Strength of Mild Steel.
8. IS: 1598-1960-Izod Impact Test for Steel.
9. IS: 1499-1959-Method for Charpy Impact Test (U-Notch) for Steel.
10. IS; 1500-1668-Method for Brinell Hardness Test for Steel.
11. IS: 1586-1968-Method for Rockwell Hardness Test for Steel.

12. IS: 1599-1960-Method for Bend Test for Steel Products other than Sheet, Strip, Wire and Tube.
13. IS: 5619-1970-Indian Standard Recommendations for Fatigue Testing of Metals.
14. Manual on Fatigue Testing, A.S.T.M. Special Technical Publication No. 91.
15. IS: 5069-1969- Indian Standard on Glossary of terms relating to methods of mechanical testing of metals.

STRUCTURAL ANALYSIS-I

Subject Code: BCIE1-409 **L T P C** **Contact Hrs.: 45**
3 1 0 4

Unit-I

1. Deflection of Beams: Review of Double Integration Method and Macaulay's Method, Moment Area Method, Conjugate Beam Method, Unit Load Method, Energy Methods, Maxwell’s reciprocal theorem.

2. Thin Cylinders and Spheres: Introduction, stresses and strains in thin cylinders and spherical shell, volumetric change, wire wound thin cylinders, thin vessels subjected to internal pressure.

Unit-II

3. Analysis of determinate Trusses: Introduction, determination of forces in member of trusses by method of joints, method of sections, Tension Coefficient Method, Deflection of Joints of plane frames by castigliano's first theorem and unit load method, Effect of Lack of Fit & Temperature Change.

4. Analysis of Dams, chimneys and Retaining Walls: Introduction, limit of eccentricity for no tension in the section, core of the section, middle third rule, wind pressure on chimneys.

Unit-III

5. Simple Cable & Arch Structures: Introduction, shape of a loaded cable, cable carrying point loads and UDL, cables with ends at different level, cable subjected to temperature stresses, Analysis of Cables, Analysis of three hinged (Parabolic and Circular) Arches for Horizontal Thrust, Bending Moment, Normal Thrust, and Radial Shear.

6. Suspension Bridges: Introduction, Analysis of suspension bridges with two hinged and three hinged stiffening girders, Temperature Stresses in Three Hinged and Two Hinged Stiffening Girders.

Unit-IV

7. Rolling Loads: Introduction to rolling loads and influence lines, Determination of shear force, bending moment at a section and absolute shear force and bending moment due to single point load, uniformly distributed load, several point loads etc.

8. Influence Lines: Construction of Influence lines for reaction, shear forces and bending moment for beams, influence lines for girders with floor beams, Influence lines for forces in members of frames. Influence lines for Three Hinged Arches & Stiffening Girders.

Recommended Book:

1. C.S. Reddy, ‘Basic Structural Analysis’.
2. Vazirani & Ratwani, ‘Analysis of Structures’, Vol- I, II.
3. C.K.Wang, ‘Intermediate Structural Analysis’.

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SURVEY

Subject Code: BCIEI-410 **L T P C** **Contact Hrs.: 45**
3 1 0 4

Unit - I

Definition, principles of surveying, different types of surveys, topographical map, scale of map. Measurement of distances with chain and tape, direct & indirect ranging, offsets.

Instruments used in traversing, bearings, meridians, declination, dip of magnetic needle, bearing of lines from included angles, local attraction, closing error and its removal.

Unit-II

Principle of plane table survey, setting up the plane table and methods of plane tabling.

Setting up a dumpy level, booking and reducing the levels by rise & fall method and height of instrument method, correction due to curvature and refraction, characteristics of contours, methods of contouring, uses of contour maps.

Unit – III

Temporary and permanent adjustments of theodolite, measurement of horizontal and vertical angles, closed & open traverse, consecutive and independent co-ordinates, advantages and disadvantages of traversing, Latitudes and Departures, closing error, Bowditch & Transit Rules, Gales traverse table, Different cases of omitted measurements.

Determination of tachometer constants, Measurement of horizontal & vertical distances with tachometer.

Unit – IV

Selection of stations and base line for geodetic survey, corrections for base line, satellite station and reduction to centre. Elements of curves, different methods of setting out of curves, transition curve.

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Recommended Books:

1. B.C. Punmia, Ashok Kumar Jain, and Arun Kumar Jain, 'Surveying', Vol. I, II, Laxmi Publications, **2005.**
2. R. Agor, 'Surveying', Khanna Publishers, **1982.**
3. S.S. Bhavikatti, 'Surveying & Levelling Vol. I, II, **2009.**
4. Narinder Singh, 'Surveying', Tata McGraw Hill.
5. N.N. Basak, 'Surveying and leveling', Tata McGraw Hill, New Delhi, **2000.**

IRRIGATION ENGINEERING –II

Subject Code: BCIEI-411 **L T P C** **Contact Hrs.: 45**
3 1 0 4

Unit-I

Head Works: Types of head works, Functions and investigations of a diversion head work: component parts of a diversion head work and their design considerations, silt control devices.

Theories of Seepage: Seepage force and exit gradient, assumptions and salient features of Bligh's Creep theory, Limitations of Bligh's Creep theory, salient features of Lane's weighted Creep theory and Khosla's theory, Comparison of Bligh's Creep theory and Khosla's theory, Determination of uplift pressures and floor thickness.

Unit-II

Design of Weirs: Weirs versus barrage, types of weirs, main components of weir, causes of failure of weir and design considerations with respect to surface flow, hydraulic jump and seepage flow. Design of barrage or weir.

Energy Dissipation Devices: Use of hydraulic jump in energy dissipation, Factors affecting design, Types of energy dissipaters and their hydraulic design.

Unit-III

Canal Regulators: Offtake alignment, cross- regulators – their functions and design, Distributary head regulators, their design, canal escape.

Canal Falls: Necessity and location, types of falls and their description, selection of type of falls, Principles of design, Design of Sarda type, straight glacis and Inglis or baffle wall falls and level crossing**.**

Unit-IV

Cross-Drainage works: Definitions, choice of type, Hydraulic design consideration, Aqueducts their types and design, siphon aqueducts – their types and design considerations, super passages, canal siphons

Canal Out-lets: Essential requirements, classifications, criteria for outlet behaviors, flexibility, proportionality, sensitivity, sensitiveness, etc. Details and design of nonmodular, semi-modular and modular outlets.

Recommended Books:

1. Santosh Kumar Garg, ‘Irrigation Engineering & Hydraulic Structure’, Khanna Publishers.
2. R.K. Sharma, ‘Design of Irrigation Structures’, Oxford IBH Publishers.
3. S.R. Sahasrabudhe, ‘Irrigation Engineering and Hydraulics Structures’, Katson Publishing.
4. K.B. Khushlani, ‘Irrigation Practice and Design’, Vol. I to VII, Oxford IBH Publishers.
5. P.N. Modi, ‘Irrigation with Resources and with Power Engineering’, Standard Book House.
6. Ivan E. Houk, ‘Irrigation Engineering’, Vol. I, II, John Wiley and Sons.

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ENVIRONMENTAL ENGINEERING-I

Subject Code: BCIEI-412	**L T P C** **3 1 0 4**	**Contact Hrs.: 45**

Unit – I

Public Water Supply: Beneficial uses of water, water demand, per capita demand, variation in demand, causes detection and prevention of wastage of water, population forecasting, and water demand for firefighting, population forecasting and water demand estimation.

Water sources and development: Surface and ground water sources; Selection and development of sources; Assessment of potential; Flow measurement in closed pipes, intakes and transmission systems.

Unit – II

Pumps and Pumping Stations: Types of pumps and their characteristics and efficiencies; Pump operating curves and selection of pumps; pumping stations.

Quality and testing of Water: Impurities in water, sampling of water, physical, chemical and bacteriological water quality parameters, drinking water quality standards and criteria.

Water treatment: Water treatment schemes; Basic principles of water treatment; Design of plain sedimentation, coagulation and flocculation, filtration – slow, rapid and pressure; Disinfection units; Fundamentals of water softening, fluoridation and defluoridation, and water desalination and demineralization, taste and odour removal.

Unit – III

Transportation of Water: Pipes for transporting water and their design, water distribution systems and appurtenances; Water supply network design and design of balancing and service reservoirs; operation and maintenance of water supply systems.

Rural water supply: Principles, selection of source, rain water harvesting, quantitative requirements, low cost treatment techniques.

Unit – IV

Miscellaneous Methods of Water Treatment: Aerial colour, odors & Taster from water, control, removal of iron & manganese from water softening processes, base exchange process, swimming pool water treatment.

Recommended Books:

1. B.C. Punmia, Ashok Jain, Arun Jain, 'Water Supply Engineering - Environmental Engineering', Vol. I, Laxmi Publications, New Delhi.
2. Arcadio P. Sincero and Gregoria P. Sincero, 'Environmental Engineering - A Design Approach', Prentice Hall of India, New Delhi.
3. Howard S. Peavy, Donald R. Rowe & George Tchobanoglous, 'Environmental Engineering', McGraw Hill, International Edn.
4. S.K. Garg, 'Water Supply Engineering- Environmental Engineering', Vol. – I, Khanna Publishers, Delhi.
5. 'Water Supply and Sewerage', E.W. Steel, McGhee, J. Terence, McGraw Hill.

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CONSTRUCTION MACHINERY & WORKS MANAGEMENT

Subject Code: BCIE1-413 **L T P C** **Contact Hrs.: 45**
3 1 0 4

UNIT-I

1. INTRODUCTION: Need for project planning & management, time, activity & event, bar chart, Milestone chart, uses & draw backs.

2. PERT TECHNOLOGY: Construction of PERT network, time estimates, network analysis, forward pass & backward pass, slack, critical path, data reduction, suitability of PERT for research project, numerical problems.

UNIT-II

3. CPM TECHNOLOGY: Definitions, network construction, critical path, fundamental rules, determination of project schedule, activity time estimates, float types, their significance in project control, numerical problems.

UNIT-III

4. COST ANALYSIS AND CONTRACT: Type of costs, cost time relationships, cost slopes, conducting a crash programme, determining the minimum total cost of project, numerical problems. updating a project, when to update, time grid diagram, resource scheduling. planning of different components of civil engineering projects such as a house, workshop, dam, tunnel.

UNIT-IV

5. CONSTRUCTION EQUIPMENT AND MACHINERY: Tractors, bull dozers, rippers, scrappers, power shovels, dragline, hoes. Line diagram of each, sizes, output, uses, factors affecting selection of each equipment, economic life of equipment, maintenance and repair cost. Hoisting & Transporting Equipment: Hosts, Winches, Cranes, Belt conveyors, Ropeways, trucks & Wagons, Basic introduction to modern constructional equipment.

RECOMMENDED BOOKS:

1. R.L. Peurifoy, 'Construction Planning and Equipment', Tata McGraw Hill, New Delhi.
2. L.S. Srinath, 'PERT and CPM', East West Press.
3. Wiest & Levy, 'Management Guide to PERT & CPM', Prentice Hall.
4. Mahesh Verma, 'Construction Equipment & Planning and Application', Artec Publication.
5. U.K. Shrivastava, 'Construction Planning and Management', Galgotia Publications Pvt. Ltd.

STRUCTURAL ANALYSIS LAB.

Subject Code: BCIE1-414 **L T P C**
0 0 2 1

Experimental Work:

1. Deflection of a simply supported beam and verification of Clark-Maxwell's theorem.
2. To determine the Flexural Rigidity of a given beam.
3. To verify the Moment- area theorem for slope and deflection of a given beam.
4. To determine the Carry Over Factor of a prismatic beam with far end fixed.
5. Experiment on three-hinged arch.
6. Experiment on two-hinged arch.
7. Deflection of a statically determinate pin jointed truss.
8. Forces in members of a Redundant frame.
9. Experiment on curved beams.
10. Unsymmetrical bending of a cantilever beam.

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SURVEY LAB.

Subject Code: BCIEI-415 **L T P C**
0 0 2 1

1. Measurement of distance, ranging a line.
2. Measurement of bearing and angles with compass, adjustment of traverse by graphical method.
3. Different methods of leveling, height of instrument, rise & fall methods.
4. Measurement of horizontal and vertical angle by theodolite, plotting of traverse.
5. Determination of tachometric constants and determination of reduced levels by tachometric observations.
6. Plane table survey, different methods of plotting, two point & three-point problem.
7. Measurement of Base Line after applying tape corrections.
8. Setting out a transition curve. Setting out of circular curves in the field using different methods.

B. TECH. (FOOD TECHNOLOGY)

Total Contact Hours = 25 Total Marks = 800 Total Credits = 24

SEMESTER 3rd		**Contact Hrs**			**Marks**			**Credits**
Subject Code	**Subject Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
BFOT1-301	Principles of Food Preservation	3	1	-	40	60	100	**4**
BFOT1-302	Food Chemistry	3	1	-	40	60	100	**4**
BFOT1-303	Food Microbiology	3	1	-	40	60	100	**4**
BFOT1-304	Fluid Flow Operations and Rheology	3	1	-	40	60	100	**4**
BSOS0-F91	Soft Skills-I	-	-	2	60	40	100	**1**
BFOT1-305	Food Chemistry (Lab)	-	-	2	60	40	100	**1**
BFOT1-306	Food Microbiology (Lab)	-	-	2	60	**40**	**100**	**1**
BFOT1-307	Training-I							**2**
Departmental Elective –I (Select any one)		3	-	-	40	60	100	**3**
BFOT1-356	Food Hygiene And Plant Sanitation							
BFOT1-357	Industrial Microbiology							
Total	**Theory = 6 Lab = 2**	**15**	**4**	**6**	**380**	**420**	**800**	**24**

Total Contact Hours = 25 Total Marks = 800 Total Credits = 22

SEMESTER 4th		**Contact Hrs**			**Marks**			**Credits**
Subject Code	**Subject Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
BFOT1-408	Food Engineering	3	1	-	40	60	100	**4**
BFOT1-409	Fruits and Vegetable Processing Technology	3	1	-	40	60	100	**4**
BFOT1-410	Milk and Milk Products Technology	3	1	-	40	60	100	**4**
BFOT1-411	Technology of Animal Products	3	1	-	40	60	100	**4**
BSOS0-F92	Soft Skills-II	-	-	2	60	40	100	**1**
BFOT1-412	Fruits and Vegetable Processing Technology (Lab)	-	-	2	60	40	100	**1**
BFOT1-413	Milk and Milk Products Technology (Lab)	-	-	2	60	40	100	1
Departmental Elective –II (Select any one)		3	-	-	40	60	100	**3**
BFOT1-458	Biochemical Engineering							
BFOT1-459	Plant Utilities							
Total	**Theory = 6 Lab = 2**	**15**	**4**	**6**	**380**	**420**	**800**	**22**

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Total Contact Hours = 24 Total Marks = 800 Total Credits = 23

SEMESTER 5th		Contact Hrs			Marks			Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
BFOT1-514	Cereals and Pulses Processing Technology	3	1	-	40	60	100	**4**
BFOT1-515	Food Processing Plant Layout and Design	3	1	-	40	60	100	**4**
BFOT1-516	Heat and Mass Transfer	3	1	-	40	60	100	**4**
BSOS0-F93	Soft Skills-III	-	-	2	60	40	100	**1**
BFOT1-517	Cereals and Pulses Processing Technology (Lab)	-	-	2	60	40	100	**1**
BFOT1-518	Heat and Mass Transfer (Lab)	-	-	2	60	40	100	1
BFOT1-519	Training-II							**2**
Departmental Elective – III (Select any one)		3	-	-	40	60	100	**3**
BFOT1-560	Grain Handling and Storage Technology							
BFOT1-561	Technologies of Beverages							
Open Elective – I (Select any one)		3	-	-	40	60	100	**3**
Total		**15**	**3**	**6**	**380**	**420**	**800**	**23**

Total Contact Hours = 25 Total Marks = 800 Total Credits = 22

SEMESTER 6th		Contact Hrs			Marks			Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
BFOT1-620	Technologies of bakery and confectionary products	3	1	-	40	60	100	**4**
BFOT1-621	Technology of Fats and Oils	3	1	-	40	60	100	**4**
BSOS0-F94	Soft Skills-IV	-	-	2	60	40	100	**1**
BFOT1-622	Technologies of bakery and confectionary products (Labs)	-	-	2	60	40	100	**1**
BFOT1-623	Technology of Fats and Oils (Labs)	-	-	2	60	40	100	1
Departmental Elective –IV (Select any one)		3	1	-	40	60	100	**4**
BFOT1-662	Food Additives							
BFOT1-663	Food Storage Engineering							
Departmental Elective – V (Select any one)		3	1	-	40	60	100	**4**
BFOT1-664	Waste Management in Food Technology							
BFOT1-665	Health Foods							
Open Elective – II (Select any one)		3	-	-	40	60	100	**3**
Total		**15**	**4**	**6**	**380**	**420**	**800**	**22**

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Total Contact Hours = 19 Total Marks = 800 Total Credits = 24

SEMESTER 7th		Contact Hrs			Marks			Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
BFOT1-724	Packaging Technology	3	1	-	40	60	100	**4**
BFOT1-725	Spices and Flavour Technology	3	1	-	40	60	100	**4**
BFOT1-726	Packaging Technology (Lab)	-	-	2	60	40	100	**1**
BFOT1-727	Spices and Flavour Technology (Lab)	-	-	2	60	40	100	**1**
BFOT1-728	Training –III				60	40	100	**4**
BFOT1-729	Project-I				60	40	100	4
Departmental Elective – VI (Select any one)		3	-	-	40	60	100	**3**
BFOT1-766	Innovative Techniques In Food Processing							
BFOT1-767	Applications of Enzymes In Food Technology							
Open Elective – III (Select any one)		3	-	-	40	60	100	**3**
Total		**12**	**2**	**4**	**400**	**400**	**800**	**24**

Total Contact Hours = 10 Total Marks = 400 Total Credits = 15

SEMESTER 8th		Contact Hrs			Marks			Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
BFOT1-830	Food Analysis & Quality Control	3	1	-	40	60	100	**4**
BFOT1-831	Food Analysis & Quality Control (Lab)	-	-	2	60	40	100	**1**
BFOT1-832	Project-II	**-**	**-**	**-**	60	40	100	**6**
Departmental Elective – VII (Select any one)		3	1	-	40	60	100	**4**
BFOT1-868	Statistical Quality Control							
BFOT1-869	Engineering Properties of Biological Materials							
Total		**6**	**2**	**2**	**200**	**200**	**400**	**15**

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Overall

Semester	**Marks**	**Credits**
1st	1000	25
2nd	900	25
3rd	800	24
4th	800	22
5th	800	23
6th	800	22
7th	800	24
8th	400	15
Total	**6300**	**180**

PRINCIPLES OF FOOD PRESERVATION

Subject Code: BFOT1-301 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

UNIT-I (11 Hrs)

Basic Consideration: Aim and objectives of preservation and processing of foods, Constituents of foods: Properties and significance; Nutritive aspects of food constituents; Concept of Water activity, osmosis and diffusion, Food Spoilage**:** Microbial, Physical, Chemical & Miscellaneous; Intermediate moisture Food.

UNIT-II (12 Hrs)

Preservation of Foods by Low Temperatures: Considerations relating to storage of foods at low temperature, controlled and modified atmosphere storage of foods, freezing process, freezing curve, slow and fast freezing of foods and its consequences, other occurrences associated with freezing of foods. Technological aspects of frozen storage and thawing of foods, freeze concentration

UNIT-III (11 Hrs)

Preservation of Foods by High Temperature: Basic concepts in thermal destruction of micro-Organisms-D, Z, F, values Heat resistance and thermophiles in micro-organisms. thermal processing of foods: Cooking, blanching, pasteurization and sterilization of foods, canning and spoilages in canned foods.

UNIT-IV (11 Hrs.)

Preservation by Water Removal: Principles, technological aspects and applications of evaporative concentration processes, and membrane processes for food concentrations. Principles, technological aspects and applications of drying and dehydration of foods

Preservation by Chemical: Use of preservative in foods: chemical and bio preservative including antibiotics, antimicrobial agents.

Recommended Books

1. P.J. Fellows, ‘Food Processing Technology Principles & Practices’, 3rd Edn., Woodhead Publisher, **2009.**
2. N.N. Potter and J.H. Hotchkiss, ‘Food Science’, CBS Publishers, **1995.**
3. James M. Jay, M.J. Loessner, D.A. Golden, ‘Modern Food Microbiology’ 7th Edn, Springer US. **2005.**
4. V. Kyzlink, ‘Principles of Food Preservation’, Elsevier Press, **1990.**
5. Desrosier & Desrosoer, ‘Technology of Food Preservation’, CBS Publication, **2006.**

FOOD CHEMISTRY

Subject Code: BFOT1-302 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

UNIT-I (12 Hrs.)

Introduction: Development of food chemistry and its role in food processing.

Water: Importance of water in foods. Structure of water & ice. Concept of bound & free water and their implications.

Carbohydrates: Nomenclature and classification, structure, physical and chemical properties of carbohydrates – monosaccharide, disaccharides and polysaccharides (cellulose, starch, fructans, galactans, hemi-cellulose, pectic substances) and their functions; dietary fiber, changes in carbohydrates during processing**.**

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UNIT-II (10 Hrs.)

Proteins: Nomenclature, classification, structure, chemistry and properties of amino acids, peptides, proteins. essential and non- essential amino acids. Changes during processing

UNIT-III (12 Hrs.)

Lipids: Structure, classification, physical and chemical properties of fatty acids and glycerides, Auto-oxidation, photo oxidation and flavor reversion, Changes in fats & oils during processing.

Vitamins & Minerals: Types, chemistry and functions, source and deficiency diseases. Changes during processing

UNIT-IV (11 Hrs.)

Enzymes: Nomenclature, mechanism of enzyme action, factors affecting enzyme action, enzymes important in foods.

Pigments: Structure and properties of chlorophyll, anthocyanins, tannin, myoglobin and carotenoids, chemical changes during processing

Recommended Books

1. Frank A. Lee, 'Basic Food Chemistry', Springer Publication, **2013.**
2. H.D. Belitz, Werner Grosch, Peter Schieberle, 'Food Chemistry', Springer-Verlag Berlin Heidelberg publisher, **2009.**
3. L.H. Meyer, L.H. Van Nostrand, 'Food Chemistry', Reinhold Company Publication, New York, London, **1998.**
4. Lehninger, 'Principles of Biochemistry', Palgrave Macmillan Publication, **2004.**

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FOOD MICROBIOLOGY

Subject Code: BFOT1-303 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

UNIT-I (11 Hrs.)

Introduction: Importance and historical developments in food microbiology, prokaryotic and eukaryotic cell, morphology, structure, microbiology and reproduction of Bacteria, Yeast, Mold, Actinomycetes and algae. Viruses-structure and replication with particular reference to food borne viruses.

UNIT-II (12 Hrs.)

Microbial growth and death kinetics: Definition, Growth curves (different phases), synchronous growth, doubling/generation time, intrinsic and extrinsic factors, relationship between number of generations and total number of microbes.

Techniques of pure culture: Definition, Serial Dilution, pour plate, streak plate, spread plate, slant, broth and enrichment culture, lyophilization.

UNIT-III (10 Hrs.)

Microorganism in Natural Products: Sources and prevention of contamination; Microbiology of atmosphere, water, influence of aw, milk and milk products; cereals and cereal products; meat and meat products; fish or fish products; poultry and eggs; sugars; spices and salt; canned foods.

UNIT-IV (12 Hrs.)

Food spoilage: Bacterial and fungal food spoilage, food poisoning, food borne infection, food borne intoxication. Toxins produced by staphylococcus, clostridium, aspergillus; bacterial pathogens-salmonella, bacillus, listeria, E. coli, shigella, campylobacter.

Microbial Control: Source of microorganism, Physical and chemical agents used in microbial control, disinfection agents and its dynamics.

Recommended Books

1. Frazier, ‘Food Microbiology’, 5th Edn. McGraw-Hill Education, **2013.**
2. Roger. Y. Stainier, ‘General Microbiology’, 5th Edn. Macmillan, **1987.**
3. Casida, ‘Industrial Microbiology’ John Wiley & Sons Inc, New York, **1968.**
4. H.J. Pelczar, ‘Microbiology’, Tata McGraw-Hill Education, **1998.**

FLUID FLOW OPERATIONS AND RHEOLOGY

Subject Code: BFOT1-304 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

UNIT-I (12 Hrs.)

Introduction to fluid, various physical properties of fluid, concept viscosity, units of viscosity, factors affecting the rheological parameters, fluid pressure and its measurement, pressure, manometers, concept of Reynolds’s number, types of fluid flow, rate of flow or discharge, derivation of continuity equation, different types of energies of a liquid in motion, pressure energy, kinetic energy, potential head, derivation Bernoulli equation, hydraulic coefficients.

UNIT-II (11 Hrs.)

Practical applications of Bernoullies equation, venturimeter, orifice meter, pitot tube, rotameter, loss of head due to friction in viscous flow, Darcy-Weisbach formula; energy losses in pipes; major losses; minor losses; coefficient of friction or fanning friction factor or skin friction factor; drag coefficient; different types of pumps.

UNIT-III (12 Hrs.)

Introduction to Rheology; perfectly elastic (Hookean body), ideal plastic behaviour; ideal viscous behaviour; stress strain diagram of a biomaterial; rheological diagram; concept of apparent viscosity, time independent fluids (no memory fluids); power law (viscous) fluids; pseudo plastic or shear thinning fluids; shear thickening fluids; dilatant fluids; viscoplastic fluids: Bingham plastic (ideal plastic) fluids; non- bingham plastic fluids; Herchel-Bulkley fluids: Time dependent fluids (memory fluids) like thixotropic fluids; antithixotropic (or rheopectic) fluids.

UNIT-IV (10 Hrs.)

Derivation of Hagen-Poiselle equation or theory of capillary viscometer; Stokes law; Viscometry, capillary tube viscometer; Ostwald viscometer; falling sphere resistance method; rotational viscometer; cone and plate type viscometer; circular disc viscometer; oscillatory measurements method; textural profile analysis.

Recommended Books

1. R.K. Bansal, ‘A Text book of Fluid Mechanics and Hydraulic Machines’, Laxmi Publications (P) Ltd, New Delhi, **2009.**
2. Shiv Kumar, ‘Fluid Mechanics’, Ane Books Pvt. Ltd, New Delhi, **2010.**
3. K.R. Arora, ‘Fluid Mechanics Hydraulic and Hydraulic machines’, Standard Publishers Distributors, New Delhi, **1993.**
4. G.S. Sawhney, ‘Fundamentals of Fluid Mechanics’, I.K. International Publishing House Pvt. Ltd., New Delhi, **2008.**

FOOD CHEMISTRY LAB.

Subject Code: BFOT1-305 **L T P C**
0 0 2 1

1. Preparation of sample for analysis
2. Determination of acidity/pH of food samples.

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3. Preparation of standard solutions.
4. Qualitative tests for the presence of carbohydrates in food samples
5. Qualitative test for the presence of protein in food samples
6. Estimation of sugar in given food sample by Lane and Eynon and Nelson & Somogy method
7. Estimation of lactose in milk sample by titrimetric method
8. Estimation of amount of fat in milk powder by Majonnier's method
9. Estimation of protein by micro-Kjeldhal method
10. Estimation of pectin in fruit (Guava)
11. Determination of saponification value and un-saponifiable matter
12. Determination of vitamin C in food sample.
13. Estimation of phosphatase activity.
14. Estimation of moisture, ash and crude fiber.

FOOD MICROBIOLOGY LAB

Subject Code: BFOT1-306 **L T P C**
0 0 2 1

1. Working study of various equipment related to Microbiology.
2. Isolation of pure culture using pour plate technique.
3. Isolating pure culture using spread plate technique.
4. Measurement the size of given microbial cell using micrometry.
5. Enumeration total viable count in a culture.
6. To perform Gram staining technique of bacteria.
7. Study the growth curve of microorganisms.
8. Preparation of nutrient broth.
9. Preparation of media with nutrient agar, PDA and special media.
10. Quantitative analysis of food sample by standard plate count (SPC) method
11. Study the quality of milk by methylene blue reductase test.
12. Preparation of curd using starter culture.
13. To perform presumptive test for coliforms in milk.
14. To study the microbial spoilage of given food sample.

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FOOD HYGEINE AND PLANT SANITATION

Subject Code: BFOT1-356 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

UNIT-I (12 Hrs.)

General principles of food hygiene. Personal hygiene. Food handling habits, Sanitation facilities and procedures in food plant operations Sanitary aspects of building and processing equipment. Establishing and maintaining sanitary practices in food plants.

UNIT-II (11 Hrs.)

Safe and effective insect and pest control: Extraneous materials in foods, Principles of Insects and pest control. Physical and chemical control, Food contamination by microorganisms, effective control of micro-organisms, importance in food sanitation, micro-organisms as indicator of sanitary quality

UNIT-III (10 Hrs.)

Sanitary aspects of water supply: Source of water, quality of water, water supply and its uses in food industries. Purification and disinfection of water preventing contamination of potable water supply.

UNIT-IV (12 Hrs.)

Effective detergency and cleaning practices: Importance of cleaning technology, physical and chemical factors in cleaning, classification and formulation of detergents and sanitizers, cleaning practices. Role of sanitation, general sanitary consideration and sanitary evaluation of food plants. Sanitary aspects of waste disposal

Recommended Books

1. S. Roday, 'Food Hygiene and Sanitation', Tata McGraw-Hill Education, **1998.**
2. Betty C. Hobbs, 'Food Poisoning and Food Hygiene', 2nd Edn,, London Publication, **1969.**
3. Gaston and Tiffney, 'Guide to Improve Food Hygiene', Tata McGraw-Hill Education.
4. Harry H. Weiser, J. Mountney and Gord, 'Practical Food Microbiology & Technology', **2006.**
5. Norman G. Marriott, 'Principles of Food Sanitation', Springer Science & Business Media, **2013.**

INDUSTRIAL MICROBIOLOGY

Subject Code: BFOT1-357 **L T P C** **Duration: 45 Hrs.**

3 1 0 4

UNIT-I (11 Hrs.)

Economic activities of microorganisms. Propagation of food, food and baker yeasts. Technology of production of alcohol, glycerol, beer and glycerol fermentation.

Production of wine and other alcoholic beverages (Whiskey, rum etc.) activities of lactic acid bacteria and industrial production of lactic acid.

UNIT-II (12 Hrs.)

Activities of acetic acid bacteria and production of vinegar, sorbose and dihydroxyacetone.

Production of dextrons, amino acid fermentation, metabolic controls in industrial fermentation, saccharifying agents - methods of production and uses.

Activities of molds, microbial production of organic acids viz. citric, gluconic, fumaric, itaconic, gibbarellic and kojie acids.

UNIT-III (10 Hrs.)

Microbial production of vitamins B-2 and B-12

Production, Isolation and uses of microbial enzymes, immobilized enzymes and their applications, production of glucose and fructose and starch by enzymatic method

UNIT-IV (12 Hrs.)

Production of mushroom mycelium by submerged culture process. Production of algal protein and recent advances.

Production and isolation of antibacterial antibiotics like penicillin, streptomycin, streptomycin, chloromycetin, tetracyclines, semisynthetic pencillins. antifungal antibiotics.

Recommended Books

1. K. Sukesh, M.M. Joe & P.K. Sivakumar, 'An Introduction to Industrial Microbiology' S. Chand, **2010.**
2. Moo Young, 'Comprehensive Biotechnology', Pergamon Press, New York, **1985.**
3. L.E. Casida, 'Industrial Microbiology', John Wiley & Sons, **2004.**
4. Prescott and Dunn, 'Industrial Microbiology', Gerald Reed, Globe Bookservices, London., **1983.**
5. Michael J. Waites, Neil L. Morgan, John S. Rockey, Gary Higton, 'Industrial Microbiology: An Introduction', Blackwell Science Ltd., **2001.**

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FOOD ENGINEERING

Subject Code: BFOT1-408 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

UNIT-I (11 Hrs.)

Material and Energy Balance: Numerical problems on material and energy balance related to food processing.

Thermal Processing: Microbial inactivation; Derivation and application of equation for determination of thermal process time for cans, calculation of process time for continuous sterilization of liquid foods; factors affecting rate of heat penetration; related numerical problems

UNIT-II (12 Hrs.)

Steam Properties: Properties of wet, saturated and superheated steam, use of steam tables and Mollier diagram.

Evaporation: Boiling point elevation, Duhring rule, basic principles of evaporators; capacity and economy of evaporator; multiple effect evaporator: operation and various feeding systems, calculation of heat transfer area in single and multiple effect evaporators; Thermal vapour recompression and Mechanical vapour recompression system to improve evaporator economy; related numerical problems.

UNIT-III (11 Hrs.)

Psychrometry: Properties of air-water vapour mixture, psychometric chart, Humidification and dehumidification operations, Application of psychometry to drying; related numerical problems.

Drying and Dehydration: Principles of drying and dehydration, water activity, sorption and desorption isotherms, rates of drying: constant and falling rate periods during convective drying, drying rate constant; freeze drying and spray drying; calculations of freeze drying and spray drying times; related numerical problems.

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UNIT-IV (11 Hrs.)

Freezing and Crystallization: Basic concepts, theories of crystallization; Depression in freezing point, Planks equation and other modified equations for prediction of freezing time, different types of freezers and crystallizers.

Fluidization: Mechanism of fluidization, characteristics of gas –solid fluidized systems, pressure drop in fluidized bed, application of fluidization in drying.

Extrusion Technology: Theory, Engineering aspects of single and twin screw extruders, applications of extruders in food processing.

Recommended Books

1. Heldman and Singh, 'Food Process Engineering', Academic Press, **2013.**
2. R.T. Toledo, 'Fundamentals of food process Engg.', Springer & CB, **2007.**
3. P.G Smith, 'Introduction to Food Process Engineering', Springer US, **2011.**
4. C.J. Geankoplis, 'Transport Processes & Unit operations', Allyn and Bacon, **1978.**

FRUIT AND VEGETABLE PROCESSING TECHNOLOGY

Subject Code: BFOT1-409 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

UNIT-I (11 Hrs.)

Current status of production and processing of fruits and vegetables. Structural, compositional and nutritional aspects. Post-harvest physiology, handling, losses and conservation of fruits and vegetables.

UNIT-II (12 Hrs.)

Techniques of extension of shelf life of unmodified produce: use of adjuncts, novel packaging, controlled and modified atmosphere storages. Processing for conversion into products and preservation by use of chemical preservatives, chilling & freezing, sterilization & canning, concentration & dehydration and other special techniques.

UNIT-III (10 Hrs.)

Technology of Products: juices & pulps, concentrates & powders, squashes & cordials, nectars, fruit drinks & beverages carbonated and its quality control. Fermented products (Cider, wine, brandy).

UNIT-IV (12 Hrs.)

Jam, Jelly & Marmalades; candied fruits, dried fruits and fruit products (e.g. Aam papads, bars); soup mixes; sauces & ketchups; puree & pastes; chutneys & pickles, Specialty fruit and vegetable products, Waste management in fruits & vegetable industry

Recommended Books

1. B. Srilakshami, 'Food Science', New Age International, **2003.**
2. N. Shakuntala Manay and M. Shadaksharaswamy, 'Foods: Facts and Principles', 3rd Edn., New Age International (P) Ltd., **2013.**
3. S.R. Mudambi and M.V. Rajagopal, 'Fundamentals of Foods and Nutrition', New Age International, **2001.**
4. Girdhari Lal and G.S. Siddappa and G.L. Tandon, 'Preservation of Fruits and Vegetables', CBS Publications, **1959.**

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MILK AND MILK PRODUCTS TECHNOLOGY

Subject Code: BFOT1-410	**L T P C** **3 1 0 4**	**Duration: 45 Hrs.**

UNIT-I (10 Hrs.)

Introduction: Status of Dairy Industry in India. Cooperative Dairying. Operation Floods. Milk: Definition, Composition, Chemical and functional properties of milk components: physicochemical properties of milk protein, aggregation of Casein, micelles, factors affecting milk composition, milk secretion and lactation.

UNIT-II (12 Hrs.)

Fluid Milks: Physicochemical characteristics and factors affecting them. Production, collection, testing quality, cooling, storage, and transportation of liquid milks. Receiving and quality assessing of liquid milk in dairy industry for detection of adulteration, decision for acceptance/rejection, and determination of price of the milk.

Micro-organisms: importance in dairy science and technology. Microbial spoilage of milk,

UNIT-III (12 Hrs.)

Milk Processing Operations: Standardization and/or processing (pasteurization, homogenization, sterilization and UHT processing), storage, packaging and distribution of liquid milks: whole, standardized, toned, double-toned, and skim milk. Recombined, reconstituted, and flavored milks. Effect of processing of milk components and their functional properties.

Cream & Cream characteristics, manufacture of yoghurt and other fermented milk products, Ice cream manufacture, Butter making technology, technology of cheese, processing of evaporated and concentrated milks and dried milk powder.

UNIT-IV (11 Hrs.)

Indigenous Product: Fermented milks (Curd, yogurt etc.) and milk-products (cheeses, butter milk, lassi etc.); other milk products (khoa, casein, whey proteins, lactose etc.); milk and milk product-based sweetmeats (burfi, rasogolla, milk-cake, kalakand, ruberii, etc.)

Milk quality control, sanitation in the dairy plant, adulteration of milk, dairy equipment maintenance and waste disposal.

Recommended Books

1. Sukumar De, 'Outlines of Dairy Technology', Oxford University Press, **1980.**
2. James N. Warner, 'Principles of Dairy Processing', Wiley Publications, New York, **1976.**
3. C.H. Eckles, W.B. Combs and Macy, 'Milk and Milk Products', Tata McGraw Hill, **1957.**
4. Aneja et al, 'Technology of Indian Milk Products', A Dairy India Publication, **2002.**

TECHNOLOGY OF ANIMAL PRODUCTS

Subject Code: BFOT1-411 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

UNIT-I (11 Hrs.)

Introduction: Scope of meat, poultry and fish industry in India.

Structure and Composition of Muscle and Associated Tissue: Muscle tissue, skeletal muscle, skeletal muscle fiber, myofibrils, myofilaments, smooth muscle, cardiac muscle, epithelial tissue, nervous tissue, Connective tissues, Connective tissue proper, adipose tissue, Muscle bundles and associated connective tissues, Muscle and fiber types, Chemical composition of skeletal muscle.

UNIT-II (11 Hrs.)

Conversion of Muscle to Meat: Homeostasis, Exsanguination, circulatory failure to muscle, postmortem pH decline, rigor mortis, Enzymatic degradation.

Properties of Fresh Meat: Water holding capacity, chemical basis of water holding capacity, color, pigments, Chemical state of pigments.

UNIT-III (10 Hrs.)

Principles of Meat Processing: Curing, meat curing ingredients, methods for incorporation of cure ingredients, chemistry of cured color, comminution, blending and emulsification, Technology of sausages**.**

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UNIT-IV (12 Hrs.)

Beef, Mutton and Pork: Slaughtering of cattle, sheep and pig, By products of meat industry**.**

Poultry Dressing and Egg Processing: Stunning, bleeding, scalding, evisceration, packaging and storage, Structure, compositive nutritive value of an egg, Functional properties of egg constituents, Interior quality of eggs and its preservation Egg products.

Fish Processing: Selection of raw material for processing of streaking and filleting of fish; production of fish paste, fish oils, sauce, fish protein concentrates, By products of fish Processing industry.

Recommended Books

1. J. Kerry, J. Kerry and D. Ledward, 'Meat Processing Improving Quality', CRC Woodhead Publisher, **2011.**
2. Robert L. Henrickson, 'Meat, Poultry and Seafood Technology', Prentice Hall, New Jersey.
3. B. Panda, 'Poultry Production', **ICAR.**
4. J.C. Forest, E.D. Aberle, H.B. Hedrick W.H., 'Principles of Meat Science', Freeman and Company, **1975.**

FRUITS AND VEGETABLE TECHNOLOGY LAB.

Subject Code: BFOT1- 412 **L T P C**
0 0 2 1

1. Preservation and processing of certain vegetables by drying.
2. Preparation of tomato ketchup and its preservation.

3. Preparation of tomato puree and its preservation.
4. Preparation of pickles.
5. Preparation of jam,
6. Preparation of jelly
7. Preparation of marmalades
8. Preparation of fruit juice, squash and cordial.
9. Processing and Preservation of peas by use of high temperatures (Bottling of Peas).
10. Blanching of a given sample (pea) and assessment of its adequacy.
11. Enzymatic browning of fruits and vegetables and its control.
12. Osmotic dehydration of given sample (Carrot/Grapes).
13. Preparation of amla preserve and dried fruit product (Aam papad, bars)
14. Freezing of fruits and vegetables.
15. Can seaming operations and canning of fruits and vegetables

MILK AND MILK PRODUCTS TECHNOLOGY

Subject Code: BFOT1-413 **L T P C**
0 0 2 1

1. Determination of titrable acidity of milk.
2. Determination of specific gravity of milk & observe effect of water addition on it.
3. Performance of platform tests on given sample of milk.
4. Detection of adulterants and preservatives in milk.
5. Determination of bacteriological quality of milk.
6. Preparation of sterilized flavored milk.
7. Preparation of certain dairy products (Khoya, paneer, curd, yogurt, cream, ice cream, kalakand) and assessment of yield and quality of prepared products.
8. Determination of solubility, dispersibility of dried milk powders (spray & drum-dried samples).
9. Determination of fat content of milk
10. Visit to a milk processing plant.

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BIOCHEMICAL ENGINEERING

Subject Code: BFOT1-458 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

UNIT-I (12 Hrs.)

Introduction: Introduction to biochemical engineering, chemical engineering, microbiology, biotechnology and biochemistry.

Cell Growth: Introduction, quantifying cell concentration, growth patterns and kinetics in batch culture, effect of environmental conditions on growth kinetics, heat generation by microbial growth.

UNIT-II (12 Hrs.)

Media Sterilization: Medium formulation, Thermal sterilization, Sterilization by filtration, Design criteria and design equations for sterilization process, Temperature-time profile and design calculations, Methods of air sterilization, Interception, diffusion and combined mechanism

UNIT-III (10 Hrs.)

Enzymes: Introduction, uses and application of enzymes in food industry and biosensors, Biochemical reaction kinetics, Michaelis- Menten type kinetics, Briggs-Halden approach.

UNIT-IV (11 Hrs.)

Fermenter design, control and scale up: Aeration and agitation in fermenter, oxygen supply and demand in microbial processes, oxygen transfer in fermentation, types of spargers, etc.

Recommended Books

1. M.L. Shuler and F. Kargi, 'Bioprocess Engineering: Basic Concepts', Prentice Hall, **2011.**
2. H.C. Vogel and C.L. Todaro, 'Fermentation and Biochemical Engineering Handbook: Principles, Process Design and Equipment', Standard Publishers Distributors, Delhi, **1996.**
3. A.V.N. Swamy, 'Fundamentals of Biochemical Engineering', BS Publications, **2008.**
4. D.G. Rao, 'Introduction to Biochemical Engineering', McGraw Hill Publishing Co. Ltd., **2005.**

PLANT UTILITIES

Subject Code: BFOT1-459 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

UNIT-I (12 Hrs.)

Properties of Steam: Introduction – steam formation – Thermodynamic properties of steam – Sensible heat, latent heat, dryness fraction, wet fraction – superheated steam – steam table, expansion of steam

Steam Generators: Introduction, Classification & Boilers, Water tube, Fire tube type, Vertical tabular boilers, types of fire and water tube boilers, boiler mounting & accessories, Performance of steam generator, Evaporation rate. Performance, boiler efficiency, Factors influencing Boiler efficiency problems.

UNIT-II (12 Hrs.)

Fuels & Combustion: Introduction, solid, liquid & gaseous fuel, Calorific value of fuel, flue gases per kg. of fuel, Minimum Air required per kg. of fuel, Excess Air Problems.

Condensers: The function of a condenser in a Steam Power Plant, Vacuum, Classification, Comparison of Jet & Surface Condensers, Advantages/Disadvantages Mass of Circulating Water required in a condenser, Air Removal.

Fitting, Safety & Maintenance: Selection of size of steam pipes – layout of pipe lines – Energy audit of steam boilers – economy of heat utilization – boiler codes – Indian boiler regulation act – safety in steam plant maintenance

UNIT-III (11 Hrs.)

Gears: Introduction, Classification of Gears, Parallel Shafts, Spur Gears Spur Rack & Pinion, Helical Gears, Intersecting Shafts, Straight Bevel Gears, Spiral Bevel Gears, Skew Shafts, Crossed Helical Gears, Worm Gear, Hypoid Gears, Gear Terminology, Pitch Circle, Pitch dia, Pitch, Circular Pitch.

UNIT-IV (10 Hrs.)

Lubrication: Introduction, Physical & Chemical Test of Lubricants, Methods of Applying Lubrication, Hand oiling, drop feed cup, ring type of lubrication etc.

Corrosion: Corrosion & its control, General Corrosion, Localized Corrosion, Pitting Corrosion etc. Factors influencing Corrosion, Combating Corrosion, Selection of material.

Recommended Books

1. López-Gómez Gustavo V. Barbosa-Cánovas, 'Food Plant Design' CRC Press, Boca Raton, **2005.**
2. C.P. Mallet, 'Frozen Food Technology', Blackie Academic & Professional an imprint of Chapman & Hall., **1993.**
3. J. Lal & J.M. Shah, 'Theory of Machine', Metropolitan Book & Co. Pvt. Ltd, Delhi-6.
4. S.S. Rattan, 'Theory of Machine', Tata McGraw Hill Publishing Co. Ltd, New Delhi, **2009.**
5. P.L. Ballaney, 'Thermal Engineering', Khanna Publishers, New Delhi-6, **1995.**

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CEREALS AND PULSES PROCESSING TECHNOLOGY

Subject Code: BFOT1-514 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

UNIT-I (12 Hrs)

General introduction to cereals and pulses; Production and utilization trends of various cereals and pulses; Grain classification, structure and composition; Importance of cereals and pulses, Post-harvest quality and quantity losses. Recommended pre-processing practices for handling of cereals and pulses for their safe storage, including control of infestation, National and International quality and grading standards.

UNIT-II (11 Hrs)

Structure, types, composition, quality characteristics and physicochemical properties of wheat. Cleaning, tempering and conditioning, and milling processes for different wheat's. Turbo-grinding & Air Classification. Blending of flours. Milling equipment and milling products (Dalia, Atta, Semolina and flour). Flour grades and their suitability for baked goods. By-product utilization.

UNIT-III (12 Hrs.)

Structure, types, composition, quality characteristics and physicochemical properties of rice. Milling and parboiling of paddy, Curing and ageing of paddy and rice. Criteria in and assessment of milling, cooking, nutritional and storage qualities of raw & parboiled rice. Processed rice products (flaked, expanded and puffed rice). By- product (husk and rice bran) utilization.

UNIT-IV (10 Hrs.)

Structure, types and composition of corn. Dry and wet milling of corn. Processed corn products (popped corn, corn flakes etc.) Structure and composition of barley, bajra, jowar and other cereal grains and millets. Malting of barley. Parched and snack products.

Pulses: Anti-nutritional factors and methods of inactivation; pre-treatments; Traditional and modern milling methods and equipment involved.

Recommended Books

1. D.A.V. Dendy & B.J. Dobraszezk, 'Cereals & Cereals Products- Chemistry & Technology', Aspen Publication, **2001.**
2. 'Development in Milling & Baking Technology', AFST (I), CFTRI, Mysore, India.
3. N.N. Potter and J.H. Hotchkiss, 'Food Science', CBS Publishers.
4. N. Shakuntala Manay and M. Shadaksharaswamy, 'Foods: Facts and Principles', 3rd Edn., New Age International (P) Ltd, **2013.**
5. N.L. Kent, 'Technology of Cereals', Pergamon/Woodhead Publishing, **1994.**

FOOD PROCESSING PLANT LAYOUT AND DESIGN

Subject Code: BFOT1-515 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

UNIT-I (11 Hrs.)

Introduction: Introduction to plant design and its importance in food processing industries.

Plant Location: Influence of location on plant layout, location factors, location theory and models.

UNIT-II (12 Hrs.)

Plant Layout: Types of manufacturing process, Plant layout problem, objectives and principles of layout; classical types of layout Viz. product layout, process layout and stationary layout; plant layout tools and techniques like process charts, process flow diagram, machine data cards, material movement

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patterns machine models and sketches, space requirement for machines, work stations and storage, plant layout procedures.

Evaluation of Layouts: Measurement of effectiveness of layout; Layout evaluation by systematic, optimization and mathematical models.

UNIT-III (12 Hrs.)

Network Analysis of Processes: Basic terms, objectives and advantages of Network analysis, various Network techniques like PERT and CPM.

Plant Buildings: Consideration in building design, types of factory buildings, types of building construction; Building materials, drainage, ventilation and illumination in food processing industries.

UNIT-IV (10 Hrs.)

Layout of different industries: Layout of different types of food industries like bread, biscuits, soft drinks, canning, dairy, rice mill and wheat mill.

Recommended Books

1. Farrall Krieger, 'Engineering for Dairy and Food Products', **2006.**
2. Peterse and Timmerhaus and R.E. West, 'Plant Design for Chemical Engg.', 5th Edn. McGraw-Hill Education, **2003.**
3. J.M. Moore, 'Plant Layout and Design', Macmillan, **1962.**
4. O.P. Khanna, 'Production Engg. and Industrial Management', Dhanpat Rai Publishing Company.
5. Rase and Barrow, 'Project Engineering of Process Plants', Wiley Publications, **1957.**

HEAT AND MASS TRANSFER

Subject Code: BFOT1-516 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

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UNIT-I (11 Hrs.)

Heat Transfer: Introduction of heat transfer, importance of heat transfer, modes of heat transfer, thermal conduction in solids, liquids and gases.

Conduction: Fourier's law, thermal conductivity, steady state conduction of heat through a composite solid, cylinder and sphere; Insulation and its purpose, critical thickness of insulation for cylinders and sphere; general heat transfer equation for extended surfaces.

UNIT-II (11 Hrs.)

Convection: Natural and forced convection, Nusselt number, dimensional analysis of free and forced convection, dimensionless numbers used in convective heat transfer, important correlations for free and forced convection.

Radiation: Introduction, reflection, absorption and transmission of radiation, characteristics of black, gray and real bodies in relation to thermal radiation, Stefan Boltzman Law, Kirchoff's Law, Wein's displacement law, Intensity of radiation, radiation exchange between black bodies and diffuse gray surface.

UNIT-III (11 Hrs.)

Heat Exchangers: Overall heat transfer coefficient, fouling factors, log mean temperature, difference for parallel and counter flow, heat exchangers, shell and tube type heat exchangers, effectiveness of parallel and counter flow heat exchangers by general and NTU method.

Evaporators: Types of evaporators -natural circulation evaporators, force circulation evaporators, falling film evaporators, climbing film evaporators, agitated thin-film evaporators and plate evaporators, principles of evaporation and evaporators.

UNIT-IV (12 Hrs.)

Mass Transfer: Introduction to mass transfer, different modes of mass transfer, Mass flux and molar flux for a binary system. Fick's law of diffusion of mass transfer, Derivation of general diffusion mass transfer equation, Molecular diffusion in gases, liquids and solids.

Steady state equimolar counter diffusion, convective mass transfer coefficient, natural and forced convective mass transfer, dimensional analysis for free and forced convective mass transfer, important correlations of convective mass transfer; permeability of films and laminates.

Recommended Books

1. A.J. Chapman, 'Heat Transfer', Maxwell Macmillan New York, **1984.**
2. J.P. Holman, 'Heat Transfer', McGraw-Hill, New York, **1997.**
3. B.K. Dutta, 'Heat Transfer: Principles and Applications', PHI, New Delhi, **2001.**
4. W.L. Badger & J.T. Bachero, 'Introduction to Chemical Engineering', MacGaw Hill, Singapore, **1995.**
5. Mc Cabe, Smith & Harriot, 'Unit Operation of Chemical Engineering', 7th Edn., McGraw Hill Education, **2005.**

CEREALS AND PULSES PROCESSING TECHNOLOGY LAB.

Subject Code: BFOT1-517 **L T P C**
0 0 2 1

1. Experimental milling of wheat and paddy.
2. Parboiling and Cooking properties of different varieties of rice.
3. Determination of moisture content and ash content of wheat flour.
4. Determination of physical properties of different cereal grains
5. Determination of sedimentation value of the Maida.
6. Determination of alcoholic acidity of the sample of the wheat flour / Maida.
7. To determine the water absorption capacity of the wheat flour / Maida.
8. Determination of adulterant (NaHCO3) in wheat flour/ Maida.
9. Estimation of Protein content of different Cereals and Legumes.
10. Storage studies of cereal and legume grains having different moisture levels.
11. Determination of Gluten content in wheat flour samples.
12. Preparation of expanded & puffed rice from raw and parboiled materials and assessment of quality of products including expansion in volume.
13. Determination of foaming capacity of given flour sample.
14. Determination of dough raising capacity of given flour sample.
15. Traditional and improved pretreatments and its effect on dehusking of some legumes.
16. Determination of dry and wet gluten of a given flour sample.
17. Visit to a working modern roller flour mill and FCI godowns.
18. Visit to working rice mill, collection of samples at various steps of milling and analysis for efficiency of cleaning, shelling, paddy separation, and degree of polish.

HEAT AND MASS TRANSFER LAB.

Subject Code: BFOT1-518 **L T P C**
0 0 2 1

1. Determine the experimental and theoretical value of heat transfer coefficient for natural convection process.
2. Determine the theoretical and experimental value of heat transfer coefficient for forced convection

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process.

3. Determine the individual thermal conductivities and overall thermal conductivity for composite wall apparatus.
4. Determine the value of surface conductance for given finite geometry shapes (unsteady state heat transfer).
5. Find the emissivity of a given test plate with respect to the black plate.
6. Calculate the heat transfer coefficient for heat transfer in packed bed.
7. Observe boiling phenomena and to determine the heat flux and surface heat transfer coefficient as a function of the temperature excess at constant pressure.
8. Study heat transfer rate, overall heat transfer coefficient and effectiveness of shell and Tube Heat Exchanger.
9. Determine heat transfer from condensing vapors for Dropwise and Flimwise condensation.
10. Study the working principle and operation of an evaporator.

GRAIN HANDLING AND STORAGE TECHNOLOGY

Subject Code: BFOT1-560 **L T P C** **Duration: 45 Hrs.**

3 1 0 4

UNIT-I (11 Hrs.)

Introduction, need for grain storage, principles of grain storage, problems during grain storage. Stored product pests- insects, rodents, fungi, their nature and occurrence.

UNIT-II (11 Hrs.)

Pest control- Techniques of pesticides application and fumigations Pesticide chemistry, their toxicology and residual analysis Pest control measures and sanitation of mills

UNIT-III (11 Hrs.)

Grain procurement and handling Modern techniques of infestation control Pesticides and health hazards MAS / CAS, Hypobaric storage

UNIT-IV (12 Hrs.)

Storage and handling of grain Storage structure- Bag storage, Cover and plinth, CAP storage (Ceiling and Plinth Storage), Silos and large bins -Design of storage structures- Silos flow pattern and problem-Fumigation Processes- Feeding and discharging of silos- conveyors and elevators for grain handling.

Recommended Books

1. Metcalf & Luckemann, 'Introduction of Insect', Wiley Interscience Publications, **1994.**
2. A. Chakraverty, 'Post Harvest Technology of Cereals, Pulses and Oilseeds', Oxford and IBH Publishing Co, Calcutta, **1995.**
3. N.L. Kent and A.D. Evans, 'Technology of Cereals', 4th Edn., Elsevier Science (Pergaman), Oxford, U.K**., 1994.**
4. Samuel A. Matz, 'The Chemistry and Technology Cereals as Food and Feed', CBS Publishers & Distributors Pvt. Ltd., **1996.**

TECHNOLOGIES OF BEVERAGES

Subject Code: BFOT1-561 **L T P C** **Duration: 45 Hrs.**

3 1 0 4

UNIT-I (12 Hrs.)

Basic Ingredients in Beverages Beverage-definition-why we drink beverages-ingredients- water, carbon dioxide, bulk and intense sweeteners, water miscible and water dispersible flavouring agents, colours –

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natural and artificial, Micro and Nano emulsions of flavors and colors in beverages, preservatives, emulsifiers and stabilizers.

UNIT-II (11 Hrs.)

Beer and Wine Manufacture

Ingredients- Malt- hops- adjuncts- water, yeast. Beer manufacturing process malting, preparation of sweet wort, brewing, fermentation, pasteurization and packaging. Beer defects and Spoilage. Wine-fermentation-types –red and white. Wine defects and spoilage

UNIT-III (11 Hrs.)

Carbonated Beverages

Procedures- carbonation equipment-ingredients-preparation of Syrups-Filling system-packaging-containers and closures

Non-Carbonated Beverage

Coffee bean preparation-processing-brewing-decaffeination- instant Coffee-Tea types- black, green and oolong- fruit juices, nectars, quash, RTS beverages, isotonic Beverages. Flash pasteurization, Canning and Aseptic Packaging of beverages.

UNIT-IV (12 Hrs.)

Quality Control

Effective application of quality controls- sanitation and hygiene in beverage Industry-Quality of water used in beverages - threshold limits of various ingredients according to PFA, EFSA and FDA – Absolute requirements of Soluble solids and titrable acidity in beverages.

Recommended Books

1. Steen and Ashurst, ‘Carbonated soft drinks – Formulation and manufacture’, Blackwell Publishing Ltd., **2000.**
2. P.R. Ashurst, **‘**Chemistry and technology of Soft drink and Fruit Juices’, Blackwell Publishing Ltd., **2005.**
3. Charles W. Bamforth, ‘Food, fermentation and microorganisms’, Blackwell Science Publishing Ltd., **2005.**
4. N. Shakuntala Manay and M. Shadaksharaswamy, ‘Foods: Facts and Principles’, New Age International (P) Ltd., **2013.**

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TECHNOLOGIES OF BAKERY AND CONFECTIONARY PRODUCTS

Subject Code: BFOT1-620 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

UNIT-I (12 Hrs.)

Introduction: Global status of Bakery and Confectionary industry.

Raw Material for Bakery Products: Essential and optional raw materials for bakery products, Dough development, Methods of dough mixing, Dough chemistry, Rheological testing of dough-Farinograph, Mixograph, Extensograph, Amylograph / Rapid Visco Analyzer, Falling number, Hosney’s dough stickiness tester and interpretation of the data.

UNIT-II (11 Hrs.)

Manufacturing of Bakery Products: Detailed description of unit operations for the manufacturing of bakery Products-Bread, Biscuits, Cakes and the effect of variations in formulation and process parameters on the quality of the finished product; quality consideration and parameters; Staling and losses in baking.

UNIT-III (11 Hrs.)

Manufacturing of Confectionary Products: Characteristics and processing of raw material; Technology of manufacturing of toffee, chocolate, fruit drops, hard boiled candies, bars, chewing gums, bubble gums and special confectionary products; colour, flavour and texture of confectionary; standard and regulations.

UNIT-IV (11 Hrs.)

Equipment Used in Bakery and Confectionary Industry: Construction and working of various equipment like Mixers, proofing chambers, dough dividers, moulder and sheeter, baking ovens, cooling chamber, sealing and packaging machines, Rolling and cutting machines project profile of bakery and confectionary unit.

Recommended Books

1. Matz. 'Bakery Technology and Engineering', AVI Publisher.
2. Dendy & Dobraszczyk, Aspen, 'Cereal and Cereal Products', Springer Publication, **2001.**
3. S.B. Arora, 'Hand Book of Bakery Products', SIRI.
4. Karel Kulp and J.G. Ponte, 'Handbook of Cereal Science and Technology', CRC Press, **2000.**
5. N.L. Kent, 'Technology of Cereals', Woodhead Publication, **1994.**
6. W.P. Edwards, 'The Science of Sugar Confectionary', RSC Publishers, **2000.**

TECHNOLOGY OF FATS AND OILS

Subject Code: BFOT1-621 **L T P C** **Duration: 45 Hrs.**

3 1 0 4

UNIT-I (11 Hrs.)

Introduction: Importance and functions of fats and oils in foods and health, composition of fats/oils from different animal sources and oilseeds.

Oil Extraction: Different methods of oil extraction, oil expression from oilseeds like, mustard/rapeseed, coconut, sunflower, groundnut, sesame, cotton. Machines (Mechanical expellers and solvent extractors) used in the expression of oils, Calculations based on the extraction processes.

UNIT-II (11 Hrs.)

Oil/fat Purification: Refining techniques, bleaching, refining losses and deodorization, Batch and continuous refining losses.

Hydrogenation: Chemistry of hydrogenation, Effect of process conditions, Hydrogenation in Practice, Catalysts and catalysis.

UNIT-III (10 Hrs.)

Chemistry of Fats and Oils: Lipolysis, auto-oxidation, thermal decomposition, chemistry of frying oils, effects of ionizing radiation in fats, inter-esterification, reversion.

Technology of Individual Fat Products: Butter, Margarine, Shortening, Lard, Salad, cooking and frying oil.

UNIT-IV (11 Hrs)

Different Quality Parameters: Peroxide value, Saponification value, Iodine value, acid value, TBA, M value, P-value, Kries value, Adulteration in oils and fats.

Soap processing: Chemistry, physical properties of soap, processing and finishing, different types of soaps, soaps in cosmetics and toiletries.

Recommended Books

1. Michael Bockisch, 'Fats and Oils Handbook', AOCS Press, **1997.**
2. D.P.J. Moran and K.K. Rajah, 'Fats in Food Products', Springer U.S., **1993.**
3. Srinivasan Damodaran, Kirk L. Parkin, Owen R. Fennema, 'Fennema's Food Chemistry', CRC Press, **2011.**
4. L.H. Meyer and L.H. Van Nostrand, 'Food Chemistry by (1998) Reinhold Company Publication, New York, London, **1998.**
5. H.W. Lawson, 'Food Oils and Fats- Technology, Utilization and Nutrition', Springer USA, **1995.**

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6. Frank D. Gunstone, ‘Vegetable Oils in Food Technology’, Composition, Properties and Uses’, Blackwell Publishing Ltd., **2011.**

TECHNOLOGIES OF BAKERY AND CONFECTIONARY PRODUCTS LAB.

Subject Code: BFOT1- 620 **L T P C**
0 0 2 1

1. Raw material quality checks on wheat flour.
2. Determination of baking quality of flour for manufacture of bakery products.
3. Preparation of bakery products (Biscuits, cookies, cakes, etc.)
4. Estimation of quality characteristics of bakery products.
5. Preparation of toffee.
6. Preparation of hard boiled candy.
7. Preparation of fudge.
8. Visit to a bakery plant.
9. Visit to a confectionary plant.

TECHNOLOGY OF FATS AND OILS LAB.

Subject Code: BFOT1- 621 **L T P C**
0 0 2 1

1. Experimental expeller processing of oilseeds.
2. Solvent extraction process.
3. Determination of Iodine value of fats and oils sample.
4. Saponification value of fats and oils sample.
5. Estimation of R.M. value, Kirschner, and Polenski value of fats and oils sample.
6. Determination of melting point of fats and oils sample.
7. Determination of peroxide value of fats & oils sample.
8. Adulterants in fats and oils.
9. Imitated dairy products, margarine etc.
10. Production of protein concentrates and isolates.
11. Determination of anti-oxidant-used in oil.

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FOOD ADDITIVES

Subject Code: BFOT1-662 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

UNIT-I (11 Hrs.)

Introduction to Food Additives: Definition, Types of additives, Benefits of additives, risk of additives; Consume attitude towards food additives; Food Additive Intake Assessment: Scope and purpose of food additive intake assessment, regulation of maximum levels of food additives, method of estimating dietary intake of additives. Class I and Class II preservatives as per PFA Act. Nutritional Additives: Vitamins, Amino Acids, Fatty Acids, Minerals and trace minerals, dietary supplements.

UNIT-II (11 Hrs.)

Fat Substitutes and Replacers: Introduction, Chemistry, application in foods, toxicology

Food Additives for special dietary purposes: Nutrition, palatability, manufacturing, stabilizers, thickeners, future development. Flavoring Agents and enhancers: Flavors, their nature, creation and production, function of flavors and their utilization, flavor regulations, flavor safety; definition, properties, function of flavor enhancers.

UNIT-III (11 Hrs.)

Sweeteners: Non-nutritive sweeteners, nutritive sweeteners, choice of sweetener

Antioxidants: Oxidation chemistry, mechanisms of oxidation inhibition, natural and synthetic antioxidant, antioxidant and health, toxicology.

Antimicrobial Agents: Introduction, Types of antimicrobial agents.

Emulsifiers: Chemistry, function, mechanism and application; Anti-caking agents, Firming agents.

UNIT-IV (12 Hrs.)

Colorants: Natural and synthetic food colorants, chemistry, sources, analysis, effect on foods applications, safety

Anti-browning Agents: Chemistry of browning reactions in foods, browning inhibitors, special problems in control of enzymatic browning

pH Control Agents and Acidulants: Introduction, mode of action of acids as antimicrobial agents, types of agents, chemical analysis and assay.

Recommended Books

1. A. Larry Branen, P. Michael Davidson, Seppo Salminen, John Thorngate, 'Food Additives', CRC Press, **2001.**
2. Fennema, 'Food Chemistry', 4th Edn. CRC Press, **2007.**
3. H.D. Belitz, Werner Grosch, Peter Schieberle, 'Food Chemistry', Springer-Verlag, Berlin Heidelberg Publisher, **2009.**
4. M.A. Amerine, 'Principles of sensory analysis of Food', 2nd Edn., Academic Press, **1965.**

MRSPTU

FOOD STORAGE ENGINEERING

Subject Code: BFOT1-663	**L T P C** **3 1 0 4**	**Duration: 45 Hrs.**

UNIT-I (12 Hrs)

Introduction: Purpose and justification of storage of perishable and non-perishable foods, factors influencing shelf life of food materials, engineering properties of biological materials important in design of handling and storage equipment.

Storage Requirements: Storage environment and its interaction with stored product; temperature and moisture migration; storage practices (including fumigation and aeration of stored product); design of aeration systems.

UNIT-II (10 Hrs)

Mechanical Handling Equipment: Design of handling equipment like bucket elevators, belt, screw and pneumatic conveyors, and fans

UNIT-III (11 Hrs)

Storage Structures for Nonperishables: Grain pressure theories- Rankine and Airy theory: Design of bulk storage structures like bins and silos; Design of bag storage structures such as cover and plinth (CAP) and warehouses

UNIT-IV (12 Hrs)

Storage Structures for Perishables: Design aspects of ventilated, cold, modified and controlled atmosphere storage systems.

Management Practices: Labeling, record keeping and management of godowns, silos and cold storages; maintenance of buildings and equipment; sanitary conditions in storages.

Recommended Books

1. B.K. Bala, 'Drying and Storage of Cereal Grains', Science Pub., **1997.**
2. S. Vijayaraghavan, 'Grain Storage Engineering and Technology' Batra Book Services, **1993.**
3. 'Handling and Storage of Food Grains in Tropical and Subtropical Areas', Oxford and IBH, **1970.**

4. Volkind and Roslov and Mukhanov, 'Modern Potato and Vegetable Storage', Amrind Publishing Company Pvt. Ltd. New Delhi, **1983.**
5. A. Chakraverty, 'Post Harvest Technology of Cereals, Pulses and Oilseeds', Oxford and IBH Publishing Co, Calcutta, **1995.**
6. Multon., 'Preservation and storage of grains, seeds and their by-products: cereals, oilseeds, pulses and Animal Feed', Lavoisier, New York, USA, **1988.**

WASTE MANAGEMENT IN FOOD TECHNOLOGY

Subject Code: BFOT1-664 **L T P C** **Duration: 45 Hrs.**

3 1 0 4

UNIT-I (12 Hrs.)

Waste Utilization from Cereal Food Industries: Different sources of wastes from food industries and their availability in India nature of different waste - Waste utilization from rice mill - Thermal and biotechnological uses of rice husk - pyrolysis and gasification of rice husk - cement preparation and different thermal applications - utilization of rice bran - - stabilization - defatted bran utilization.

UNIT-II (11 Hrs.)

Utilization of Fruit and Vegetable Wastes: Processes for Waste utilization from fruit and vegetable industries- Distillation for production of alcohol - oil extraction from waste - waste management in sugar mills - citric acid production from fruit waste

UNIT-III (10 Hrs.)

Fish, Meat and Poultry Waste Utilization: Fish industry by products and waste utilization - meat and poultry waste recycling.

UNIT-IV (12 Hrs.)

Tuber Crops Waste Utilization: Waste from tuber crops - effluent safe disposal- effluent treatment plant- waste recycling plant - feasibility report for food industries using food waste and by products.

Recommended Books

1. P.N. Chereminoff and A.C. Morresi, 'Energy from Solid Wastes', New Tork, Dekker, **1976.**
2. Joshi and Sharma, 'Food Processing Waste Management: Treatment and Utilization Technology', New India Publishing Agency, **2011.**
3. K. Waldron, 'Handbook of Waste Management and Co-Product Recovery in Food Processing', Woodhead Publishing, **2007.**
4. Beagle, 'Rice Husk Conversion to Energy', Rome: Food and Agriculture Organization of the United Nations.

HEALTH FOODS

Subject Code: BFOT1-665 **L T P C** **Duration: 45 Hrs.**

3 1 0 4

UNIT-I (12 Hrs.)

Definition, status and scope of health and functional foods in India, Definition of nutraceuticals and their importance. Types of health benefits and functional foods and their properties.

UNIT-II (12 Hrs.)

Various food constituents responsible for functional effects: Anti-carcinogenic, hypocholesterolemic and hypoglycemic foods, - Dietetic foods, anti-ageing foods, - Fortified foods, diabetic foods, - Biofedic, prebiotics and probiotic foods.

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UNIT-III (10 Hrs.)

Processing of health and functional foods, criteria for selection of raw materials, and their processing. Storage, packaging and labeling of health and functional food.

UNIT-IV (11 Hrs.)

Marketing aspects of health and functional foods. Safety / Legal aspects of health and functional foods. Organic foods and Genetically Modified (GM) foods in relation to health.

Recommended Books

1. R. Chadwick, 'Functional Foods', Springer, **2004.**
2. E.C. Robert Wildman and Wallace, 'Handbook of Nutraceuticals and Functional Foods', CRC Press, **2006.**
3. W. Jeffrey Hurst, 'Methods of Analysis for Functional Foods and Nutraceuticals', 2nd Edn., CRC Press, **2008.**

PACKAGING TECHNOLOGY

Subject Code: BFOT1-724 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

UNIT-I (10 Hrs.)

Introduction: Definitions, Objectives and functions of packaging and packaging materials.

Properties of Packaging Materials: Packaging requirements and selection of packaging materials, properties of materials such as tensile strength, bursting strength, tearing resistance, puncture resistance, impact strength, tear strength.

UNIT-II (11 Hrs.)

Packaging Materials: (a) Paper: pulping, fibrillation and beating, types of papers and their testing methods, cellulosics, paper board. (b) Glass: composition, properties, types of closures, methods of bottle making. (c) Metals: Tinplate containers, tinning process, components of tinplate, tin free steel (TFS), types of cans, aluminium containers, lacquers (d) Plastics: types of plastic films, laminated plastic materials, coextrusion, edible films, biodegradable plastics.

UNIT-III (12 Hrs.)

Barrier Properties of Packaging Materials: Theory of permeability, factors affecting permeability, permeability coefficient, gas transmission rate (GTR) and its measurement, water vapour transmission rate (WVTR) and its measurement.

Packaging equipment and Machinery: Vacuum packaging machine, gas packaging machine, seal and shrink packaging machine, form and fill sealing machine, bottling machines, carton making machines.

UNIT-IV (12 Hrs.)

Food Packaging Systems: Different forms of packaging such as rigid, semi-rigid, flexible forms and different packaging system for (a) dehydrated foods (b) frozen foods (c) dairy products (d) fresh fruits and vegetables (e) meat, poultry and sea foods.

Specialized Techniques in Food Packaging: Active packaging system, retortable pouches, aseptic packaging, controlled and modified atmospheric packaging, irradiation in food packaging.

Recommended Books

1. F.A. Paine, 'A Handbook of Food Packaging', Blackie Academic and Professional, London, **1992.**
2. M. Mathlouthi, 'Food Packaging and Preservation', Springer US, **1994**.
3. G.L. Robertson, 'Food Packaging: Principles and Practice', 3rd Edn. CRC Press Taylor and Francis Group, **2013.**
4. S. Sacharow, 'Handbook of Package Materials', AVI Publishing Co. Westport, Conn., **1976.**

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SPICES & FLAVOUR TECHNOLOGY

Subject Code: BFOT1-725 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

UNIT-I (11 Hrs.)

Introduction: Status and scope of spice and flavour processing industries in India; Spices, Herbs and seasonings: sources, production, selection criteria; flavours: commercially available materials, classification on the basis of origin, physical characteristic.

UNIT-II (12 Hrs.)

Processing Technology of Spices: Chemical composition of spices; processing methods: equipment used in the processing of spices; spice encapsulation; effect of processing on spice quality: contamination of spices with micro-organisms and insects.

Spice Essential Oils: Definition, methods of extraction, isolation, separation equipment.

UNIT-III (10 Hrs.)

Flavour Technology: Essence (flavour) recovery techniques from fruits, spices and herbs along with the equipment used: liquid and Solid flavour production; flavour intensifiers: synthetic flavours; effect of processing on flavour quality.

UNIT IV (12 Hrs.)

Spice Oleoresins: Definition, method of extraction, isolation, separation equipment**.**

Spices and flavour quality evaluation: Criteria for assessment of flavour quality; identification of natural food flavours; methods of flavour evaluation (chemical, instrumental, sensory); PFA standards for flavouring materials and flavours.

Recommended Books

1. G. Reineccius, 'Flavor Chemistry and Technology', CRC Press, Taylor and Francis Group, **2006.**
2. Susheela Raghavan, 'Handbook of Spices, Seasonings and Flavorings', CRC Press, Taylor and Francis Group, **2007.**
3. K. Hirasa and M. Takemasa, 'Spice Science and Technology', CRC Press, Taylor and Francis Group, **1998.**

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PACKAGING TECHNOLOGY LAB.

Subject Code: BFOT1-724 **L T P C**
0 0 2 1

1. Determination of physical properties of packaging film.
2. Identification of different packaging materials.
3. Packaging of fresh fruits and vegetables.
4. Estimation of shelf life of packaged foods.
5. Determination of grease resistance of packaging material.
6. Determination of continuity of lacquer coating.
7. Determination of tensile strength and heat sealability of packaging material.
8. Determination of WVTR of packaging material.
9. Determination of water absorption of paperboard and CFB.

SPICES AND FLAVOR TECHNOLOGY (LAB)

Subject Code: BFOT1-725 **L T P C**
0 0 2 1

1. Identification and characterization of flavouring compounds of spices.
2. Valuable oil determination. Extraction of oil from clove, pepper, cardamom-chili
3. Extraction of oleoresins-Turmeric, ginger, pepper, clove
4. Detection of adulteration in spices.
5. Study of standard specification of spices
6. Spice analysis.
7. Identification of whole spices
8. Application of spices in processed food products.
9. Visit to spice processing unit.
10. Packaging study of spices
11. Chemical analysis of spices moisture, valuable oil, specific gravity, refractive index, acid value

INNOVATIVE TECHNIQUES IN FOOD PROCESSING

Subject Code: BFOT1-766 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

MRSPTU

UNIT-I (11 Hrs.)

Membrane technology: Introduction to pressure activated membrane processes: microfiltration, UF, NF and RO and their industrial application. (06 Hrs.) Supercritical fluid extraction: Concept, property of near critical fluids NCF, extraction methods.

UNIT-II (12 Hrs.)

Microwave and radio frequency processing: Definition, Advantages, mechanism of heat generation, application in food processing: microwave blanching, sterilization and finish drying.

Hurdle technology: Types of preservation techniques and their principles, concept of hurdle technology and its application.

UNIT-III (11 Hrs.)

High Pressure processing: Concept, equipment for HPP treatment, mechanism of microbial inactivation and its application in food processing.

Ultrasonic processing: Properties of ultrasonic, application of ultrasonic as processing techniques.

UNIT-IV (11 Hrs.)

Newer techniques in food processing: Application of technologies of high intensity light, pulse electric field, ohmic heating, IR heating, inductive heating and pulsed X-rays in food processing and preservation.

Nanotechnology**:** Principles and applications in foods.

Recommended Books

1. James G. Brennan, Alister S. Grandison, **‘**Food Processing Handbook 2nd Edn. Wiley VCH, **2011.**
2. P. Fellows, ‘Food Processing Technology’, 3rd Edn., Woodhead Publishing.
3. P.J. Fellows, ‘Food Processing Technology- Principles and Practice’, 2nd Edn., CRC Publications.
4. R.P. Singh and D.R. Heldman, ‘Introduction to Food Engineering’, Academic Press, **1993.**
5. Barbosa-Canovas, ‘Novel Food Processing Technologies’, CRC Press, **2004.**

APPLICATIONS OF ENZYMES IN FOOD TECHNOLOGY

Subject Code: BFOT1-767 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

UNIT-I (11 Hrs.)

General properties and classification of enzymes. Co-enzymes, cofactors, enzymes inhibitors. Enzyme kinetics, factors affecting enzyme action Immobilized enzymes. Sources of enzymes and their production.

UNIT-II (12 Hrs.)

Endogeneous enzymes in food quality- color- lipoxynase, chlorophyllase, polyphenol oxidase, texture-Pectic enzymes, Amylases, cellulases, proteases, flavour and aroma-nutritional quality. Role of enzymes in meat tenderization.

UNIT-III (11 Hrs.)

Significance of enzymes in starch industry- high fructose corn syrups, glucose syrups, monohydrate dextrose. Application of amylases, proteases, lipoxidase, lipases and pentosanases in baking industry.

UNIT-IV (11 Hrs.)

Applications of enzymes in milk and milk products Enzymes in fruits and vegetables processing-clarification and debittering. Enzymes in beer and wine making.

Recommended Books

1. G. Reed, ‘Enzymes in Food Processing’, Academic Press, New York, **1980.**
2. Robert J. Whitehurst and Maarten Van Oor, ‘Enzymes in Food Technology’, Wiley Blackwell, **2009.**
3. Price and Steven, ‘Fundamentals of Enzymology’, Oxford Scientific, **1999.**
4. T. Godfrey, S. West, ‘Industrial Enzymology’, 2nd Edn., Mac Millan Press, London, **1996.**

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FOOD ANALYSIS AND QUALITY CONTROL

Subject Code: BFOT1-830 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

UNIT-I (12 Hrs.)

Introduction: Quality Control and its importance, functions of quality control departments and quality control laboratories.

Colour: Importance and need of colour determination, methods of colour determination with Spectrophotometer, Colorimeter, Hunter Colour lab, Lovibond Tintometer, Munsell colour and colour difference meter and their applications.

Flavour: Importance of flavour, food flavours, factors affecting food product flavours, measurement of food flavours.

UNIT-II (10 Hrs.)

Kinesthetics and Texture: Food texture, Physical characteristics of food, working of texture measuring instruments such as Texture Analyser, Instron Universal Testing machine, Fruit pressure tester, puncture tester, succulometer, tenderometer, texturometer, maturometer, fibrometer, Texture Profile Analysis (TPA).

UNIT-III (12 Hrs.)

Non Destructive Methods: Near Infrared Spectroscopy (NIR), Nuclear Magnetic Resonance (NMR) and its application, Ultrasonic equipment, conductivity and resistivity meters.

Chromatography: Principle and working of Gas chromatography (GC), High pressure liquid chromatography (HPLC), types of detectors used in GC and HPLC, Thin layer chromatography (TLC), Column Chromatography, chromatographic methods applied as quality control.

UNIT-IV (11 Hrs.)

Sensory evaluation: Objectives, panel selection, Different test methods and their groups such as difference tests, rating tests, sensitivity tests, Sensory scores, statistical analysis of the data, application of statistical tests such as t-Test, Chi-Square test, F-test, Linear Regression and Correlation Coefficient.

Food Safety and Regulations: Food Safety and Standards Act (2006), Codex Alimentarius, ISO series, HACCP, Good Manufacturing Practices (GMP), Good Hygienic Practices (GHP), Good Agricultural Practices (GAP), Genetically Modified Foods (GMF).

Recommended Books

1. S. Suzanne Nielsen, 'Food Analysis', Springer, **2010.**
2. A. Kramer and B.A. Twigg, 'Fundamentals of quality control for the food industry', AVI Publishing Co., Westport, Conn. USA. **1962**
3. S. Ranganna, 'Handbook of Analysis of Fruit and Vegetable', Tata McGraw-Hill.
4. Y.H. Hui, 'Handbook of Food Science, Technology and Engineering', CRC Press, Taylor and Francis Group. **2006**
5. R.S. Kirk, R. Sawyer & H. Egan, 'Pearson's Composition and Analysis of Foods', Harlow, Essex, U.K. Longman. **1991.**

FOOD ANALYSIS & QUALITY CONTROL LAB.

Subject Code: BFOT1-831 **L T P C**
0 0 2 1

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1. Estimation of moisture content of food sample.
2. Estimation of ash content of food sample.
3. Recognition of threshold concentration of primary taste.
4. Flavor recognition of food sample.
5. Determination of color of food sample using tintometer.
6. Texture analysis of food sample.
7. Detection of adulteration in food sample.
8. Quality control tests in milk.
9. Quality examination of canned food product.
10. Estimation of total phenols in a food sample.
11. Estimation of antioxidant activity of a food sample.
12. Thin layer chromatography of food colors.

STATISTICAL QUALITY CONTROL

Subject Code: BFOT1-868 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

UNIT-I (11 Hrs.)

Introduction: The meaning of quality and quality improvement, Statistical methods for quality control and improvement.

Food Quality System: The link between quality and productivity, Quality costs, Legal aspects of quality, implementing quality improvement.

Control Charts for Variables: Statistical basis of the charts, Development and use of x and R,
Charts based on standard values, Interpretation of x and R charts, The effect of non-normality on x and R charts.

UNIT-II (12 Hrs.)

Sampling: Population and sampling distributions, Sampling and non-sampling errors, Mean and standard deviation of x, Shape of the sampling distribution of x, Applications of the sampling distribution of x, Population and sample proportions, Mean, standard deviation.

Test Methods: Hypothesis tests, Estimation and hypothesis testing: two populations, Chi-square tests, Analysis of Variance, Simple linear regression, Non-parametric methods.

UNIT-III (11 Hrs.)

Statistical Process Control (SPC) Techniques: SPC for short production runs, Modified and acceptance control charts, SPC with auto correlated process data, Economic design of control charts.

Multivariate Process Monitoring and Control: Description of multivariate data, The Hoteling T2 control chart, The multivariate EWMA (Exponentially Weighted Moving Average) control chart, Latent structure methods.

UNIT-IV (11 Hrs.)

Process Capability Analysis (PCA): PCA using probability plot, Process capability ratios, PCA using a control chart, PCA using designed experiments.

Design of Experiments and Process Optimization: Guidelines for designing experiments, Factorial experiments, the 2k factorial design, Fractional replication of the 2k design, Response surface methods and designs

Six Sigma: Introduction, Six-sigma control chart, Six-sigma quality performance.

Recommended Books

1. Jerome D. Braverman, 'Fundamentals of Statistical Quality Control', Brady and Prentice Hall, **1981.**
2. P.S. Maan. 'Introductory Statistics', John Wiley and Sons, **2010.**
3. D.C. Montgomery, 'Statistical Quality Control', 7th Edn., John Wiley & Sons, **2012.**
4. M. Jaya Chandra, 'Statistical Quality Control', CRC Publisher. **2001.**

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ENGINEERING PROPERTIES OF BIOLOGICAL MATERIALS

Subject Code: BFOT1-869 **L T P C** **Duration: 45 Hrs.**

3 1 0 4

UNIT-I (11 Hrs.)

Introduction: Physical, Mechanical, Thermal, Electrical and Optical properties of bio-food materials, Effect of temperature on water activity, controlling food water content; Physical characteristics, shape, size, volume, density, porosity and surface area of the food materials. True density of the grains, Angle of repose, Test weight, Co-efficient of external friction, Co-efficient of internal friction, colour of food Materials

UNIT-II (12 Hrs.)

Basic concept of rheology, Rheological equations and models, viscoelastic characterization of food materials, Rheological properties of food materials; Force-deformities, stress- strain, elastic – plastic, Bulk stress – strain, viscoelastic behaviour; Rheology and texture of food materials.

UNIT-III (10 Hrs.)

Mechanical damage of food materials, causes, Biological and chemical reaction, Damage of food materials under static, impact and vibration; Aero-hydrodynamic characteristics and its application to agricultural products.

UNIT-IV (12 Hrs.)

Basic concepts of friction in food materials, solid friction, rolling resistance, internal friction, angle of repose. Power losses due to friction, Thermal, Electrical and Optical properties of food materials.

Recommended Books

1. Chakravarthy, 'Post Harvest Technology of Cereals and Pulses', Oxford & Ibh Publishing Co. Pvt. Ltd., **2008.**
2. K.P. Sudheer and V. Indra, 'Post Harvest Technology of Horticultural Crops', New India Publishing Agency, **2007.**
3. James Freeman Steffe, 'Rheological Methods in Food Process Engineering', Freeman Press, **1996.**

MRSPTU

B. TECH. (CHEMICAL ENGG.)

Total Contact Hours = 25 Total Marks = 900 Total Credits = 24

SEMESTER 3rd		Contact Hrs			Marks			Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
BCHE1-301	Chemical Process Calculations	3	1	-	40	60	100	**4**
BCHE1-302	Fluid Flow	3	1	-	40	60	100	**4**
BCHE1-303	Mathematical Methods in Chemical Engg.	3	1	-	40	60	100	**4**
BCHE1-304	Mechanical Operations	3	1	-	40	60	100	**4**
BSOS0-F91	Soft Skills - I	-	-	2	40	60	100	**1**
BCHE1-305	Training-I	-	-	-	60	40	100	**2**
BCHE1-306	Fluid and Particle Mechanics Lab.	-	-	2	60	40	100	**1**
BCHE1-307	Numerical Methods in Chemical Engg. Lab.	-	-	2	60	40	100	**1**
Departmental Elective –I (Select any one)		3	-	-	40	60	100	**3**
BCHE1-356	Nanotechnology							
BCHE1-357	Corrosion Engineering							
BCHE1-358	Energy Engineering							
Total	**Theory = 6 Lab = 2**	**15**	**4**	**6**	**420**	**480**	**900**	**24**

**** Training-I (During summer vacation after 2nd semester)***

MRSPTU

Total Contact Hours = 25 Total Marks = 800 Total Credits = 22

SEMESTER 4th		Contact Hrs			Marks			Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
BCHE1-408	Strength of Materials	3	1	-	40	60	100	**4**
BCHE1-409	Chemical Process Industries	3	1	-	40	60	100	**4**
BCHE1-410	Chemical Engineering Thermodynamics	3	1	-	40	60	100	**4**
BCHE1-411	Heat Transfer	3	1	-	40	60	100	**4**
BSOS0-F92	Soft Skills - II	-	-	2	60	40	100	**1**
BCHE1-412	Heat Transfer Lab.	-	-	2	60	40	100	**1**
BCHE1-413	Chemical Tech. Lab.	-	-	2	60	40	100	**1**
Departmental Elective –II (Select any one)		3	-	-	40	60	100	**3**
BCHE1-459	Plant Utilities							
BCHE1-460	Renewable Energy Resources							
BCHE1-461	Enzyme Technology							
Total	**Theory = 6 Lab = 2**	**15**	**4**	**6**	**380**	**420**	**800**	**22**

Total Contact Hours = 24 Total Marks = 800 Total Credits = 23

SEMESTER 5th		Contact Hrs			Marks			Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
BCHE1-514	Industrial Pollution Control	3	1	-	40	60	100	**4**
BCHE1-515	Chemical Reaction Engg. –I	3	1	-	40	60	100	**4**
BCHE1-516	Mass Transfer-I	3	1	-	40	60	100	**4**
BSOS0-F93	Soft Skills – III	-	-	2	60	40	100	**1**
BCHE1-517	Training – II	-	-	-	-	-	-	**2**
BCHE1-518	Chemical Reaction Engg. & Environmental Engg. Lab	-	-	2	60	40	100	**1**
BCHE1-519	Chemical Process Plant Design-I Lab.	-	-	2	60	40	100	**1**
Departmental Elective –III (Select any one)		3	-	-	40	60	100	**3**
BCHE1-562	Fluidization Tech.							
BCHE1-563	Project Management							
BCHE1-564	Polymer Science &Engineering							
Open Elective – I (Select any one)		3	-	-	40	60	100	**3**
Total	**Theory = 6 Lab = 2**	**15**	**3**	**6**	**380**	**420**	**800**	**23**

Total Contact Hours = 25 Total Marks = 800 Total Credits = 22

SEMESTER 6th		Contact Hrs			Marks			Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
BCHE1-620	Mass Transfer-II	3	1	-	40	60	100	**4**
BCHE1-621	Chemical Reaction Engg. –II	3	1	-	40	60	100	**4**
BSOS0-F94	Professional Skills – IV	-	-	2	60	40	100	**1**
BCHE1-622	Mass Transfer Lab.	-	-	2	60	40	100	**1**
BCHE1-623	Process Equipment Design Lab.	-	-	2	60	40	100	**1**
Departmental Elective –IV (Select any one)		3	1	-	40	60	100	**4**
BCHE1-665	Engineering Materials							
BCHE1-666	Petroleum Refining Engg							
BCHE1-667	Optimization Techniques							
Departmental Elective – V (Select any one)		3	1	-	40	60	100	**4**
BCHE1-668	Polymer Reactor Design							
BCHE1-669	Heat Exchangers							
BCHE1-670	Transport Phenomena							
Open Elective – II (Select any one)		3	-	-	40	60	100	**3**
Total	**Theory = 6 Lab = 2**	**15**	**4**	**6**	**380**	**420**	**800**	**22**

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Total Contact Hours = 26 Total Marks = 700 Total Credits = 24

SEMESTER 7th		Contact Hrs			Marks			Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
BCHE1-724	Process Instrumentation, Dynamics & Control	3	1	-	40	60	100	**4**
BCHE1-725	Process Engineering & Economics	3	1	-	40	60	100	**4**
BCHE1-726	Project – I	-	-	8	60	40	100	**4**
BCHE1-727	Training – III	-	-	-	-	-	-	**4**
BCHE1-728	Chemical Process Plant Design-II Lab.	-	-	2	60	40	100	**1**
BCHE1-729	Process Instrumentation, Dynamics and Control Lab.	-	-	2	60	40	100	**1**
Departmental Elective –VI (Select any one)		3	-	-	40	60	100	**3**
BCHE1-771	Separation Processes							
BCHE1-772	Petrochemical Technology							
BCHE1-773	Biochemical Engg.							
Open Elective – II (Select any one)		3	-	-	40	60	100	**3**
Total	**Theory = 6 Lab = 2**	**12**	**2**	**12**	**240**	**360**	**700**	**24**

Total Contact Hours = 26 Total Marks = 400 Total Credits = 15

SEMESTER 8th		Contact Hrs			Marks			Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
BCHE1-830	Process Modelling & Simulation	3	1	-	40	60	100	**4**
BCHE1-831	Project – II	-	-	12	60	40	100	**6**
BCHE1-832	Process Simulation Lab.	-	-	2	60	40	100	**1**
Departmental Elective –VI (Select any one)		3	1	-	40	60	100	**4**
BCHE1-874	Chemical Process Safety							
BCHE1-875	Fuel Cell Technology							
BCHE1-876	Environmental Impact Assessment							
Total	**Theory = 2 Lab = 1**	**6**	**2**	**14**	**200**	**200**	**400**	**15**

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Total Credits = 25 + 25 + 24 + 22 + 23 + 22 + 24 + 15 = 180

CHEMICAL PROCESS CALCULATIONS

Subject Code: BCHE1-301 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

Learning Objectives: The objective of this course is to present to the students, an introduction to chemical engineering calculations, establish mathematical methodologies for the computation of material balances, energy balances and to present an overview of industrial chemical processes. It is prerequisite for several other courses in the curriculum, including courses in process dynamics, heat transfer and phase equilibrium.

UNIT-I (10 Hrs.)

Introduction to Chemical Engineering Calculations: Units & Dimensions, Conversion of units, Mole concept, Basic Concept, Stoichiometric and composition relationship, limiting-excess- reactant, conversion and yield, Degrees of Freedom.

UNIT-II (13 Hrs.)

Material Balance: *Without Chemical reaction* - Ideal gas-law calculations, real-gas relationships, vapour pressure of immiscible liquids, solutions and problems based on Raoult's, Henry & Dalton's Law. Absolute Humidity, Relative Humidity, Saturation, Dry bulb temperature, Wet bulb temperature, Adiabatic saturation temperature & use of psychometric Chart.

With Chemical Reaction- Combustion, gas-synthesis, acid-alkali production recycle, purge, bypass in batch, stagewise and continuous operations in systems with or without chemical reaction.

UNIT-III (12 Hrs.)

Energy Balance: *Review:* Thermophysics, Thermochemistry-law of constant heat summation, Hess's Law, standard heat of reaction, combustion and formation, problems using Hess Law.

Heat balances for non-reacting processes and reaction processes. Theoretical flame temperature, Adiabatic reaction temperature, flame temperature, combustion calculation.

UNIT-IV (10 Hrs.)

Material and Energy Balances: Applied to industrial processes such as combustion and gasification of fuels, synthesis of ammonia, production of sulphuric acid, nitric acid, hydrochloric acid

Recommended Books

1. D.M. Himmelbleau, J.B. Riggs, 'Basic Principles and Calculations of Chemical Engg.', 7th Edn, Prentice Hall, **2004.**
2. P.A. Hougen, K.M. Watson, R.A. Ragatz, 'Chemical Process Principles', Part – I, John Wiley & Sons.
3. B.L. Bhatt and S.M. Vora, 'Stoichiometry', Tata McGraw Hill Publishing Co. Ltd., New Delhi.
4. R.M. Felder & R.W. Rousseau, 'Elementary Principles of Chemical Processes', 2nd Edn, John Wiley & Sons.
5. G.V. Reklaitis, 'Introduction to Material and Energy Balances', John Wiley & Sons.
6. W.K. Lewis, A.H. Radasch, H.C. Lewis, 'Industrial Stoichiometry', McGraw Hill.

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FLUID FLOW

Subject Code: BCHE1-302 **L T P C** **3 1 0 4** **Duration: 45 Hrs.**

Learning Objectives: The course introduces the students to the principles of fluid mechanics that are of fundamental importance to chemical engineers i.e. fluid statics and dynamics, boundary layer, laminar and turbulent flows, fluid machinery etc. It is a prerequisite to Heat Transfer, Mass Transfer I & II.

UNIT-I (15 Hrs.)

Introduction: Concept of fluid, difference between solids, liquids and gases; ideal and real fluids, Introduction to fluid statics and fluid flow

Fluid Statics: Normal forces in fluids, Manometers of different types, Forces on submerged bodies, Buoyancy and stability.

Fluid Properties: Concept of capillarity, vapour pressure, compressibility and bulk modulus, Newtonian and non- Newtonian Fluids, Nature of turbulence, Eddy Viscosity, Flow in Boundary Layers.

UNIT-II (10 Hrs.)

Basic Equations of Fluid Flow: Momentum Balance, Continuity equation, Bernoulli's Equations - Derivation and Application, Navier Stokes Equations. Dimensional Analysis of Fluid Flow Problems using Rayleigh method and Buckingham π method, Dimensionless numbers and their significance.

UNIT-III (10 Hrs.)

Flow of Incompressible Fluids: Concept of boundary layer, Laminar and Turbulent flow in pipes, Velocity distribution in pipes, Frictional Losses in pipes and fittings, effect of roughness, Fanning Equation, Estimation of Economic Pipe Diameter, Derivation of Hagen Poiseuille's equation and $f = 16/Re$.

Flow of Compressible Fluids: Compressible flow, basic equation, Mach number and its significance and isentropic flow through nozzles.

UNIT-IV (10 Hrs.)

Flow Measurement: *In closed channels* - Pitot tube, Orifice meter, venturimeter, Rotameter, Hot wire Anemometers, Vortex meters**.** *In open channels*- Notches, Weirs, plumes.

Fluid Machinery: Classification and performance of Pumps, Positive displacement pumps and its types, Centrifugal pumps- characteristic curves, Net positive Suction Head and cavitation, Turbines, Compressors, Blowers, Selection and specification.

RECOMMENDED BOOKS

1. McCabe, L. Warren, Julian C. Smith and P. Harriot, 'Unit Operations of Chemical Engg.', 7th Edn., McGraw Hill, **2005.**
2. J.R. Backhurst, J.H. Harker, J.F. Coulson, J.M. Richardson, 'Chemical Engineering', Vol. 1, 6th Edn., Butterworth Heinemann, **1999.**
3. A.S. Foust, L.A. Wenzel, C.W. Clump, L. Maus, L.B. Anderson, 'Principles of Unit Operations', 2nd Edn, John Wiley & Sons, **2008**.
4. K.S.N. Raju, 'Fluid Mechanics, Heat Transfer and Mass Transfer, Chemical Engineering Practice', John Wiley and Sons, **2011.**
5. W.L. Badger and J.T. Banchero, 'Introduction to Chemical Engg.', McGraw Hill.
6. J. Philip, P.J. Pritchard, Fox and McDonald's, 'Introduction to Fluid Mechanics', 8th Edn., John Wiley and Sons, **2011.**
7. P. Chattopadhyay, 'Unit Operations of Chemical Engg.', Vol.-1, 3rd Edn., Khanna Publishers.

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MATHEMATICAL METHODS OF CHEMICAL ENGG.

Subject Code: BCHE1-303 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

Learning Objectives: This course is aimed at providing the students with knowledge about the numerical solutions to various mathematical expressions that they may come across in Chemical Engg. Practice, those are not easily solvable by conventional techniques. These techniques are very useful for the students for experimental data analysis, integration and differentiation of involved functions, solutions of certain implicit equations.

UNIT-I (12 Hrs.)

Linear Algebraic Equations: Cramer's rule, Gauss Elimination and LU Decomposition, Gauss-Jordan elimination, Gauss-Seidel and Relaxation Methods.

Nonlinear Algebraic Equation: Single variable successive substitutions (Fixed Point Method), Multivariable successive substitutions, single variable Newton-Raphson Technique, Multivariable Newton-Raphson Technique.

UNIT-II (11 Hrs.)

Eigen values and Eigen vectors of Matrices: Fadeev Leverrier's Method, Power Method.

Function Evaluation: Least squares curve-fit (Linear Regression), Newton's interpolation formulae (equal intervals), Newton's Divided Difference Interpolation Polynomial, Lagrangian Interpolation Unequal intervals. Extrapolation Technique of Richardson and Gaunt. Numerical Differentiation, Numerical Integration or Quadratures (Trapezoidal, Simpson's1/3and3/8 rules).

UNIT-III (10 Hrs.)

Ordinary Differential Equations (ODE-IVPs) and partial differential Equations: The Finite Difference Technique, Runge-Kutta method.

UNIT-IV (12 Hrs.)

Laplace Transforms: Laplace transforms of various standard functions, properties of Laplace transforms, inverse Laplace transforms, transform of derivatives and integrals, Laplace transform of unit step function, impulse function, periodic functions, applications to solution of ordinary linear differential equations with constant coefficients, and simultaneous differential equations.

Recommended Books

1. S.K. Gupta, 'Numerical Methods for Engineers', 2nd Edn., New Age International Publishers, **2009.**
2. B.S. Grewal, 'Higher Engineering Mathematics',43rd Edn., Khanna Publishers, **2014**.
3. M.K. Jain, S.R.K. Iyengar and R.K. Jain, 'Numerical Methods for Scientific and Engineering Computation', New Age International.
4. R.G. Rice and Do Duong D., 'Applied Mathematics and Modelling for Chemical Engineers', John Wiley & Sons, Inc., **1995.**
5. S.S. Sastry, 'Introductory Methods of Numerical Analysis', 4th Edn., Prentice Hall of India.
6. E. Kreyszig, 'Advanced Engineering Mathematics', 8th Edn., John Wiley, New Delhi.

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MECHANICAL OPERATIONS

Subject Code: BCHE1-304 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

Learning Objectives: The objective of this course is to develop the understanding of the students about solids, their characterization, handling and the various processes involving solids. The students are exposed to basic theory, calculations and machinery involved in various solid handling operations.

UNIT-I (11 Hrs.)

Characterization and Handling of Solids: Characterization of solid particles: Shape, size, specific surface, Particle size distribution**,** Properties of particulate masses: Major distinctive properties, pressures in masses of particles, angle of internal friction, angle of repose.

Storage and Conveying of Bulk Solids: Basic idea of conveyor, conveyor selection, screw, belt, vibrating, continuous flow and pneumatic conveyors, bulk storage, bin storage, feeders.

Screening: Capacity and Effectiveness of a screen, calculation of average size of particles in mixture by screen analysis, types of screens.

UNIT-II (10 Hrs.)

Agitation and Mixing: Agitation of low viscosity particle suspensions: axial flow impellers, radial flow impellers, close-clearance stirrer, unbaffled tanks, baffled tanks, basic idea for designing agitators. Power number, Froude number, power consumption in agitation, Mixing of Solids: Types of mixers, various mixers for cohesive solids, power requirements, mixing index, axial mixing, Mixers for free flowing solids: ribbon blenders, screw mixers, tumbling mixers import wheels, mixing index in blending granular solids, mixing index at zero time, rate of mixing.

UNIT-III (12 Hrs.)

Size Reduction: Principles of Comminution: Criteria for comminution, characteristics of products, Energy and Power requirements, Bond's, Rittinger's and Kick's Law and Work Index. Size Reduction Equipment: Crushers, Grinders, and ultrafine grinders cutting machines, equipment operation.

Filtration: Classification of filters, various types of cake filters, principles of cake filtration, clarifying filters: liquid clarification, Gas cleaning, principles of clarification, Filtration Equipment and centrifuges and their selection, Cross flow Filtration, micro filtration.

UNIT-IV (12 Hrs.)

Settling: Motion of particles through fluids: Terminal velocity, hindered settling, Stoke's law,

Gravity settling processes: Classifiers, clarifiers, thickeners, flocculation, rate of sedimentation, Centrifugal Settling processes: Cyclones, hydroclones, decanters, tubular, disk and nozzle discharge centrifugal sludge separators, Centrifugal class fitters, principles of centrifugal sedimentation.

Fluidization: Fluidization and fluidized bed, conditions for fluidization, Ergun equation and Kozeny-Carman equation, minimum fluidization velocity, types of fluidization, expansion of fluidized beds and particulate fluidization, continuous fluidization; industrial applications.

Recommended Books

1. McCabe, L. Warren, Julian C. Smith and P. Harriot, 'Unit Operations of Chemical Engg.', 7th Edn., McGraw Hill, **2005.**
2. J.H. Harker, J.F. Richardson, J.R. Backhurst, 'Chemical Engg.' Vol.-2, 5th Edn., Butterworth-Heinemann, **2003.**

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3. A.S. Foust, L.A. Wenzel, C.W. Clump, ‘Principles of Unit Operations’, 2nd Edn., John Wiley & Sons, **2008.**
4. W.L. Badger and J.T. Banchero, ‘Introduction to Chemical Engg’, McGraw Hill.
5. R.H. Perry, D.W. Green, ‘Chemical Engineers Handbook’, 8th Edn, McGraw Hill, **2008.**

FLUID AND PARTICLE MECHANICS LAB.

Subject Code: BCHE1-306 **L T P C**
0 0 2 1

1. Characteristic curves of a centrifugal pump.
2. Verification of Bernoulli’s equation for flow process.
3. Measurement of flow by a venturimeter/orifice meter
4. Measurement of flow by a V-notch in an open channel.
5. Measurement of losses in various fitting, valves and variation in cross section/ shapes.
6. Verification of Stokes Law.
7. Screen analysis of given sample for its particle size distribution.
8. Determination of variation in pressure drop & bed height w.r.t superficial velocity and minimum fluidization velocity for a bed of solids.
9. Operating characteristics of crushing and grinding equipment (Jaw crusher and Ball mill).
10. Evaluation of the filtration constants for $CaCO_3$ slurry in water and cake compressibility.
11. Determination of %age recovery of coal in froth from coal and sand mixture.
12. Determination of thickener capacity using batch sedimentation.
13. Determination of the separation efficiency of the classifier.

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NUMERICAL METHODS IN CHEMICAL ENGINERING LABORATORY

Subject Code: BCHE1-307 **L T P C**
0 0 2 1

1. Solution of a system of linear equations in unknowns by Gaussian elimination.
2. Gauss-Seidel iterative method to solve a linear system of equations.
3. Solution of a system of linear equations by Gauss-Jordan method.
4. Application of Faddeev-Leverrier's method.
5. Method for finding dominant Eigen value and corresponding Eigen vectors by power method.
6. Solution of nonlinear equation by Newton Raphson method.
7. Application of Newton's formulae for interpolation.
8. Application of Lagrange polynomial interpolation formula.
9. Application of Newton's formula for numerical differentiation.
10. Numerical integration by Trapezoidal rule.
11. Numerical integration by Simpson's rules.
12. Solution of an O.D.E. by Runge Kutta Methods.
13. Application of finite difference technique.

NANO-TECHNOLOGY

Subject Code: BCHE1-356 **L T P C** **Duration: 34 Hrs.**
3 0 0 3

Learning Objectives: The course will provide an overview of Nano materials, their characterization, usage and use in biomaterials.

UNIT-I

Introduction: Terminologies, History & Scope

Characterization: Contemporary Characterization Methods, top down & Bottom up Fabrication, Solution based Synthesis of Nanoparticles, Vapour Phase Synthesis & Synthesis with framework

UNIT-II

Fabrication: Nanolithography, Dip Pen Lithography. Artificially Layered Materials: Quantum Well, Quantum Dots, Super lattices & Layered Structures.

Self-Assembly: Supramolecular & dimension Control in Nanostructure, thermodynamics and coded self-assembly.

UNIT-III

Biomaterials: DNA & Nanomaterials, Bioanocomposites, Biometrics, molecular motor.

UNIT-IV

Nanoelectronics and Molecular Computing: Molecular wires, Nanowires, Nanotubes, Molecular switch, Molecular logic gates and molecular storage devices, DNA Computing Quantum Computing.

Recommended Books

1. C.P. Poole, F.J. Owens, 'Introduction to Nanotechnology', Wiley Publications, **2003.**
2. 'Understanding Nanotechnology', Scientific American, **2002.**
3. M. Ratner & D. Ratner, 'Nanotechnology: A Gentle Introduction to the Next Big Idea', Prentice Hall, **2003.**
4. M. Wildon, K. Kannagara, G. Smith, 'Nanotechnology', CRC.

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CORROSION ENGINEERING

Subject Code: BCHE1-357 **L T P C** **Duration: 34 Hrs.**
3 0 0 3

Learning Objectives: The course will provide an overview of corrosion effects, the various processes and applications where corrosion is dominant and mitigation strategies.

UNIT-I

Corrosion: Direct & two stage attack, electrochemical attack, environment conditioning.

UNIT-II

Techniques for Corrosion Resistance: Higher corrosion resistance through proper selection of material, isolation of corrosion prone materials form destructive environment,

UNIT-III

Technologies of anodization, enamelling, rubber lining, glass lining, refractory lining, painting and other surface protective measures.

UNIT-IV

Corrosion engineering in special applications: Material transport, pumping, filtration, condensation, boiling, riveting, welding, high temperature environments etc. Cost factor in competitive corrosion prevention/inhibition techniques.

Recommended Books

1. H.H. Uhling, 'Corrosion Control', John Wiley & Sons, **1971.**
2. G. Butler & H.C.K. Ison, 'Corrosion 7 its prevention in Waters', Leonard Hill - London, **1966.**
3. P. Maslow, 'Chemical Materials for Construction', Structures Publishing Co., **1974.**
4. H.F. Payne, 'Organic Coatings Technology', John Wiley & Sons.
5. M.G. Fontance & N.D. Gtretrnee, 'Corrosion Engineering', McGraw Hill, **1967.**

ENERGY ENGINEERING

Subject Code: BCHE1-358 **L T P C** **Duration: 34 Hrs.**
3 0 0 3

Learning Objectives: The objective of this course is to teach the students about the various options available to meet the ever growing demand of energy by the industry. It includes both the conventional and non-conventional energy sources.

Unit – I

Introduction:

Energy crisis in the world and position in India

Conventional Sources of Energy:

Solid Fuels:

Composition and classification of coals, analysis and properties of coal, characteristics and distribution of Indian coals, coal carbonization, briquetting, gasification and liquefaction of solid fuels.

Unit – II

Liquid Fuels:

Petroleum and Related Products:

Introduction: Origin, occurrence and reserves, reserves, Production and consumption, classification and characteristics of Petroleum properties and characteristics, petroleum refining in India.

Petroleum Products - Naphtha, motor gasoline, aviation gasoline, kerosene, diesel oil, gas oils, fuel oils, lubricants, petroleum waxes, Petroleum coke.

Unit – III

Gaseous Fuels:

Producer, water carburettor, water, coal, blast furnace and refinery gases, gases from biomass, LPG, CNG.

Combustion Process and Appliances:

Nature and types of combustion processes, mechanism of combustion reaction, spontaneous ignition temperature, gas and oil burners, coal burning equipment, fluidized bed combustion.

Unit – IV

Non- Conventional Sources of Energy:

Nuclear energy: - Nuclear reactions, fuel materials, moderators and structural materials, reactors Energy by bio-processes-bio-gas, Solar Energy - Photovoltaic cells, solar collectors, wind Energy and biofuels.

Recommended Books

1. Sarkar Samir, ‘Fuels and Combustion’, 2nd Edn., Orient Longman, **2003**.
2. O.P. Gupta, ‘Elements of Fuels, Furnaces and Refractories’, Khanna Publications, **1997.**
3. P.J. Wilson, G.H. Wells, ‘Coal, Coke and Coal Chemicals’, McGraw Hill, **1950.**
4. J. Griswold, ‘Fuels, Combustion and Furnaces’, McGraw Hill, **2006.**

STRENGTH OF MATERIALS

Subject Code: BCHE1-408 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

Learning Objectives: This course is aimed at giving an insight to students about the behaviour of materials under external forces. The concept of stress, strain, elasticity etc. as applied to various structural members under loading are included.

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UNIT-I (10 Hrs.)

Simple Stresses & Strains: Simple stresses and strains: Concept of stress and strain; St. Vernants principle, stress and strain diagram, Hooke's law, Young's modulus, Poisson ratio, stress at a point, stress and strains in bars subjected to axial loading. Modulus of elasticity, stress produced in compound bars subject to axial loading. Temperature stress and strain calculations due to applications of axial loads and variation of temperature in single and compound bars.

UNIT-II (12 Hrs.)

Theory of Bending: Compound stress and strains, the two dimensional system; stress at a point on a plane, principal stresses and principal planes; Mohr's circle of stress; ellipse of stress and their applications. Generalized Hook's Law, principal stresses related to principal strains

Slopes and Deflections of Beams: Slopes and deflections in beams and cantilevers, calculation of slopes and deflections using double integration moment area theorems and Macaulay's method.

UNIT-III (11 Hrs.)

Theories of failure: Strain energy, various theories of failure, their necessity and significance, graphical representation of theories of failure.

Torsion of shafts and springs: Torque, angle of twist and shear stresses in hollow and solid shafts with in elastic limit, assumptions intrusion, power transmitted by a shafts, analysis of close coil, spring subjected to axial load couple. Shafts subjected to torsion.

UNIT-IV (12 Hrs.)

Thin Cylinders/ spheres: Thin cylinders subjected to internal pressure, circumferential and longitudinal stress and strains, maximum shear stress, increase in diameter and volume, thin spheres subjected to internal pressure.

Columns: Columns under uniaxial loads, buckling of columns slenderness ratio, and conditions. Derivations of Euler's formula for elastic-buckling load, equivalent length, Rankine-Garden empirical formula.

Recommended Books

1. V.N. Vazirani & Ratwani, 'Analysis of Structures,' Vol. I, 17th Edn., Khanna Publishers.
2. R.K. Bansal, 'Strength of Materials', Luxmi Publishers, **2010.**
3. S. Timoshenko, 'Strength of Materials', Vol.-I, Elementary Theory and Problems, 3rd Edn., CBS Publishers, **2002.**
4. E.P. Popov, 'Engineering Mechanics of Solids', 2nd Edn., Prentice Hall, **1999.**

CHEMICAL PROCESS INDUSTRIES

Subject Code: BCHE1-409 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

Learning Objectives: The main aim of this course is to acquaint the students with various broad categories of chemicals, their properties, usage and various technologies available for manufacture. The concept of flow diagrams and requirement of engineering materials for these technologies is included.

UNIT-I (11 Hrs.)

Oils and Fats: Status and scope, major oil seeds production in India; solvent extraction, energy and solvent requirements, hydrogenation of oils, Corrosion problems and materials of construction.

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Soaps and Detergents: History and growth, raw material, manufacturing of detergents, biodegradability, Fat-splitting, purification of fatty acids, soap manufacture, glycerine manufacture, materials of construction.

UNIT-II (12 Hrs.)

Sugar: Manufacturing equipment and technology, cane sugar refining, bagasse utilization, energy requirements and conservation, environmental considerations.

Pulp and Paper: Growth of industry, raw materials, pre-treatment, pulping, manufacture of paper, recovery of chemicals.

Acids: Manufacture and uses of Phosphoric acid, hydrochloric acid, nitric acid, sulphuric acid, major engineering problems.

UNIT-III (11 Hrs.)

Fertilizers: Synthesis: naphtha, natural gas and ammonia based fertilizers, manufacture of phosphatic fertilizers and potash fertilizers, N-P-K values. Corrosion problems and materials of construction.

Soda Ash: Manufacturing processes- Solvay and modified Solvay process, environmental considerations, corrosion problems and material of construction.

UNIT – IV (11 Hrs.)

Chlor Alkali: Electrochemistry of brine electrolysis, current efficiency, energy efficiency, diaphragm cells, mercury cells, mercury pollution and control, caustic soda, chlorine, corrosion problems and materials of construction.

Glass and Cement: Types and properties of cement, Method of production of Portland Cement, major engineering problems.

Types and properties of glass, Manufacturing process of glass, Applications, major engineering problems.

Recommended Books

1. M.G. Rao, M. Sittig, 'Dryden's Outlines of Chemical Technology for 21st Century', 3rd Edn., Affiliated East West Press Pvt. Ltd., **2008.**
2. G.N. Pandey, 'Chemical Technology', Vol.-I & II, Vikas Publication, **2010.**
3. J.A. Moulijn, M. Makkee, A. Diepen, 'Chemical Process Technology', John Wiley, **2001.**

HEAT TRANSFER

Subject Code: BCHE1-410 **L T P C** **3 1 0 4** **Duration: 45 Hrs.**

Learning Objectives: The objective of the course is to introduce to students about heat transfer mechanisms in solids and fluids and their chemical process applications. At the conclusion of the course, the student should possess the ability to model steady and unsteady heat transfer in simple systems and design heat exchangers. It requires use of thermodynamics and fluid mechanics and sets the basis for the design of reactors and separation processes.

UNIT-I (12 Hrs.)

Modes of Heat Transfer: ***Conduction*** - Fourier's law, one dimensional heat conduction through plane and composite structures having plane wall, spherical & cylindrical geometry. Steady state heat flow with heat source through plane wall and cylindrical surface. Thermal conductivity of materials. Insulating materials and critical thickness of insulation, Unsteady-state conduction; Lumped heat capacity system, semi-infinite solid and Heisler chart.

UNIT-II (12 Hrs.)

Convection: Free and forced convection, Concept of thermal boundary layer, concept of overall heat transfer coefficient for laminar and turbulent flow, Heat transfer inside &

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outside tubes with significance of Nusselt Prandtl, Reynolds, Biot, Fourier and Peclet numbers. Modelling of convective heat transfer coefficient by using dimensional analysis for natural convection.

Radiation: Distribution of radiant energy, Definition of emissivity, absorptivity, Reflectivity and transmissivity, concept of Black and Grey bodies, Planck's law of monochromatic radiation, Kirchhoff's law, Wien's displacement law, Stefan-Boltzmann law, definition of intensity of radiation. Radiation formula for radiation exchange between simple bodies, two parallel surfaces and between any source and receiver, radiation shields.

UNIT-III (11 Hrs.)

Condensation and Boiling Heat Transfer: Dropwise and Filmwise condensation of pure and mixed vapours, Convective, Nucleate & Film boiling, Theory and correlations, critical boiling flux.

UNIT-IV (10 Hrs.)

Heat exchangers: Heat exchangers - double pipe heat exchanger, Shell-and-Tube heat exchangers, plate type heat exchanger, concept and calculation of log mean temperature difference, temperature correction factor for shell & tube exchangers, fouling factors, overall heat transfer coefficient.

Theory of Fins and their applications, Reboiler and Condensers, counter current dry contact Condenser, parallel current- wet contact Condenser.

Evaporators: Various types of evaporators- Standard vertical tube evaporator, basket type vertical evaporator, forced circulation evaporator and horizontal tube evaporators.

Single effect evaporators and multi-effect evaporators and its various types of feed arrangements, boiling point elevation, capacity and economy of evaporators. Evaporation under vacuum.

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Recommended Books

1. J.P. Holman, 'Heat Transfer', 10th Edn, McGraw Hill, **2010.**
2. J.R. Backhurst, J. H. Harker, J.F. Coulson, J.M. Richardson, 'Chemical Engineering', Vol.-1, 6th Edn., Butterworth Heinemann, **1999.**
3. W.H. McAdams, 'Heat Transmission', 3rd Edn., Kreiger Publishing Co, **1985.**
4. McCabe, L. Warren, C. Smith and P. Harriot, 'Unit Operations of Chemical Engg.', 7th Edn, McGraw Hill, **2005.**
5. D.Q. Kern, 'Process Heat Transfer', McGraw Hill.

CHEMICAL ENGINEERING THERMODYNAMICS

Subject Code: BCHE1-411	**L T P C** **3 1 0 4**	**Duration: 45 Hrs.**

Prerequisite: The students should have studied Elements of Mechanical Engineering as a prerequisite to study this course

Learning Objectives: This course covers the application of thermodynamic principles to chemical engineering problems. The concept of equations of state, phase and chemical equilibrium with emphasis on vapor/liquid systems and their applications to separation processes is included.

UNIT-I (12 Hrs.)

Brief Review: Importance of thermodynamics in chemical engineering, State functions, types of systems, internal energy, heat and work reversible and irreversible processes. 1st law of thermodynamic and its engineering applications, i.e., constant volume processes, constant pressure processes, isothermal and adiabatic processes, Throttling process, Joule-Thomson coefficient, liquefaction of gasses, Standard heat of reaction, standard heat of formation, standard heat of combustion, flame temperature, enthalpy for phase change etc.

UNIT-II (11 Hrs.)

Review of 2nd and 3rd Law of thermodynamics: Concept of Entropy and lost work, Microscopic interpretation of entropy. Third law of thermodynamics and its applications, free energy functions and their significance in phase and chemical equilibria. Clapeyron equation and some important correlations for estimating vapour pressures. Estimation of thermodynamic properties by using graphs and tables.

Equations of State: Equation of state for real gases and their mixtures. Principle of corresponding states and generalized compressibility factor, H-x diagrams, heat of solution

UNIT-III (12 Hrs.)

Phase Equilibria: Partial molar properties, partial molar Gibbs free energy, chemical potential and its dependence on temperature and pressure. Ideal solutions (Lewis-Randall Rule). Fugacity and its calculations. Dependence of fugacity on temperatures and pressure.Solution behaviour of real liquids and solids. Activity and activity coeffiecients. Variation of activity co- efficient with temperature and composition. Activity coefficients of electrolytes. Standard states. Properties of mixing. Excess properties. Gibbs-Duhem equation and its application to vapour- liquid equilibria.

UNIT-IV (10 Hrs.)

Chemical Equilibria: Equilibrium constant in terms of measurable properties, variations of equilibrium constant with temperature and pressure. Adiabatic reactions. Gibbs phase rule, equilibria in heterogeneous reactions. Electrochemical reactions.

Recommended Books

1. J.M. Smith and H.C. Van Ness, 'Introduction to Chemical Engineering Thermodynamics', 7th Edn., McGraw Hill Book Co., **2005.**
2. B.F. Dodge, 'Chemical Engg. Thermodynamics', McGraw Hill Book Company, Inc.
3. R. Balzhiser, M. Samuels, J. Eliassen, 'Chemical Engineering Thermodynamics', Prentice Hall, **1972.**

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HEAT TRANSFER LAB.

Subject Code: BCHE1-412 **L T P C**
0 0 2 1

1. Determination of heat transfer coefficient for different types of heat transfer equipment.
2. Wilson Plots for unsteady state heat transfer in jacketed vessels.
3. Developing correlation of instantaneous heat transfer coefficients with time for steady deposition of scale on a heating surface.
4. Determination of heat losses from insulated pipes.
5. Performance characteristics of a shell and tube heat exchanger and an induced draft cooling tower.
6. Study and operation of forced circulation and multiple effect evaporators.
7. To prepare Duhring's plot for solutions involving non-volatile solutes
8. To find the heat transfer coefficient of heat loss from a vertical cylinder by natural convection.
9. To find heat transfer coefficient for parallel flow and counter flow for double pipe heat exchanger.
10. To find heat transfer coefficient for heat loss by forced convection to air flowing through it for different air flow rates & heat flow rates.
11. To study filmwise and dropwise condensation.
12. To find emissivity for a given surface in comparison to black surface.

CHEMICAL TECHNOLOGY LAB.

Subject Code: BCHE1-413 **L T P C**
0 0 2 1

LIST OF EXPERIMENTS

PART A

1. To perform proximate analysis of a given sample.
2. Determination of HCV and LCV of a given fuel by bomb calorimeter.
3. To determine the acid value of an oil/fat.
4. To determine the saponification value of an oil/fat.
5. To determine the iodine value of an oil/fat.
6. To estimate the given reducing/non-reducing sugar.
7. To determine the sediment in Crude Petroleum and Fuel oils.
8. To determine the viscosity of a given sample by Flow cup/Ostwald viscometer.

PART B

1. Preparation of an addition /condensation polymer.
2. Preparation of polymer product using injection moulding.
3. Preparation of compounded polymer sample using two roll mill.
4. Preparation of polymer product using compression moulding
5. Determination of performance of a given polymer sample under tensile loading like stress-strain curve, modulus of elasticity.
6. To find the cement composition in a given mortar sample.
7. To prepare soap by Hot and Cold process by mustard oil.

At least five experiments should be conducted from each part.

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PLANT UTILITIES

Subject Code: BCHE1-459 **L T P C** **Duration: 34 Hrs.**
3 0 0 3

Learning Objectives: The aim of this course is to familiarize the students with utility services required in chemical process industries, their importance and fundamental principles.

UNIT-I

Introduction: Importance of Process utilities in Chemical Plant.

Steam: Boilers-classification, various types, construction, boiler mountings & accessories, properties of steam-tables, Mollier Diagram.

UNIT-II

Power Generation: Internal Combustion Engines- classification, two- stroke, four stroke petrol & diesel engine, valve timing diagram, carburetor, Combustion Phenomena.

Refrigeration: Air refrigeration cycles, vapour compression cycle, P-H diagram, liquefactions processes.

UNIT-III

Compressed Air and Vacuum: Use of compressed air. Classification of compressors. Reciprocating compressors-mechanical details, single stage and two stage reciprocating compressor, inter cooler, minimum work input in multistage. Centrifugal compressor-velocity diagram for centrifugal compressors, dimensional parameters, slip factor, impeller blade shapes, losses in axial flow compressors.

UNIT-IV

Water: Cooling water, cooling towers, raw water, DM water, soft water.

Waste Disposal: Plant sewer system and waste disposal.

Recommended Books

1. B. Yadav, 'Thermodynamics & Heat Engines', Central Publishing House, Allahabad, **2000.**
2. Vasandani, 'Treatise on Heat Engines', 4th Edn., Metropolitan Book Co. Pvt Ltd, New Delhi, **2008.**
3. O Lyle, 'The efficient Use of Steam', Her Majesty's Stationary Office, London, **1974.**
4. W.D. Bansal, 'Preliminary Chemical Engineering Plant Design', 2nd Edn., New York, **1989.**

RENEWABLE ENERGY SOURCES

Subject Code: BCHE1-460	**L T P C** **3 0 0 3**	**Duration: 34 Hrs.**

Learning Objectives: The objective of this course is to acquaint the students with the renewable energy sources available to supplement and augment the energy requirements.

UNIT-I

Introduction: Global and Indian scenario, sources, Energy conservation, types of NCES with applications

Solar Energy: Role and development of new renewable energy sources, instruments for measuring solar radiations, solar radiation data, Flat plat and concentrating collectors, classification of concentrating collectors, advanced collectors, different methods of solar energy storage, solar ponds solar applications: Solar heating/cooling technique, solar distillation and drying, photovoltaic energy conversion.

UNIT-II

Hydro electric Energy: Hydro-electric power plant, conversion of hydro energy into electricity.

Wind Energy: Sources and potentials, horizontal and vertical axis, wind mills, wind regime analysis and evaluation of wind mills.

UNIT-III

Biomass and Biofuels: Recycling of agricultural waste, anaerobic/ aerobic digestion and types of biogas digesters; gas yield, and combustion characteristics of bio gas, design of biogas system for heating, lighting and running IC engines. Introduction to Biofuels such as biodiesel, ethanol, biobutanol etc., their production and present status.

UNIT-IV

Geothermal Energy: Resources, types of wells, methods of harnessing the energy.

Ocean and Tidal Energy: Introduction and conversion technique, mini hydel power plants and their economics.

Recommended Books

1. G.D. Rai, 'Non-Conventional Energy Sources', 4th Edn., Khanna Publishers, **2009.**
2. Ashok V. Desai, D. Jhirad, M. Munasinghe, 'Non-Conventional Energy', New Age International, **1990.**
3. S.P. Sukhatme, 'Solar Energy: Principles of Thermal Collection and Storage', 3rd Edn, Tata McGraw-Hill Education, **2008.**
4. K.M. Mittal, 'Non-Conventional Energy System, Principles, Progress and Prospects', Wheeler Pub., **1997.**

MRSPTU

ENZYME TECHNOLOGY

Subject Code: BCHE1-461 **L T P C** **Duration: 34 Hrs.**
3 0 0 3

Learning Objectives: The course is aimed at enabling the students to understand the enzymatic reactions, their importance and the various fundamentals involved in enzymatic reactions.

UNIT-I

Kinetics and Mechanism of Enzyme Action: Nature and function of enzyme., classification of enzymes; quantification of enzyme activity and specific activity, Estimation of Michaelis Menten parameters, Effect of pH and temperature on enzyme activity, kinetics of inhibition. Modelling of rate equations for single and multiple substrate reactions.

UNIT-II

Immobilised Enzyme Reactions: Techniques of enzyme immobilisation-matrix entrapment, ionic and cross linking, column packing; Analysis of mass transfer effects of kinetics of immobilised enzyme reactions

Mass transfer Effects in Immobilised Enzyme Systems: Analysis of film and Pore Diffusion Effects on kinetics of immobilised enzyme reactions; Formulation of dimensionless groups and calculation of Effectiveness Factors

UNIT-III

Applications of Enzymes: Extraction of commercially important enzymes from natural sources; Commercial applications of enzymes in food, pharmaceutical and other industries; enzymes for diagnostic applications. Industrial production of enzymes. Case studies on application - chiral conversion, esterification etc.

UNIT-IV

Enzyme Biosensors: Applications of enzymes in analysis; Design of enzyme electrodes and case studies on their application as biosensors in industry, healthcare and environment.

Recommended Books

1. H.W. Blanch, D.S. Clark, 'Biochemical Engineering', 1st Edn., Marcel Dekker, **1997.**
2. James M. Lee, 'Biochemical Engineering', PHI, USA, **2009.**
3. J.E. Bailey & D.F. Ollis, 'Biochemical Engineering Fundamentals', 2nd Edn., McGraw Hill, **1986.**

INDUSTRIAL POLLUTION CONTROL

Subject Code: BCHE1-514 **L T P C** **Duration: 46 Hrs.**
3 1 0 4

Prerequisite: The students should have studied Mechanical Operations as a prerequisite to study this course

Learning Objectives: The course aims at giving the students an insight into the environmental issues related to chemical process industries in terms of their impact on land, water and air and the possible mitigation techniques to reduce this effect for sustainable processing.

UNIT-I (11 Hrs.)

Introduction: Ambient air and water standards, principle sources of pollution, Inter relationship between energy and environmental pollution, Prevention of environmental pollution through conservation.

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UNIT-II (12 Hrs.)

Air Pollution: Principal air pollutants and their usual sources, Effects of air pollution on human health, animals and vegetation and materials, Atmospheric dispersion of air pollutants, Temperature inversions. Ambient air sampling, dust fall jar and high volume sampler, stack sampling

Air pollution control techniques –Process and equipment's used for the control of gaseous pollutants- equipment efficiency, gravity settler, cyclone separator, fabric filters, Electrostatic precipitators, scrubbers.

UNIT-III (12 Hrs.)

Water Pollution: Types of water pollutants, their sources and effects. BOD and COD, BOD_5, oxygen sag curve, waste water sampling- grab and composite sample.

Waste water treatment: Primary Treatment through settling techniques and equipment like flocculation, skimming, flotation.

Secondary Treatment: aerobic and anaerobic digestion, activated sludge process, trickle filter and oxidation ponds.

UNIT-IV (11 Hrs.)

Solid Waste: Control and disposal, sanitary landfill, incineration, pyrolysis gasification and recycling.

Recommended Books

1. H.C. Perkins, 'Air Pollution', McGraw Hill, N.Y., **1974.**
2. B.G. Liptak, Liu D. H. F., 'Environmental Engineers Handbook', 2nd Edn., CRC Press, **1999.**
3. S.J. Willisamson, 'Fundamentals of Air Pollution', Addison Wesley Co. N.Y., **1973.**
4. C.S. Rao, 'Environmental Pollution Control Engineering', 2nd Edn., New Age International Pvt. Ltd., **2006.**
5. Metcalf and Eddy, 'Waste-Water Engineering', 4th Edn, Tata McGraw Hill, **2007**.
6. S.P. Mahajan, 'Pollution Control in Process Industries', Tata McGraw Hill, **2008.**
7. A.P. Sincero, G.A. Sincero, 'Environmental Engineering', Prentice-Hall of India, **1999**.

MRSPTU

CHEMICAL REACTION ENGINEERING-I

Subject Code: BCHE1-515 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

Learning Objectives: This course teaches the principles of reaction engineering and reactor design for homogeneous reactions. It is one of the core subjects in the chemical engineering curriculum. The course integrates fluid mechanics and heat transfer to the design and analysis of isothermal, non-isothermal, ideal and non-ideal reactors. Students learn the application of stoichiometry and rate law to design a chemical reactor that produces the desired conversion of reactants.

UNIT-I (11 Hrs.)

Introduction: Introduction & Importance of Chemical Reaction Engineering, Kinetics of homogeneous reactions, Concepts of reaction rates, rate equation, rate constant, order & molecularity, Mechanism for Elementary & Non-elementary reaction.

UNIT-II (12 Hrs.)

Design for Single Reactions: Material balance equation for ideal batch reactor and its use for kinetic interpretation of data and isothermal reactor design for simple & complex rate equation.

Performance equations for CSTR and PFR and their use for kinetic interpretation and design
Comparison of batch reactor, CSTR & PFR, Recycle reactor, concept of yield & selectivity
Reactor combinations of CSTR and PFR

UNIT-III (12 Hrs.)

Design for Multiple Reactions: Quantitative treatment of Series & parallel multiple reaction in a batch reactor, CSTR & PFR, Concept of Product distribution for multiple reactions.

Temperature & Pressure effects: Concept of adiabatic & non-isothermal operations, Energy balance equation for Batch, CSTR & PFR and their application to design of reactors, optimal temperature progression, multiple steady states in CSTR.

UNIT-IV (10 Hrs.)

Non–Ideality: Basics of non-ideal flow, residence time distribution, States of segregation

Measurement and application of RTD, E-Age distribution function & F-curve and inter-relationship between them, Conversion in non-ideal reactors.

Recommended Books

1. O. Levenspiel, 'Chemical Reaction Engineering', 3rd Edn., John Willey, **2004.**
2. J.M. Smith, 'Chemical Engineering Kinetics', 3rd Edn., McGraw Hill, **1981**.
3. D.G. Peacock, J.F. Richardson, 'Chemical Engineering', Vol.-3, 3rd Edn., Butterworth Heinemann, **1994.**
4. S.M. Walas, 'Reaction Kinetics for Chemical Engineers', 3rd Edn., McGraw Hill Book Co., Inc.
5. K.G. Denbigh, J.C.R. Turner, 'Chemical Reactor Theory-An Introduction', 3rd Edn., Cambridge Univ. Press London, **1984.**

MRSPTU

MASS TRANSFER-I

Subject Code: BCHE1-516 **L T P C** **Duration: 46 Hrs.**
3 1 0 4

Learning Objectives: The objective of this course is to present the principles of mass transfer and their application to separation and purification processes. The concept of mass transfer coefficients, rate expressions and some mass transfer operations is developed.

UNIT-I (11 Hrs.)

Introduction: Importance and classification of mass transfer operations in Chemical Engineering.

Diffusion: Diffusion in gases and liquids, Fick's First law of diffusion, Mass balance in simple situations - with and without chemical reaction. Diffusion in solids, diffusion through porous solids and polymers, unsteady state diffusion

UNIT-II (12 Hrs.)

Interphase Mass Transfer: Theories of Mass transfer, Individual and overall mass transfer coefficients, Convective mass transfer. Mass balance in concurrent and counter-current continuous contact equipment, Concept of operating line, Multi-stage counter current operations, Concept of ideal stage, Stage efficiencies, Design of continuous contact equipment, HTU and NTU concepts.

UNIT-III (11 Hrs.)

Gas Absorption: Design of plate and packed absorption columns, Scrubbers, Non-isothermal absorption, Simultaneous heat and mass transfer.

Drying of Solids: Rate of drying curves, through circulation drying, Continuous drying, Types of dryers.

UNIT-IV (12 Hrs.)

Humidification Operations: VLE & Enthalpy, Reference substance plots, vapour gas mixtures, concept of adiabatic saturation, psychometric charts, adiabatic operations-humidification operations and water cooling operations. Dehumidification Equipment: water cooling towers & spray chambers

Membrane Separations: Types of membranes, permeate flux for ultra-filtration concentration polarization, partial rejection of solutes, microfiltration, Reverse Osmosis and Electro-dialysis.

Recommended Books

1. Treybal Robert E., 'Mass Transfer Operations', 3rd Edn., McGraw Hill, **2001.**
2. T.K. Sherwood, R.L. Pigford, C.R. Wilke, 'Mass Transfer', Chemical Engineering Series, McGraw Hill, **1975.**
3. J.R. Backhurst, J.H. Harker, J.F. Coulson, J.M. Richardson, 'Chemical Engineering', Vol.-1, 6th Edn., Butterworth Heinemann, **1999.**
4. A.H.P. Skelland, 'Diffusional Mass Transfer', Kreiger Publishing Co., **1985**.
5. McCabe, L. Warren, Julian C. Smith P. Harriot, 'Unit Operations of Chemical Engg.', 7th Edn., McGraw Hill, **2005.**

CHEMICAL REACTION ENGINEERING ENVIRONMENTAL ENGG LAB.

Subject Code: BCHE1-518 **L T P C**
0 0 2 1

1. Study of Rate kinetics and temperature dependency using an isothermal batch reactor.
2. Study of Rate kinetics using an isothermal Plug flow reactor
3. Study of Rate kinetics using an isothermal CSTR
4. Study of Rate kinetics using a cascade CSTR
5. To find the residence time distribution for a CSTR.
6. To find the residence time distribution for Packed bed reactor
7. To determine the Total Solids, Total Dissolved Solids, Fixed and Volatile solids of a given sample.
8. To determine conductivity, alkalinity and hardness of the given sample.
9. To find out amount of Sulphates and chlorides in a given sample.
10. To find the quantity of the Dissolved Oxygen and BOD in the given sample
11. To determine the COD of a given wastewater sample.
12. Analysis of Particulate matter and gaseous pollutants using a High volume sampler.

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CHEMICAL PROCESS PLANT DESIGN-I LAB.

Subject Code: BCHE1-519 **L T P C**
0 0 2 1

1. Selection, Preparation of specification sheet for a centrifugal pump
2. Design of piping and piping networks
3. Process design of gravity chambers
4. Process design of cyclones
5. Process Design of Shell and Tube Heat Exchanger
6. Process Design of Condensers
7. Process Design of Agitated vessels
8. Introduction to plate heat exchangers and its design
9. Specification sheet for Heat exchangers

The students are to appear in a viva-voce examination based on design report.

Recommended Books

1. Coulson, Richardson & R.K. Sinnott, 'Chemical Engineering', Vol.-6 – An Introduction to Chemical Engineering Design', 4th Edn., Elsevier Butterworth Heinemann, **2005.**

2. R.H. Perry, D.W. Green, 'Chemical Engineers Handbook', 8th Edn., McGraw Hill, **2008.**
3. A.K. Coker, 'Ludwig's Applied Process Design in Chemical & Petrochemical Plants', Vol.-1, 4th Edn., Gulf Publication- Butterworth Heinemann, **2007.**
4. F. C. Vilbrandt, C.E. Dryden, 'Chemical Engg. Plant Design', 4th Edn., McGraw Hill, **1959.**
5. M.S. Peters, K.D. Timmerhaus, 'Plant Design and Economics for Chemical Engg.', 5th Edn., McGraw Hill, **2003.**

FLUIDIZATION TECHNOLOGY

Subject Code: BCHE1-562 **L T P C** **Duration: 34 Hrs.**
3 0 0 3

Learning Objectives: The aim of this course is to present to the students, the importance of fluidization and the fundamental principles involved in fluidization engineering.

UNIT-I

Introduction and Applications: Introduction to fluidised bed systems, Fundamentals of fluidisation, Industrial applications of fluidised beds - Physical operations. Synthesis reactions, cracking and reforming of hydrocarbons, Gasification, Carbonisation, Gas-solid reactions, calcining and clinkering.

UNIT-II

Behaviour of Fluidised Beds: Gross behaviour of fluidised beds, Minimum and terminal velocities in fluidised beds, Types of fluidisation.

Design of distributors, Voidage in fluidised beds, TDH, variation in size distribution with height, viscosity and fluidity of fluidised beds, Power consumption.

Analysis of bubble and emulsion Phase: Davidson's model, Frequency measurements, bubbles in ordinary bubbling bed model for bubble phase.

Emulsion phase: Experimental findings, Turnover rate of solids. Bubbling bed model for emulsion phase Interchange coefficients.

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UNIT-III

Flow Pattern of Gas and Heat & Mass Transfer in Fluidised Beds

Flow pattern of gas through fluidised beds, Experimental findings, the bubbling bed model for gas interchange, Interpretation of Gas mixing data.

Heat and Mass Transfer between Fluid and Solid: Experiment findings on Heat and Mass Transfer, Heat and mass transfer rates from bubbling bed model.

Heat transfer between Fluidised beds and surface- Experiment finding theories of bed heat transfer, comparison of theories.

UNIT-IV

Entrainment & Elutriation: Entrainment of or above TDH, model for Entrainment and application of the entrainment model to elutriation, High velocity fluidized beds, Circulating fluidized beds, Design of fluidized bed reactors.

Recommended Books

1. D. Kunii & O. Levenspiel, 'Fluidization Engineering', 2nd Edn., Butterworth Heinemann, **1991.**
2. Maria Laura Passos, Marcos Antonio S. Barrozo Arun S. Mujumdar, 'Fluidization Engineering', Laval – Canada, **2014.**
3. R.H. Perry, D.W. Green, 'Chemical Engineers Handbook', 8th Edn., McGraw Hill, **2008.**
4. J.R. Backhurst, J.H. Harker, J.F. Coulson, J.M. Richardson, 'Chemical Engineering', Vol.-1, 6th Edn., Butterworth Heinemann, **1999.**

PROJECT MANAGEMENT

Subject Code: BCHE1-563 **L T P C** **Duration: 34 Hrs.**
3 0 0 3

Learning Objectives: The aim of this course is to provide an overview of project management for small scale and medium scale industries and the regulations relevant to these industries.

UNIT-I

Small Scale Industries and Government Policies: Small scale industries and list of products reserved under it. Relative merits and demerits of SSI and large/medium policy resolutions of 1956 and 1977. Mini plants and Govt. Incentives, Present status of small scale industry in the country.

UNIT-II

Small Scale Industry-Requirements and Trends: Types of product and standardization of their qualities, Raw materials requirements, Utilities services, market survey, economic viability, employment potential, promotion of regional development
Trends of growth in India and abroad.

UNIT-III

Project management of SSI: Feasibility report, patterns of financial assistance, available from state/central government and financial institutions. Exploitation of R & D work from technological pools like patent office, CSIR, IIT, NRDC. Technical tie-up. Turnkey and other projects.

UNIT-IV

Legal Obligations: Import license, marketing techniques, product identification and selling, Promotion of export and legal obligations.

Recommended Books

1. Geoffery G. Mcredity, R.E. Nerson, P.A. Neck, 'The Practice of Entrepreneurship, Dialogue Publication', **1982.**
2. S. Chaudhary, 'Project Management', Tata McGraw Hill Publishing Co. Ltd.', **2004.**
3. Aswathappa, 'Factory Organisation and Management', Himalaya Publishing House.
4. Bhojwani Ramesh, 'Small, Medium & Large Scale Industries Vol. I & II', Small Industry Research Institute, Delhi.

MRSPTU

POLYMER SCIENCE & ENGINEERING

Subject Code: BCHE1-564 **L T P C** **Duration: 34 Hrs.**
3 0 0 3

Learning Objectives: The course will provide an overview of Polymers, focusing on the various types of polymers, polymerization processes, their properties and characterization.

UNIT-I

Introduction to Polymers: Classification of polymers, polymerization process, Kinetics of step growth and chain growth polymerization, polymerization techniques: Bulk, Solution, Suspension and Emulsion Polymerisation.

Molecular Weight & Size of Polymers: Number average and weight average molecular weight, significance of molecular weight, determination of molecular weight, viscosity method, osmotic pressure, light scattering method, gel permeation chromatography method.

UNIT-II

Polymer Properties & their Testing: Glass transition temperature and associated properties, Tensile strength & impact strength and their determination, softening point, heat distortion dielectric and power factor.

Synthesis & Properties of Commercial Polymers: Manufacture, processing and properties of resins and fibre forming polymers such as phenol formaldehyde, LDPE, HDPE, polypropylene, polyvinyl chloride, polystyrene, polyurethane and polyamides.

UNIT-III

Introduction to Rubber & Elastomers: Natural & synthetic rubber, Buna S, Buna N, Butyl rubber, neoprene, thiokols, polyurethane, Fillers, accelerators, activators, antioxidants & other additives.

UNIT-IV

Polymer Degradation: Thermal, Mechanical and by ultrasonic waves, photo degradation, heat energy radiation, oxidation and hydrolysis.

Recommended Books

1. V.L. Gowariker, N.V. Viswanathan and J. Sreedhar, 'Polymer Science', 1st Edn., New Age International.
2. P. Ghosh, 'Polymer Science & Technology of Plastics & Rubber', 3rd Edn., Tata McGraw Hill, New Delhi, **2010.**
3. F.W. Billmeyer, 'Text Book of Polymer Science', 3rd Edn, John Wiley,
4. R. Sinha, 'Outlines of Polymer Technology - Manufacture of Polymers', PHI.
5. A. Kumar, R.K. Gupta, 'Fundamentals of Polymers', McGraw Hill, **1998.**
6. A. Kumar, R.K. Gupta, 'Fundamentals of Polymer Science and Engineering', Tata McGraw Hill, New Delhi, **1978.**

MRSPTU

MASS TRANSFER - II

Subject Code: BCHE1-620 **L T P C** **Duration: 45 Hrs.**

3 1 0 4

Prerequisite: The students should have studied Mass Transfer-I as a prerequisite to study this course

Learning Objectives: The objective of this course is to present the principles of mass transfer and their application to separation and purification processes. The concept of various mass transfer operations is developed which are extensively used.

UNIT-I (12 Hrs.)

Distillation: Roult's law, ideal solutions, x-y & H-x-y diagrams, Flash vaporisation and condensation. Differential distillation, Batch distillation, Rayleigh equation, Steam distillation, Binary distillation, McCabe-Thiele and Ponchon-Savarit method, Total reflux, minimum and optimum reflux ratios, Efficiency – local, overall and Murphree efficiency.

UNIT-II (10 Hrs.)

Distillation Column Design: Introduction to distillation column design, Design of distillation columns with open steam, partial condensers and total condensers. Approximate plate to plate calculations for multi-component distillation.

UNIT-III (11 Hrs.)

Liquid-liquid Extraction: Extraction equipment, equilibrium diagram. Choice of solvent. Single stage and multistage counter-current extraction with/without reflux. Continuous contact extractors.

Leaching: Leaching equipment and equilibrium. Single stage and multistage cross current and counter current leaching.

UNIT-IV (12 Hrs.)

Adsorption: Types, nature of adsorbents, Adsorption equilibria- single species- Langmuir, Freundlich isotherms, Adsorption operations – single stage and multi stage, Adsorption column sizing

Crystallization: Equilibria and yields, Methods of forming nuclei in solution and crystal growth, equipment - vacuum crystallizer, Draft tube-baffle crystallizer.

Recommended Books

1. Treybal Robert E., 'Mass Transfer Operations', 3rd Edn., McGraw Hill, **2001.**
2. T.K. Sherwood, R.L. Pigford, C.R. Wilke, 'Mass Transfer', Chemical Engineering Series, McGraw Hill, **1975.**
3. J.R. Backhurst, J.H. Harker, J.F. Coulson, J.M. Richardson, 'Chemical Engineering', Vol.-1, 6th Edn., Butterworth Heinemann, **1999.**
4. A.H.P. Skelland, 'Diffusional Mass Transfer', Kreiger Publishing Co., **1985.**
5. McCabe, L. Warren, Julian C. Smith and P. Harriot, 'Unit Operations of Chemical Engg.', 7th Edn., McGraw Hill, **2005.**
6. J.H. Harker, J.F. Richardson, J.R. Backhurst, 'Chemical Engg.', Vol.-2, 5th Edn., Butterworth-Heinemann, **2003.**

CHEMICAL REACTION ENGINEERING –II

Subject Code: BCHE1-621 **L T P C** **Duration: 46 Hrs.**

3 1 0 4

MRSPTU

Prerequisite: The students should have studied Chemical Reaction Engg. – I as a prerequisite to study this course

Learning Objectives: This course teaches the principles of reaction engineering and reactor design for heterogeneous reactions. It is one of the core subjects in the chemical engineering curriculum. The course includes the use of mass transfer and heat transfer principles as applicable to heterogeneous reactions and their application to reactor design.

UNIT-I (11 Hrs.)

Kinetics of Heterogeneous Reactions: Introduction to catalysts & their classification, Concepts of physical absorption and Chemisorption, Preparation of solid catalysts, Deactivation of Catalysts, Synthesis of rate law, mechanism & rate limiting step for catalytic reactions, Langmuir Hinshelwood rate equations and parameter estimation.

UNIT-II (12 Hrs.)

Diffusion through Porous Catalyst Particles: Effectiveness factor for pore diffusion resistance through a single cylindrical pore, Significance of Thiele modulus, Heat effects during reaction, Performance equations for solid- gas reactions for different reactor types & determination of controlling resistance.

UNIT-III (11 Hrs.)

Kinetics of Fluid-Particle Reactions: Modelling of gas-solid non-catalytic reactions and determination of parameters, Combination of resistances & determination of rate controlling step.

UNIT-IV (12 Hrs.)

Kinetics & Design of Fluid-Fluid Reactions: Interface behaviour for liquid-phase reaction, Regimes for different reaction kinetics for liquid-liquid reactions, Determination of reaction rate & tower height based on film and penetration theories, Concept of Enhancement factor & Hatta Number.

Design of Heterogeneous Reactors: Analysis of rate data design outline and selection of fixed bed, fluid bed and slurry reactors, Reactor systems and design for gas-liquid-solid non-catalytic system.

Recommended Books

1. J.M. Smith, 'Chemical Engineering Kinetics', 3rd Edn., McGraw Hill, **1981.**
2. O. Levenspiel, 'Chemical Reaction Engineering', 3rd Edn., John Willey, **2004.**
3. D.G. Peacock, J.F. Richardson, 'Chemical Engineering' Vol.-3, 3rd Edn., Butterworth Heinemann, **1994.**
4. S.M. Walas, 'Reaction Kinetics for Chemical Engineers', 3rd Edn., McGraw Hill Book Co, Inc.
5. H.S. Fogler, 'Elements of Chemical Reaction Engineering', 4th Edn., Prentice Hall, **2006.**
6. J.J. Carberry, 'Chemical and Catalytic Reaction Engineering', McGraw Hill, New York, **1976.**

MASS TRANSFER LAB.

Subject Code: BCHE1-622 **L T P C**
0 0 2 1

1. To find out the critical moisture content of the given material and to find out the equations for constant and falling rate period of drying.
2. Determination of liquid hold up in a packed column.
3. To find the mass transfer coefficient for the vaporisation of organic vapour to air.
4. To verify the Rayleigh's equation for batch distillation.
5. To find the height equivalent to a theoretical plate and height of a transfer unit for the packed distillation column under total reflux.
6. To find the yield of crystals using batch crystallizer
7. To find the efficiency of rotary drier using a granular solid
8. To find the efficiency of a distillation column.
9. To study the adsorption characteristics and plot adsorption isotherm.
10. To find the yield of a natural oil by leaching from biomass.
11. To study liquid-liquid extraction in a packed column.
12. To determine mass transfer coefficient from a wetted wall column

MRSPTU

PROCESS EQUIPMENT DESIGN LAB.

Subject Code: BCHE1-623 **L T P C**
0 0 2 1

Prerequisite: The students should have studied Strength of Materials as a prerequisite to study this course

1. Mechanical Design of Process Equipment: Introduction, Classification of pressure vessels, pressure vessel codes and standards, Fundamental Principles and equations review
2. Design Considerations: Design Pressure, Design Temperature, Materials of construction, Weld joint efficiency, corrosion allowance, Design loads.
3. Design of thin walled vessels under Internal Pressure: Cylindrical and spherical vessels
4. Design of heads and closures – design of flat head, conical head, dished heads, hemispherical and elliptical heads
5. Design of thick walled vessels under Internal Pressure
6. Design of Vessels subject to External Pressure: Cylindrical& spherical vessels, Stiffening rings, vessel heads
7. Design of vessels under combined loading: Dead Weight, wind load
8. Design of supports: Skirt support, lug support

The examination shall include a viva-voce examination based on the design report.

Recommended Books

1. L.E. Brownell and E.H. Young, ‘Process Equipment Design’, Wiley Interscience, **1959**.
2. R.C. Bhattacharya, ‘An Introduction to Chemical Equipment Design-Mechanical Aspects’, 1st Edn., CBS Publication, **1985.**
3. V.V. Mahajani, S.B. Umarji, ‘Joshi’s Process Equipment Design’, 4th Edn., Macmillan Indian Ltd., **2009.**

ENGINEERING MATERIALS

Subject Code: BCHE1-665 **L T P C** **Duration: 34 Hrs.**
3 0 0 3

Prerequisite: The students should have studied Chemical Process Industries as a prerequisite to study this course

Learning Objectives: This course is aimed at giving the students information about the availability of various types and classes of materials for engineering usage as per the demands of the end use. This course will help the students in choosing a suitable material of construction for various equipment being used in a particular processing technology.

UNIT-I

Crystal Structure: Review of bonding in solids, structure –property-processing relationship. Miller indices, effect of radius ratio on coordination, structures of common metallic, polymeric, ceramic, amorphous and partly crystalline materials. Mechanical and Thermal Properties. Methods of improving strength- reinforcement, additives.

UNIT-II

Ferrous Metals & Non Ferrous Metals: Important varieties of iron ores. Cast iron: types, properties and uses of cast iron; Pig iron: Types of pig iron. Wrought iron: properties and uses of wrought iron. Steel: factors affecting physical properties of steel and uses of steel (No manufacturing process) Aluminium, cobalt, copper, nickel, and zinc their properties and uses.

UNIT-III

Alloys: Introduction to Phase-Diagrams of metals and its alloys; Fe-Fe3C; Cu-Ni, equilibrium diagrams.

Ceramics: Definition of ceramic, clay: properties of clay, earthen wares and stoneware, uses of stoneware. Definition, classification, composition, types and properties of glass. Definition of refractory, classification of refractories, properties of refractories. Common refractory bricks like silica bricks, fire clay bricks, dolomite bricks and high alumina bricks.

UNIT-IV

Polymers & Composites: Classification of polymers, Properties and Engineering Usage of Nylon-66, nylon-6, polyesters, polycarbonates, polyurethanes, rubber, polymer composite blends

Novel Materials: Introduction to nano materials and biomaterials and their uses

Recommended Books

1. W.J. Patton, ‘Materials in Industry’, 2nd Edn., Prentice Hall, **1975.**
2. Van Vlack L.H., ‘Elements of Material Science & Engineering’, 6th Edn., Pearson Education Inc., **2008.**
3. B.K. Aggrawal, ‘Introduction to Engineering Materials’, Tata McGraw Hill, **2008.**
4. G.S. Narula, K.S. Narual, V.K. Gupta, ‘Material Science’, Tata McGraw Hill, **2007.**
5. H.S. Bawa, ‘Materials and Metallurgy’, Tata McGraw Hill, **1986.**
6. W.D. Callister, D.G. Rethwisch, ‘Materials Science & Engineering-An Introduction’, 8th Edn., Wiley International, **2010.**

MRSPTU

OPTIMIZATION TECHNIQUES

Subject Code: BCHE1-666 **L T P C** **Duration: 34 Hrs.**
3 0 0 3

Prerequisite: The students should have studied Numerical Methods in Chemical Engg. as a prerequisite to study this course

Learning Objectives: This course aims at training the students in the use of various optimization techniques for finding the best operating conditions or values for design variables such that some objective is justified. It includes the optimization of linear, non-linear, single variable and multivariable problems.

UNIT-I

Introduction: Engineering application of optimization, Design variables, constraints, objective function, variable bounds, statement and formulation of an optimization problem, Examples of chemical engineering Optimization problems, Classification of optimization problems, different optimization algorithms.

Optimal Point: Local optimal point, global optimal point and inflection point. Optimality criterion.

UNIT-II

Single variable Optimization Techniques:

1. Bracketing method (Bounding phase method).
2. Region elimination methods (Internal halving method, Fibonacci search method, Golden section search method).
3. Point estimation method (Successive quadratic estimation methods).
4. Gradient-based methods (Newton-Raphson method, Bisection method, Secant, Cubic search method).
5. Root finding using optimization techniques.

UNIT-III

Multivariable Optimization Techniques:

1. Optimality criterion – Hessian Matrix and its use in optimization
2. Unidirectional search method.
3. Direct search method (Evolutionary method, Hooke-Jeeves Pattern Search method, Powell's conjugate direction method)
4. Gradient-based methods (Steepest descent method, Newton's method, Marquardt's methods)

UNIT-IV

Constrained Optimization Algorithms:

1. Kuhn - Tucker conditions
2. Transformation method (penalty function method)
3. Direct search for constrained minimization (variable elimination method, complex search method.)

Linear Programming: Linear programing problems, Degeneracy, Simplex method of linear programming, dual phase simplex method.

Recommended Books

1. K. Deb, 'Optimization for Engg. Design Algorithms and Examples', Prentice Hall of India, **2005.**
2. T.I. Edgar & D.M. Himmelblau, L.S. Lasdon, 'Optimization of Chemical Processes', McGraw Hill, **2001.**
3. S.S. Rao, 'Engineering Optimization Theory and Practice', 4th Edn., John Wiley and Sons,

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2009.

4. W.H. Ray & J. Szekely, 'Process Optimization with Applications to Metallurgy & Chemical Engg.' Wiley Interscience, **1973.**
5. S.G. Beveridge & R.S. Schechter, 'Optimization: Theory & Practice', McGraw Hill, **1970**.
6. B.S. Grewal, 'Numerical Methods in Engineering and Science', Khanna Publishers, **1991.**

PETROLEUM REFINING ENGINEERING

Subject Code: BCHE1-667 **L T P C** **Duration: 34 Hrs.**
3 0 0 3

Learning Objectives: The course is aimed at providing the understanding of petroleum refining industry. It includes the characterization of crude and petroleum products and their usage and the various processes involved.

UNIT-I

Introduction to Petroleum Industry: World petroleum resources, petroleum industry in India. Origin, exploration, drilling and production of petroleum crudes, Transportation of crudes and products.

Crude Pre-treatment: Composition and classification of crudes, methods of evaluation: ASTM, TBP and EFV distillation.

UNIT-II

Petroleum Products: Properties and specifications of petroleum products such as LPG, gasoline, naphtha, kerosene, diesel oils, lubricating oils, waxes and the like.

Testing of petroleum products:
(i) Physical test: Density and specific gravity, viscosity.
(ii) Chemical test: Organic and inorganic constituents.
(iii) Flammability Test: Flash point, volatility.
(iv) Knock Rating Test: For Gasoline Octane Number.

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UNIT-III

Separation Processes: Design and operation of topping and vacuum distillation units, Tube still furnaces, Solvent extraction processes for lube oil base stock and for aromatics from naphtha and kerosene steams, solvent dewaxing.

UNIT-IV

Conversion Process: Thermal cracking, visbreaking and coking processes, Catalytic cracking, reforming, hydro processing, alkylation, polymerization and isomerisation. Safety and pollution considerations in refineries.

Recommended Books

1. W.L. Nelson, 'Petroleum Refinery Engineering', 5th Edn. McGraw Hill, **1985.**
2. G.D. Hobson, W. Pohl, 'Modern Petroleum Technology', 5th Edn. John Wiley, **1984.**
3. V.B. Guthrie, 'Petroleum Products Handbook', McGraw Hill, **1960.**
4. B.K. Rao, 'Modern Petroleum Refining Processes', 5th Edn., Oxford & IBH Publishing Co., **2009.**

POLYMER REACTOR DESIGN

Subject Code: BCHE1-668 **L T P C** **Duration: 34 Hrs.**
3 0 0 3

Prerequisite: The students should have studied Polymer Science and Engineering as Elective-1, Chemical Reaction Engg. I as a prerequisite to study this course.

Learning Objectives: The course will provide a detailed study of application of chemical engineering principles in the design and analysis of reactors for polymer production.

UNIT-I

Introduction: A brief introduction to various types of polymers, polymerization methods and their importance. Reactors: Definition, types, application-fields.
Reactor Design: meaning, general design procedure.

UNIT-II

Reaction Engineering of step growth polymerization: Introduction, analysis of semi batch reactors, MWD of ARB polymerization in homogeneous continuous flow stirred-tank reactors (HCSTRs), advanced stage of polymerization, similarity solution of step growth polymerization in films with finite mass transfer.

UNIT-III

Reaction engineering of chain growth polymerization: Introduction, design of tubular reactors, copolymerization, solution of equations describing isothermal radical polymerization.
Emulsion polymerization: Introduction, emulsion polymerization in homogeneous continuous flow stirred tank reactors (HCSTRSs).

UNIT-IV

Design of Batch Reactors: Detailed Design of ideal batch reactor for the production of Phenol-Formaldehyde (novolac) starting from phenol & formaldehyde as raw materials.

Recommended Books

1. A. Kumar & R.K. Gupta, 'Fundamentals of Polymers', 2nd Edn., McGraw Hill, **1998.**
2. A. Kumar & R.K. Gupta, 'Fundamentals of Polymer Science and Engineering', Tata McGraw Hill, New Delhi, **1978.**
3. H.S. Fogler, 'Elements of Chemical Reaction Engineering', 4th Edn., Prentice Hall, **2006.**

HEAT EXCHANGERS

Subject Code: BCHE1-669 **L T P C** **Duration: 34 Hrs.**
3 0 0 3

Learning Objectives: The course will provide an overview of analysis of heat exchange equipment in an industry based on pinch technology and minimization of utilities, number of heat exchangers etc. It includes the networking of heat exchange equipment to yield better performance.

UNIT-I

Pinch Technology: Introduction, Basic concept, how it is different than energy auditing, Role of thermodynamic laws, Problem addressed by Pinch technology. Key Steps of Pinch Technology: Data extraction, Targeting, Designing, Optimization- Super targeting.

UNIT-II

Basic Elements of Pinch Technology: Grid diagram, Composite curve, Problem table algorithm, Grand composite curve.

UNIT-III

Heat Exchanger Network (HEN): Targeting of Energy, Area targeting, Number of units targeting, Shell targeting, cost targeting. Designing of HEN: Pinch design methods, Heuristic rules, Stream splitting, Design of maximum energy recovery (MER).

UNIT-IV

Design of multiple utilities and pinches, Design for threshold problem, Loops and Paths.
Heat Integration of Equipment.

Recommended Books

1. Kumar, 'Chemical Synthesis and Engineering Design', Tata McGraw Hill.

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2. V. Uday Sheno, ‘Heat Exchanger Network Synthesis’, Gulf Publishing Co, USA, **1995.**
3. James M. Douglas, ‘Conceptual Design of Chemical Process’, McGraw Hill, New York, **1988**.
4. R. Smith, ‘Chemical Process Design’, McGraw Hill, **1995.**

TRANSPORT PHENOMENA

Subject Code: BCHE1-670 **L T P C** **Duration: 34 Hrs.**

3 0 0 3

Prerequisite: The students should have studied Heat Transfer, Fluid Flow and Mass Transfer I, as a prerequisite to study this course

Learning Objectives: This course introduces the student to the rigorous formulation of transport problems using the conservation principles and flux expressions, and identifies the similarities and differences among the transport processes for momentum, heat and mass. The main focus of the course is on microscopic treatment of transport problems, with particular emphasis on proper use of dimensional analysis and scaling arguments.

UNIT-I

Review: Transport of momentum, heat and mass by molecular Motion-Newton’s law of Viscosity, Fourier’s law of heat conduction, Fick’s law of diffusion.

UNIT-II

Transport Properties: Viscosity, thermal conductivity and mass diffusivity. Emphasis on the analogy between momentum, heat and mass transfer with respect to transport mechanism and governing equations.

UNIT-III

Development of Mathematical Models of Transfer Process by Shell Momentum Balance: Shell energy balance and shell mass balance for solving specific problems of transport of momentum, heat and mass in laminar flow or in solids in one dimension.

UNIT-IV

Development of General Differential Equations of Fluid Flow: Heat transfer and mass transfer and their applications in solving one-dimensional steady state and unsteady state problems of momentum, heat and mass transfer.

Interphase Transport: Interphase transport of Momentum, heat and mass and dimensionless correlations for each one of them.

Transport Analysis: Momentum, heat and mass transfer analysis and analogies.

Recommended Books

1. R.B. Bird, W.E. Stewart, ‘Transport Phenomena’, 2nd Edn., John Wiley & Sons, **2005.**
2. C.J. Geankoplis, ‘Transport Processes and Separation Process Principles’ (Includes Unit Operations), 4th Edn., Prentice Hall, **2003.**
3. J.R. Weity, R.E. Wilson and C.E. Wicks, ‘Fundamentals of Momentum Heat and Mass Transfer’, 4th Edn., John Wiley & Sons.
4. C.O. Bennett and J.E. Myres, ‘Momentum Heat and Mass Transfer’, 3rd Edn., McGraw Hill, **1982.**

PROCESS INSTRUMENTATION, DYNAMICS & CONTROL

Subject Code: BCHE1-724 **L T P C** **Duration: 45 Hrs.**

3 1 0 4

Learning Objectives: The course is devoted to the analysis of the various types of instruments used in chemical processes, dynamical behavior of systems and the mathematical

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tools used in their analysis. Further, the control of these processes by using various types of controllers and their design is included in the course.

UNIT-I (11 Hrs.)

Introduction: Importance of instruments in Chemical Process industries, Static and Dynamic characteristics of instrument.

Instruments for Pressure, Temperature & Level Measurement: Bourdon gauge, bellow type gauge, Measurement of vacuum and pressure, Transducers**,** Thermocouples, resistance & filled thermometers, thermistors, optical and radiation pyrometers, Liquid level Measurement-Direct and differential method, positive displacement type meters.

UNIT-II (12 Hrs.)

General Principles of Process Control: Basic control elements, degree of freedom and fixing of control parameters, Simple system analysis, Transfer functions, block diagrams, linearization. First and higher order systems, interacting and non-interacting systems, distributed and lumped parameter systems, dead time.

UNIT-III (12 Hrs.)

Different Modes of Control and their Basic Characteristics: Proportional, Integral and Derivative Control action, Controller characteristics- P, PI & PID controllers, process characteristics and choice of indicating, recording & controlling instruments for chemical industries, Feedback control servo and regulation control. Time domain-closed loop frequency response, optimization of control system response, stability analysis – Routh criteria, Bode plots.

UNIT-IV (10 Hrs.)

Introduction to Advanced Control Techniques: Feed forward, feedback, cascade, ratio, adaptive and digital computer control.

Process Identification and Applications: Process identification of systems with unknown transfer functions.

Recommended Books

1. D.P. Eckman, ‘Industrial Instrumentation’, Wiley Eastern, **1974.**
2. D. Patranabis, ‘Principles of Process Control’, 2nd Edn., Tata McGraw Hill, **2001.**
3. G. Stephanopoulos, ‘Chemical Process Control - An Introduction to Theory and Practice’, 1st Edn., Prentice Hall of India, **1990.**
4. D.G. Peacock, J.F. Richardson, ‘Chemical Engineering’, Vol.-3, 3rd Edn., Butterworth Heinemann, **1994.**
5. B.W. Bequette, ‘Process Dynamics: Modelling, Analysis and Simulation’, Prentice Hall, **1998.**
6. Pollard, ‘Process Control for Chemical and Allied Industries’, Butterworth Heinemann, **1971.**
7. T.W. Weber, ‘An Introduction to Process Dynamics & Control’, Kreiger Publishing Co., **1988.**
8. P. Harriott, ‘Process Control’, Tata McGraw Hill Publishing Co. Ltd., New Delhi, **2001.**

PROCESS ENGINEERING & ECONOMICS

Subject Code: BCHE1-725	**L T P C** **3 1 0 4**	**Duration: 46 Hrs.**

Learning Objectives: The objective of this course is to enable the students to make an economic analysis of different technologies or operations based on understanding of various costs involved. A brief introduction to patents and IPRs is also included to give an insight to the students in this field.

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UNIT-I (12 Hrs.)

Cost Estimation: Factors affecting investment and production costs, Capital investments - fixed investments and working capital. Cost indices. Estimating equipment costs by scaling 6/10 factor rule. Methods for estimation capital investment. Estimation of total product cost. Different costs involved in the total product for a typical chemical process plant.

Balance Sheet and Income Statement: Concept of Gross Profit, Net Profit, Return on Investment, Current Ratio, Quick Ratio, Debt-equity ratio

UNIT-II (11 Hrs.)

Interest and Investment Costs: Simple and compound interest, Nominal and effective rates of interest. Continuous interest, Annuity, Perpetuity and capitalized costs.

Depreciation: Types of depreciation, service life, salvage value, present value and methods of determining depreciation, single unit and group depreciation.

UNIT-III (12 Hrs.)

Taxes and Insurance: Types of taxes and tax returns, types of insurance and legal responsibility.

Profitability: Alternative Investments and Replacements: Mathematical methods of profitability evaluation, Cash flow diagrams, Determination of acceptable investments alternative when an investment must be made and analysis with small increment investment, replacement, Break even analysis.

UNIT-IV (11 Hrs.)

Optimum Design: Procedure with one variable, Optimum reflux ratio in distillation and optimum pipe diameter.

IPR and Patent Systems: Intellectual property, IPRs and its types, Patent claims, legal decision making process and ownership of tangible and intellectual property. Indian patent system, current IPR laws and legislations in India for IPR Documents required for filing patent, infringement of patents and remedies

Recommended Books

1. M.S. Peters, K.D. Timmerhaus, 'Plant Design and Economics for Chemical Engg.', 5th Edn., Tata McGraw Hill, **2005.**
2. G.D. Ulrich, 'A Guide to Chemical Engineering Process Design and Economics', John Wiley, 1**984.**
3. K.M. Guthrie, 'Process Plant Estimating, Evaluation and Control', Craftsman Solano Beach, California,
4. Couper James R., 'Process Engineering Economics', Marcel Dekker, NY, **2003.**

CHEMICAL PROCESS PLANT DESIGN –II LAB.

Subject Code: BCHE1-728 **L T P C**
0 0 2 1

1. Design of Sieve Tray Column and column internals
2. Design of Bubble Cap Column and column internals
3. Design of Packed Column and column internals
4. Specification sheet for fractionating column
5. Design of Homogeneous Reactors
6. Design of Heterogeneous reactors – Fixed & Fluidized bed
7. Types of Flow Sheets
8. Overview of plant layout

The student is to appear in a viva-voce examination based on design report.

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Recommended Books

1. Richardson Coulson & R.K. Sinnott, 'Chemical Engineering' Vol.-6 – An Introduction to Chemical Engineering Design', 4th Edn., Elsevier Butterworth Heinemann, **2005.**
2. R.H. Perry and D.W. Green, 'Chemical Engineers Handbook', 8th Edn., McGraw Hill, **2008.**
3. A.K. Coker, 'Ludwig's Applied Process Design in Chemical & Petrochemical Plants', Vol.-1, 4th Edn., Gulf Publication-Butterworth Heinemann, **2007.**
4. F.C. Vilbrandt, C.E. Dryden, 'Chemical Engg. Plant Design', 4th Edn., McGraw Hill, **1959.**
5. M.S. Peters, K.D. Timmerhaus, 'Plant Design and Economics for Chemical Engg.', 5th Edn., McGraw Hill, **2003.**
6. F. Molyneux, 'Chemical Plant Design –I', Butterworth Heinemann, **1963.**

PROCESS INSTRUMENTATION, DYNAMICS & CONTROL LAB.

Subject Code: BCHE1-729 **L T P C**
0 0 2 1

1. Calibration of temperature, pressure, flow and composition measuring instruments.
2. Study of process dynamics of a liquid level tank
3. Study of process dynamics of interacting / non-interacting tank
4. Study of process dynamics of some processes.
5. Investigation of the operation of pneumatic and electronic controllers with proportional integral derivative action.
6. To determine the best setting of a controllers with controlling an actual process.
7. To solve first order or higher order differential equations with the help of an analog computer/ computer and to study control problems by simulation.
8. To control the level of liquid in the process tank using multi process trainer for different controller settings.
9. Study of control valve characteristics.
10. Study of Programmable Logic Control system.

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SEPARATION PROCESSES

Subject Code: BCHE1-771 **L T P C** **Duration: 34 Hrs.**
3 0 0 3

Learning Objectives: The course is aimed at providing the understanding of separation techniques used in industry. It includes the study of details of techniques like membrane separations, adsorption, chromatography.

UNIT-I

Separation Processes: Industrial chemical processes, Mechanism of separation, separation power, selection of feasible separation processes.

UNIT-II

Membrane Separations: Membrane Materials, Membrane Modules, Transport in Membranes – Porous Membranes, Bulk Flow, Liquid Diffusion in Pores, Gas Diffusion, Nonporous Membranes, Solution-Diffusion for Liquid Mixtures, Solution-Diffusion for Gas Mixtures, Module Flow Patterns, Cascades, External Mass-Transfer Resistances, Concentration Polarization and Fouling.

UNIT-III

Dialysis and Electro dialysis, Reverse Osmosis, Gas Permeation, Pervaporation, Ultrafiltration, Microfiltration.

Ion Exchange, and Chromatography: Ion Exchangers, Sorbents for Chromatography Equilibrium Considerations: Pure Gas Adsorption, Liquid Adsorption, Ion Exchange Equilibria, Equilibria in Chromatography Kinetic and Transport Considerations: External Transport, Internal Transport, Mass Transfer in Ion Exchange and Chromatography

UNIT-IV

Adsorption Systems: Adsorption, Ion Exchange, Chromatography, Slurry Adsorption (Contact Filtration), Fixed-Bed Adsorption (Percolation), Thermal-Swing Adsorption, Pressure-Swing Adsorption, Continuous, Counter current Adsorption Systems, Simulated-Moving-Bed Systems, Ion-Exchange Cycle, Chromatographic Separations

Recommended Books

1. J.D. Seader & E.J. Henley, 'Separation Processes Principles', 2nd Edn, John Wiley & Sons, **2006.**
2. R.W. Rousseau, 'Handbook of Separation Process Technology', Wiley-Interscience, **1987.**
3. H. Strathmann, 'Ion Exchange Membrane Separation Processes', Elsevier Science.

PETROCHEMICAL TECHNOLOGY

Subject Code: BCHE1-772 **L T P C** **Duration: 34 Hrs.**

3 0 0 3

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Learning Objectives: The course aims at providing the knowledge of petrochemical industry to the students which includes the processes, products and their production in petrochemical industry.

UNIT-I

Introduction: Petro chemicals; Definition, importance and growth potential of the field. Concepts of quality and environmental pollution control in petrochemical industries.

UNIT-II

Petrochemical Feed Stocks: Raw material for petrochemical industries, sources, economics and advantage, Production of olefin containing gases; various purification and separation processes. Important intermediate material for petrochemical industry e.g. Aromatic, Ammonia, Butadiene, Alcohol, synthesis gas.

UNIT-III

Processes for Petrochemical Feed Stock: Cracking- thermal and catalytic, polymerization and isomerisation. Desulphurization of petrochemical feed stock.

UNIT-IV

Manufacture of Important Petrochemicals: Plastics, Fertilizer, Carbon Black, Synthetic fibers, Synthetic Rubber, Synthetic Detergents.

Recommended Books

1. B.K.B. Rao, 'Modern Petroleum Refinery Processes', 5th Edn., Oxford & IBH Publishing Co. Pvt. Ltd., **2009.**
2. H. Steiner, 'Industries to Petroleum Chemicals', Pergammon Press, **1992.**
3. A.C. Waddone, 'Chemicals from Petroleum', John Murry, **1988.**
4. A.V. Top Chev, 'Synthetic Materials from Petroleum', Pergammon Press, **1982.**
5. M.J. Astle, 'Synthetic Materials from Petroleum', Pergammon Press.

BIOCHEMICAL ENGINEERING

Subject Code: BCHE1-773 **L T P C** **Duration: 34 Hrs.**
3 0 0 3

Learning Objectives: This course is aimed at giving the students an insight into biochemical processes, their importance and fundamentals in these processes like biochemistry, kinetics and transport.

UNIT-I

Biochemistry: Structure and function of carbohydrates, lipids, amino acids and peptides, nucleic acid and nucleotides, proteins, enzymes.

Classification of Microorganisms: Morphological, structural and biochemical characteristics of prokaryotes and eukaryotes, Microbial nutrients and growth media. Microbial reproduction and growth.

UNIT-II

Kinetics of Microbial Growth: Enzyme kinetics including enzyme inhibition. **Sterilization of air and media.**

UNIT-III

Nutrient Transport across Cell Membrane.

Mass Transfer and Microbial Respiration: Mass transfer resistance, physical and enzymatic considerations, critical value of dissolved oxygen concentration, respiration of mycelial pellet.

UNIT-IV

Bubble Aeration and Mechanical Agitation: Single bubbles, series of bubbles, power number versus Reynolds number, decrease of power requirement in aeration.

Cardinal rules for Fermenter design, materials of construction.

Recommended Books

1. M.J. Pelzer, E.C.S. Chan and N.R. Kerig, 'Microbiology', 3rd Edn, McGraw Hill Book Co., **1993.**
2. L. Stryer, W.H. Freeman, 'Biochemistry', 5th Edn., W.H. Freeman and Co, **2002.**
3. J.E. Bailey & D.F. Ollis, 'Biochemical Engineering Fundamentals', 2nd Edn, McGraw Hill, **1986.**
4. M.L. Shuler, F. Kargi, 'Bioprocess Engineering: Basic Concepts', 2nd Edn., Prentice Hall, **2000.**
5. Shuichi Aiba, 'Biochemical Engineering', 2nd Edn., Academic Press Inc. New York, **1973.**

CHEMICAL PROCESS SIMULATION

Subject Code: BCHE1-830 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

Learning Objectives: This course aims at developing the ability of the students in the mathematical treatment of chemical engineering processes. This course includes the concept of models, variables, parameters, parametric sensitivity and model formulation and their solution through simulation.

UNIT-I (11 Hrs.)

Introduction: Concept of Dynamics, Variables and Degrees of freedom, Definition of mathematical model, Classification of models - lumped parameter model & distributed parameter model, uses of mathematical models, principles of formulation of models, parametric sensitivity.

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UNIT-II (11 Hrs.)

Fundamental Laws: Continuity equations, energy equations, equations of motion, transport equations, equations of state, equilibrium, chemical kinetics.

Mathematical Models of Chemical Reaction Engg. System

1. Model for Series of isothermal CSTRs
2. Model for an Isothermal/non-isothermal plug-flow reactor.
3. Model for a gas phase pressurized CSTR
4. Model for a Non isothermal CSTR
5. Model for a Jacketed Batch reactor
6. Model for Biochemical reactor.

UNIT-III (12 Hrs.)

Mathematical Models of Chemical Engg. Systems:

1. Model for a Single component vaporizer
2. Model for Multi component flash drum
3. Model for Ideal/ Non-ideal distillation column
4. Model for batch distillation column
5. Equilibrium-constant & titration curve models for pH systems
6. Lumped parameter model of a gas absorber
7. Lumped parameter model of a liquid-liquid extraction column
8. Model involving energy equation of heated tanks.
9. Model for Heat-exchangers
10. Model for a system of interacting & non-interacting tanks.
11. Model for a Reactor along with Mass Transfer

UNIT-IV (11 Hrs.)

Simulation: Meaning of simulation; simulation strategy for simple isothermal CSTR, simple non-isothermal CSTR and simple isothermal batch reactor.

Recommended Books

1. W.L. Luyben, 'Process Modelling and Simulation and Control for Chemical Engineers', McGraw Hill.
2. Husain, 'Chemical Process Simulation', 1st Edn., Wiley Eastern, **1986.**
3. F.W. Ramirez, 'Computational Methods in Process Simulation', 2nd Edn., Butterworth Heinemann, **1998.**
4. B.W. Bequette, 'Process Control: Modelling, Design and Simulation', Prentice Hall, **2003.**
5. A. Suryanarayana, 'Chemical Instrumentation & Process Control', Khanna Publication.

PROCESS SIMULATION LAB.

Subject Code: BCHE1-832 **L T P C**
0 0 2 1

1. Program involving Simulation of Bubble point calculations
2. Program involving Simulation of Dew Point Calculations.
3. Program involving Simulation of Gravity Flow tank using C++/MATLAB
4. Program involving Simulation of three isothermal CSTRs in series using C++ /MATLAB.
5. Program involving Simulation of non- isothermal CSTR using C++/MATLAB.
6. Program involving Simulation of isothermal batch reactor using C++/MATLAB.
7. Program involving Simulation of non - isothermal batch reactor using C++/MATLAB.
8. Program involving Simulation of isothermal of distillation column using C++/MATLAB.
9. Program involving Simulation of Multi-Component Flash Drum.
10. Program involving Simulation of a Heat Exchanger.

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CHEMICAL PROCESS SAFETY

Subject Code: BCHE1-874 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

Learning Objectives: The course will provide an overview of Process Safety in the Chemical Industry, focusing on the nature of chemical plant accidents, their causes, and steps to eliminate them, with emphasis on inherently safe designs. The students are expected to have active participation through case studies of disasters in the past.

UNIT-I (11 Hrs.)

Introduction: Concept of Loss prevention, acceptable risks, accident and loss statistics, nature of accident process, inherent safety.

Toxicology: Dose versus response, toxicants entry route, models for dose and response curves, TLV and PEL.

UNIT-II (12 Hrs.)

Industrial Hygiene: Identification, Material safety data sheets, Industrial hygiene evaluation and control.

Basics of Fires and Explosion: Fire triangle, definitions, flammability characteristics of liquid and vapours, LOC and inerting, types of explosions, Designs for fire prevention

UNIT-III (12 Hrs.)

Hazard identification: Hazard survey, checklist, HAZOP, safety reviews, what if analysis

Risk Assessment: Probability theory, event tree, fault tree, QRA and LOPA, Dow's fire and explosion index, Mond's index, Dow's Chemical release model.

UNIT-IV (10 Hrs.)

Accident Investigations: *Case Histories* - Bhopal gas tragedy, Flixborough disaster, Pasadena accident, IOCL disaster, nuclear disaster in Japan in 2011.

Recommended Books

1. D.A. Crowl, J.F. Louvar, 'Chemical Process Safety: Fundamentals with Applications', 3rd Edn., Prentice Hall, **2011.**
2. Coulson, Richardson & R.K. Sinnott, 'Chemical Engineering' Volume-6 – An Introduction to Chemical Engineering Design', 4th Edn., Elsevier Butterworth Heinemann, **2005.**
3. Dow Chemical Company, 'Dow's Chemical Exposure Index Guide', **1993.**
4. F.P. Lees, 'Loss Prevention in Process Industries', 2nd Edn., Butterworth, London, **1996.**
5. G.L. Wells, 'Safety in Process Plant Design', George Godwin Ltd., New York, **1980.**

FUEL CELL TECHNOLOGY

Subject Code: BCHE1-875 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

Learning Objectives: The course is aimed at providing the information about fuel cells, their types, fundamentals, technology and the problems associated with fuel cell technology.

UNIT-I (12 Hrs.)

Introduction: Fuel Cell definition and basics- cathode, anode, electrolyte, Difference between a fuel cell and a battery, Advantages and disadvantages, Basic fuel cell operation. Relationship between Gibb's free energy and electric work/ electric voltage, Reversible Voltage/ potential of fuel cell using standard electrode potentials,

UNIT-II (12 Hrs.)

Fuel Cell Fundamentals: Effect of temperature and pressure on fuel cell potential, Nernst

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equation, Fuel cell efficiency, concept of OCV, Current density, Losses in fuel cell-activation loss, ohmic loss and concentration loss, Fuel cell performance curve, 1-D model for a fuel cell, application of model to SOFC and PEMFC.

UNIT-III (11 Hrs.)

Types of Fuel Cells: Construction, fuels and usage of Phosphoric Acid Fuel Cell, Polymer Electrolyte Membrane Fuel Cell, Alkaline fuel cell, Molten Carbonate Fuel Cell, Solid Oxide Fuel cell, Relative advantages and disadvantages of the various types of fuel cells.

UNIT-IV (10 Hrs.)

Fuel Cell Systems: Fuel cell stack, engineering issues related to Fuel Cell Technology**,** Hydrogen as a fuel, availability and engineering issues.

Recommended Books

1. R.O. Hayre, S. Cha, W. Colella, 'Fuel Cell Fundamentals', John Wiley and Sons, **2006.**
2. E.D. Berger, 'Handbook of Fuel Cell Technology', Prentice-Hall, **1968.**
3. W. Vielstich, A. Lamm, H.A. Gasteiger, 'Handbook of Fuel Cells', Vol.-2, Wiley, **2003.**

ENVIRONMENT IMPACT ASSESSMENT

Subject Code: BCHE1-876 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

UNIT-I (12 Hrs.)

Environment Impact Assessment (EIA): Concept of EIA, Origin of EIA, Procedure of EIA, Evaluation Methodology for EIA, Scope Studies, Preparation and Review of Environment Impact Statement (EIS), Introduction of Life Cycle Assessment, Environmental Parameters in LCA.

UNIT-II (11 Hrs.)

Environment Audit: Concept of Environmental Audit, Necessity and Importance of EA, Audit Procedures.

UNIT-III (12 Hrs.)

Environmental Management System (EMS): Introduction, Terminology and Certification, Environmental Standards, the International Standard Organization (ISO), the ISO 9000 and the ISO 14000 Family of Standards, Guides and Technical Reports, ISO 14001 Certification as a Tool for Sustainable Development.

UNIT-IV (10 Hrs.)

Case Studies Discussion and analysis of various Case studies of environmental engineering projects.

Recommended Books

Vijay Kulkarni and T.V. Ramachandra, 'Environmental Management, Commonwealth of Learning', Canada and Indian Institute of Science, Bangalore, **2006.**

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B. TECH. AEROSPACE ENGINEERING

Total Contact Hours = 29 **Total Marks = 900** **Total Credits = 27**

SEMESTER 3rd		**Contact Hrs**			**Marks**			**Credits**
Subject Code	**Subject Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
BMAT0-F91	Mathematics-III	3	1	0	40	60	100	4
BAEE2-301	Fluid Mechanics	3	1	0	40	60	100	4
BAEE2-302	Engineering Thermodynamics	3	1	0	40	60	100	4
BAEE2-303	Strength of Materials	3	1	0	40	60	100	4
BAEE2-304	Machine Design	1	0	4	40	60	100	3
BAEE2-305	Introduction to Aerospace	3	1	0	40	60	100	4
BAEE2-306	Fluid Mechanics Lab.	0	0	2	60	40	100	1
BAEE2-307	Strength of Materials Lab.	0	0	2	60	40	100	1
BAEE2-308	Workshop Training	0	0	0	60	40	100	2
Total	**Total 6 Theory & 2 Lab. Courses**	**16**	**5**	**8**	**440**	**460**	**900**	**27**

Total Contact Hours = 29 **Total Marks = 800** **Total Credits = 25**

SEMESTER 4th		**Contact Hrs**			**Marks**			**Credits**
Subject Code	**Subject Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
BMAT0-F92	Numerical Analysis	3	1	0	40	60	100	4
BAEE2-409	Aerodynamics-I	3	1	0	40	60	100	4
BAEE2-410	Aircraft Structure-I	1	0	4	40	60	100	3
BAEE2-411	Aircraft Propulsion-I	1	0	4	40	60	100	3
BAEE2-412	Aircraft System & Instrumentation	3	0	0	40	60	100	3
BAEE2-413	Theory of Machine	3	1	0	40	60	100	4
BAEE2-414	Aircraft Structure Lab.	0	0	4	60	40	100	2
BAEE2-415	Aircraft System Lab.	0	0	4	60	40	100	2
Total	**Total 6 Theory & 2 Lab. Courses**	**14**	**3**	**12**	**360**	**440**	**800**	**25**

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Total Contact Hours = 27 Total Marks = 800 Total Credits = 26

SEMESTER 5th		Contact Hrs			Marks			Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
BAEE2-516	Aircraft Structure-II	3	1	0	40	60	100	4
BAEE2-517	Aircraft Propulsion-II	3	1	0	40	60	100	4
BAEE2-518	Aerodynamics-II	3	1	0	40	60	100	4
BAEE2-519	Control Engineering	3	0	0	40	60	100	3
BAEE2-520	Flight Dynamics-I	3	1	0	40	60	100	4
BAEE2-521	Aircraft Propulsion Lab.	0	0	4	60	40	100	2
BAEE2-522	Aerodynamics Lab.	0	0	4	60	40	100	2
BAEE2-523	Training-II	0	0	0	60	40	100	3
Total	**Total 5 Theory & 2 Lab. Courses**	**15**	**4**	**8**	**380**	**420**	**800**	**26**

Total Contact Hours = 23 Total Marks = 700 Total Credits = 21

SEMESTER 6th		Contact Hrs			Marks			Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
BAEE2-624	Experimental Stress Analysis	3	1	0	40	60	100	4
BAEE2-625	Computational Fluid Dynamics	3	1	0	40	60	100	4
BAEE2-626	Flight Dynamics-II	3	1	0	40	60	100	4
BAEE2-627	Avionics	3	1	0	40	60	100	4
Departmental Elective-I (Select any one)		3	0	0	40	60	100	3
BAEE2-656	Theory of Elasticity							
BAEE2-657	Helicopter Engineering							
BAEE2-658	Aero Elasticity							
BAEE2-628	CAD/CAM Lab.	0	0	2	60	40	100	1
BAEE2-629	Aircraft Design Lab.	0	0	2	60	40	100	1
Total	**Total 6 Theory & 2 Lab. Courses**	**15**	**4**	**4**	**320**	**380**	**700**	**21**

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Total Contact Hours = 15 Total Marks = 500 Total Credits = 19

SEMESTER 7th		Contact Hrs			Marks			Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
BAEE2-730	Mechanics of Composite Materials	3	1	0	40	60	100	4
BAEE2-731	Aerospace Quality Assurance	3	1	0	40	60	100	4
BAEE2-732	Finite Element Methods	3	1	0	40	60	100	4
Departmental Elective-II (Select any one)		3	0	0	40	60	100	3
BAEE2-759	Space Mechanics							
BAEE2-760	Guidance & Navigation							
BAEE2-761	Applied Gas Dynamics							
BAEE2-733	Training	0	0	0	60	40	100	4
Total	**Total 4 Theory & Courses**	**12**	**3**	**0**	**220**	**280**	**500**	**19**

Total Contact Hours = 6 Total Marks = 300 Total Credits = 12

SEMESTER 8th		Contact Hrs			Marks			Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
Open Elective-II		3	0	0	40	60	100	3
Departmental Elective-III (Select any one)		3	0	0	40	60	100	3
BAEE2-862	Experimental Aerodynamics							
BAEE2-863	Rockets & Missiles							
BAEE2-864	Aero Engine Maintenance & Repair							
BAEE2-834	Project	0	0	0	60	40	100	6
Total	**Total 2 Theory & Courses**	**6**	**0**	**0**	**320**	**380**	**300**	**12**

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Total Credits: 25 + 25 + 27 + 25 + 26 + 21 + 19 + 12 = 180

ENGINEERING MATHEMATICS-III

Subject Code: BMAT0-F91 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

UNIT-I (13 Hrs.)

Fourier Series: Periodic function, Fourier Seies, Dirichlet's conditions, Fourier series for even and odd functions, Change of interval, Half range Fourier series, Other forms of Fourier series.

Fourier Transforms: Dirichlet's conditions, Fourier integral formula (without proof), Fourier transform, Inverse Theorem for Fourier transform, Fourier sine and cosine transforms and their inversion formulae. Properties of Fourier transform, Convolution theorem of Fourier transforms, Parseval's identity.

UNIT-II (10 Hrs.)

Laplace Transforms: Laplace transforms of various standard functions (Exponential, Algebraic, Sine, Cosine), Properties of Laplace transforms, inverse Laplace transforms, transform of derivatives and integrals, Laplace transform of unit step function, impulse function,

Application of Laplace Transforms: Solution of ordinary linear differential equations with constant coefficients, and simultaneous differential equations.

UNIT-III (12 Hrs.)

Partial Differential Equations: Formation of partial differential equations, Linear partial differential equations, homogeneous partial differential equations with constant coefficients. Classification of partial differential equation.

Applications of PDEs: Wave equation and Heat conduction equation in one dimension. Two dimensional Laplace equation in Cartesian Coordinates, solution by the method of separation of variables.

MRSPTU

UNIT-IV (10 Hrs.)

Functions of Complex Variable: Limits, continuity and derivative of the function of complex variable, Analytic function, Cauchy-Riemann equations, conjugate functions, harmonic

functions; Conformal Mapping: Definition, standard transformations, translation, rotation, inversion, bilinear. Complex Integration: Line integrals in the complex plane, Cauchy's theorem, Cauchy's integral formula and derivatives of analytic function. Taylor's and Laurent's expansions (without proofs), singular points, poles, residue, Integration of function of complex variables using the method of residues(Integration Of type

$\int_0^{2\pi} F(Cos\theta, Sin\theta)d\theta, \quad \int_{-\infty}^{\infty} \frac{f(x)}{F(X)} dx)$

Recommended Books:

1. E. Kreyszing, 'Advanced Engineering Mathematics', 8th Edn., John Wiley, New Delhi.
2. B.S. Grewal, 'Higher Engineering Mathematics', Khanna Publishers, New Delhi.
3. Ian N. Sneedon, 'Elements of Partial Differential Equations', McGraw- Hill, Singapore, **1957**.
4. Peter. V. O'Nil, 'Advanced Engineering Mathematics', Wadsworth Publishing Company.
5. H.C. Taneja, 'Engineering Mathematics', Volume-I & II, I.K. Publisher.

FLUID MECHANICS

Subject Code: BAEE2-301 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

Unit-I

1. **Introduction:** Fluid and continuum, Physical properties of fluids, Rheology of fluids
2. **Kinematics of Fluid flow:** Types of fluid flows: Continuum & free molecular flows. Steady and unsteady, uniform and non-uniform, laminar and turbulent flows, rotational and irrotational flows, compressible and incompressible flows, subsonic, sonic and supersonic flows, sub-critical, critical and supercritical flows, one, two and three dimensional flows, streamlines, continuity equation for 3D and 1D flows, circulation, stream function and velocity potential, source, sink, doublet and half-body

Unit-II

3. **Fluid Statistics:** Pressure-density-height relationship, manometers, pressure transducers, pressure on plane and curved surfaces, centre of pressure, buoyancy, stability of immersed and floating bodies, fluid masses subjected to linear acceleration and uniform rotation about an axis
4. **Dynamics of Fluid Flow:** Euler's Equation of motion along a streamline and its integration, Bernoulli's equation and its applications- Pitot tube, orifice meter, venturi meter and bend meter, Hot-wire anemometer and LDA, notches and weirs, momentum equation and its application to pipe bends

Unit-III

5. **Dimensional Analysis and Hydraulic Similitude:** Dimensional analysis, Buckingham's Pi theorem, important dimensionless numbers and their significance, geometric, kinematics and dynamic similarity, model studies
6. **Laminar and Turbulent Flow:** Equation of motion for laminar flow through pipes, Stokes' law, transition from laminar to turbulent flow, turbulent flow, types of turbulent flow, isotropic, homogenous turbulence, scale and intensity of turbulence, measurement of turbulence, eddy viscosity, mixing length concept and velocity distribution in turbulent flow over smooth and rough surfaces, resistance to flow, minor losses, pipe in series and parallel, power transmission through a pipe, siphon, water hammer, three reservoir problems and networks

Unit-IV

7. **Boundary Layer Analysis:** Boundary layer thickness, boundary layer over a flat plate, laminar boundary layer, application of momentum equation, turbulent boundary layer, laminar sublayer, separation and its control, Drag and lift, drag on a sphere, a two dimensional cylinder, and an aerofoil, Magnus effect.

Recommended Books:

1. S. Narasimhan, 'First Course in Fluid Mechanics', University Press.
2. S.K. Som & G. Biswas, 'Introduction of Fluid Mechanics & Fluid Machines', 2nd Edn., TMH, **2000**.
3. M.M. Das, 'Fluid Mechanics & Turbomachines', Oxford University Press.
4. S.K. Agarwal, 'Fluid Mechanics & Machinery', TMH.
5. Hunter Rouse, 'Elementary Mechanics of Fluids', John Wiley & Sons. Omc., **1946.**
6. I.H. Shames, 'Mechanics of Fluids', McGraw Hill, Int. Student, Education, **1988**.
7. Jagdish Lal, 'Fluid Mechanics'.

MRSPTU

ENGINEERING THERMODYNAMICS

Subject Code: BAEE2-302 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

Unit-I

BASIC THERMODYNAMICS:
Systems, Zeroth Law, First Law - Heat and work transfer in flow, second law, Clausius statement - concept of entropy change in non-flow processes.

AIR CYCLES:
Otto, Diesel, Dual combustion and Brayton combustion cycles – Air standard efficiency - Mean effective pressure – Actual and theoretical PV diagrams of two stroke and four stroke IC Engines.

Unit-II

THERMODYNAMICS OF ONE DIMENSIONAL FLUID FLOW:
Application of continuity, momentum and energy equations- Rankine cycle – Isentropic flow of ideal gases through nozzles - Simple jet propulsion system - Thrust rocket motor – Specific impulse.

Unit-III

REFRIGERATION AND AIR CONDITIONING:
Principles of refrigeration, Air conditioning - Heat pumps - Vapour compression – Vapour absorption types - Coefficient of performance, Properties of refrigerants.

Unit-IV

AIR COMPRESSORS:
Classification and working principle of compressors (Descriptive Treatment). Isothermal and Isentropic efficiency of air compressors.

RECOMMENDED BOOKS

1. E. Rathakrishnan, 'Fundamentals of Engineering Thermodynamics', Prentice – Hall, India, **2000.**
2. P.K. Nag, 'Engineering Thermodynamics', 7th Edn., Tata McGraw-Hills Co., Ltd., **1993.**
3. Yunus A. Cengal, 'Thermodynamics an Engineering Approach', 3rd Edn., Tata McGraw-Hill Co., Ltd., **2002**.

REFERENCES

1. A. Mayhew and B. Rogers, 'Engineering Thermodynamics', Longman Green & Co. Ltd., London, E.L.B.S. Edition, **1990**.
2. G.J. Van Wylen and R.E. Sonntag, 'Fundamentals of Classical Thermodynamics', S.I. Version, 2nd Edn., **1986**.
3. D.H. Bacon, 'Engineering Thermodynamics', Butterworth & Co., London, **1989**.
4. M.A. Saad, 'Thermodynamics for Engineers', Prentice-Hall of India Pvt. Ltd., **1989**.
5. Reynolds, 'Thermodynamics', Int. Student Edn., McGraw-Hill Book Co., Ltd., **1990.**

STRENGTH OF MATERIALS

Subject Code: BAEE2-303 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

Unit-I

Compound Stress and Strains: Introduction, state of plane stress, Principal stress and strain, Mohr's stress circle.

MRSPTU

3-D Stress, Theory of Failure, Castinglion's Theorem, Impact Load: Three dimensional state of stress & strain, equilibrium equations. Generalized Hook's Law. Theories of Failure. Castigliano's Theorem. Impact load & stresses.

Unit-II

Stresses, Deflection in Beams, Torsion: Review of pure Bending**.** Direct and shear stresses in beams due to transverse and axial loads, composite beams. Equation of elastic curve, cantilever and simply supported beams, Macaulay's method, area moment method, fixed and continuous beams. Review of Torsion, combined bending & torsion of solid & hollow shafts.

Helical and Leaf Springs: deflection of springs by energy method, helical springs under axial load and under axial twist (respectively for circular and square cross sections) axial load and twisting moment acting simultaneously both for open and closed coiled springs, laminated springs.

Unit-III

Columns and Struts: Combined bending and direct stress, middle third and middle quarter rules. Struts with different end conditions. Euler's theory and experimental results, Ranking Gardon Formulae, Examples of columns in mechanical equipment and machines.

Thin & Thick cylinders & spheres: Hoop and axial stresses and strain. Volumetric strain. 2 Radial, axial and circumferential stresses in thick cylinders subjected to internal or external pressures, Compound cylinders. Stresses in rotating shaft and cylinders. Stresses due to interference fits.

Unit-IV

Curved Beams: Bending of beams with large initial curvature, position of neutral axis for rectangular, trapezoidal and circular cross sections, stress in crane hooks, stress in circular rings subjected to tension or compression.

Unsymmetrical Bending: Properties of beam cross-section, slope of neutral axis, stress and deflection in unsymmetrical bending, determination of shear center and flexural axis (for symmetry about both axis and about one axis) for I-section and channel section.

Recommended Books:

1. Pytel, 'Mechanics of Materials'.
2. Ryder, 'Strength of Materials'.
3. Timoshenko and & Yσungs, 'Strength of Materials'.
4. Bear Jhonson, 'Mechanics of Materials'.
5. C.L. Dym and I.H. Shames, 'Solid Mechanics', **1990**.
6. Nash William, 'Strength of Materials', TMH, **1998.**

MACHINE DESIGN

Subject Code: BAEE2-304 **L T P C**
1 0 4 3

Unit-I

Introduction: Definition, Design requirements of machine elements, Design procedure, Standards in design, Selection of preferred sizes, Indian Standards designation of carbon & alloy steels, Selection of materials for static and fatigue loads.

Design against Static Load: Modes of failure, Factor of safety, Principal Stresses, Stresses due to bending and torsion, Theory of failure.

Unit-II

Design against Fluctuating Loads: Cyclic stresses, Fatigue and endurance limit, Stress concentration factor, Stress concentration factor for various machine parts, Notch sensitivity, Design for finite and infinite life, Soderberg, Goodman & Gerber criteria.

MRSPTU

Riveted Joints: Riveting methods, materials, Types of rivet heads, Types of riveted joints, Caulking and Fullering, Failure of riveted joint, Efficiency of riveted joint, Design of boiler joints, Eccentric loaded riveted joint.

Unit-III

Shafts: Cause of failure in shafts, Materials for shaft, Stresses in shafts, Design of shafts subjected to twisting moment, bending moment and combined twisting and bending moments, Shafts subjected to fatigue loads, Design for rigidity

Keys and Couplings: Types of keys, splines, Selection of square & flat keys, Strength of sunk key, Couplings- Design of rigid and flexible couplings

Unit-IV

Mechanical Springs: Types, Material for helical springs, End connections for compression and tension helical springs, Stresses and deflection of helical springs of circular wire, Design of helical springs subjected to static and fatigue loading

Power Screws: Forms of threads, multiple threads, Efficiency of square threads, Trapezoidal threads, Stresses in screws, Design of screw jack

Note: Design data book is allowed in the examination

Recommended Books

1. Joseph E. Shigely, 'Mechanical Engineering Design', McGraw Hill Publications.
2. Alex Valance and VI Doughtie, 'Design of Machine Memebers', McGraw Hill Co.
3. M.F. Spott, 'Machine Design', Prentice Hall India.
4. Maleev and Hartman, 'Machine Design', **CBS**.
5. Black & Adams, 'Machine Design', McGraw Hill.
6. Sharma and Agrawal, 'Machine Design', S.K. Kataria & Sons.
7. V.B. Bhandari, 'Design of Machine Elements', Tata McGraw Hill Co.

MRSPTU

INTRODUCTION TO AEROSPACE

Subject Code: BAEE2-305 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

Unit-I

1. HISTORICAL EVALUATION: History of Aviation, Early Development of Airplanes, Biplanes and Monoplanes, History of Spaceflight, Development of Space Vehicle, Classification of Duct Jet Propulsion, Rocket Propulsion, Advance Propulsion and Applications.

2. CONFIGURATIONS: Anatomy of flight vehicles, Components of an airplanes and their function, Configuration of space vehicle, Earth's atmosphere and gravitational field, Bluff bodies v/s Streamlined body, Airfoil, Lift generation, Significance of L/D ratio, Aerodynamic forces.

Unit-II

3. PROPULSION: Classification and Essential features of propulsion, Jet propulsion, General characteristics of rocket engines, Theory of propulsion, Elementary gas dynamics, Spacecrafts and Aircraft performance.

Unit-III

4. AEROSPACE STRUCTURES AND MATERIALS: General types of Construction and Structural Layout, Flight Envelope and V-N Diagrams, Monocoque, Semimonocoque, Corrugated, Sandwich Structure, Reinforced and Honeycomb Structures, Geodesic Construction, Aerospace Materials, Metallic and Non-Metallic Materials, Uses of Aluminium Alloy, Titanium, Stainless Steel, Composite and Ceramic Materials

Unit-IV

5. INSTRUMENTS AND NAVIGATION: Basic Instrumentation, Electronics (DC Electronics, AC Electronics, Semiconductors, Electro-Optics and Digital Electronics), Sensing Devices, Bridge Circuits, Optical Devices and Introduction to Computer Based Data Acquisition, Measurements in Aerodynamics, Flight Structures, Flight Control, Principles of Navigation, Celestial, Radio, and Inertial Navigation Schemes, Navigational and Guidance Requirements for Orbital, Planetary, and Atmospheric Entry Missions

RECOMMENDED BOOKS:

1. Shevel, 'Fundamentals of Flight', Prentice Hall, **1989**.
2. G.D. Merrill, 'Principle of Guided Missile Design', Van Nostrand Co., INC., **1977.**
3. J.D. Anderson, 'Introduction to Flight', McGraw-Hill, **2000**.
4. A.C. Kermode, 'Flight without Formulae', Pitman, **1970.**

FLUID MECHANICS LAB.

Subject Code: BAEE2-306 **L T P C**
0 0 2 1

MRSPTU

1. To verify the momentum equation using the experimental set-up on diffusion of submerged air jet.
2. To determine the coefficient of discharge of an orifice of a given shape. Also to determine the coefficient of velocity and the coefficient of contraction of the orifice mouth piece.
3. To calibrate an orifice meter, venturimeter, and bend meter and study the variation of the co-efficient of discharge with the Reynolds number.
4. To study the transition from laminar to turbulent flow and to determine the lower critical Reynolds number.
5. To study the velocity distribution in a pipe and also to compute the discharge by integrating the velocity profile.
6. To study the variation of friction factor, 'f' for turbulent flow in commercial pipes.
7. To study the boundary layer

STRENGTH OF MATERIALS LAB.

Subject Code: BAEE2-307 **L T P C**
0 0 2 1

1. Strength testing of a given mild steel specimen on UTM with full details and s-e plot on the machine.
2. Other tests such as shear, bend tests on UTM.
3. Impact testing on impact testing machine like Charpy, Izod or both.
4. Hardness testing of given specimen using Rockwell and Vickers/Brinell testing machines.
5. Spring index testing on spring testing machine.
6. Fatigue testing on fatigue testing machine.
7. Creep testing on creep testing machine.
8. Deflection of beam experiment, comparison of actual measurement of deflection with dial gauge to the calculated one, and or evaluation of young's modulus of beam.
9. Torsion testing of a rod on torsion testing machine.
10. Study of non-destructive testing methods like magnetic flaw detector, ultrasonic flaw detector, eddy current testing machine, dye penetrant tests.

NUMERICAL ANALYSIS

Subject Code: BMAT0-F92 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

UNIT-1

Solution of algebraic and transcendental equations: Errors and Approximations: Absolute, Relative, Truncation and round off errors, Floating point arithmetic, Bounds on error, Error propagation in computation.

Solution of algebraic and transcendental equations: Bisection method, Iteration method, Regula-falsi method, Secant method, Newton-Raphson method. Convergence of these methods.

UNIT-2

Methods to Solve System of Linear Equations: System of linear algebraic equations: Guass elimination method, Gauss – Jordon method, LU factorization method, Jacobi and Gauss-Seidal methods. Eigen values and Eigen vectors: Rayleigh power method.

UNIT-3

Interpolation, Numerical Integration: Interpolation: Finite differences, Newton Gregory forward and Backward formula, Central differences formulae: Bessel, Stirling and Everette's formulae. Lagrange's formula, Divided differences Newton's formula

Numerical integration: Newton-Cotes Formulae-Trapezoidal, Simpson's, Boole's and Weddle's rules of integration, Romberg integration, Gaussian integration.

UNIT-4

Methods to Solve Ordinary Differential Equation: Ordinary differential equations: Taylor series and Picard's methods, Euler and modified Euler methods, Runge–Kutta methods, Predictor- Corrector methods: Adams-Bashforth and Milne methods.

Recommended Books

1. B. Bradie, 'A friendly introduction to Numerical Analysis', Pearson Prentice Hall, **2006.**
2. K.E. Atkinson, 'Introduction to Numerical Analysis', 2nd Edn., John Wiley, **1989.**
3. S.D. Conte and C. De Boor, 'Elementary Numerical Analysis: An Algorithmic Approach', 3rd Edn., McGraw Hill, New York, **1980.**
4. J.B. Scarborough, 'Numerical Mathematical Analysis', Oxford & IBH Publishing Co., **2001**

AERODYNAMICS- I

Subject Code: BAEE2-409 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

Unit-I

1. Introduction: Fluid statics, Pascal's law, Continuum and free molecular flows, Invisid and viscous flows, incompressible and compressible flows. Newtonian and Non-Newtonian flows. Pitot static tube, measurement of air-speed, pressure coefficient. Aerodynamic force and moments, Dimensional analysis, non-dimensional parameters, M, Re, Fr etc., flow similarity.

2. Description of Fluid Motion: Lagrangian and Eulerian methods, Description of properties in a moving fluid, local and material rate of change. Streamlines, Pathlines, Streaklines, Reynolds Transport theorem, Vorticity and circulation. Laws of vortex motion. Translation, rotation and rate of deformation of fluid particles.

Unit-II

3. Equations of Fluid Motion: Equation of conservation of mass for control volume, special form of equation of conservation of mass, differential form of equation of conservation of mass

MRSPTU

Euler's and Navier-Stoke equations. Derivation of Bernoulli's equation for Invisid and viscous flow fields. Momentum equation and angular momentum equation in integral form.

Unit-III

4. Invisid-Incompressible Flow: Condition on velocity for incompressible flow. Laplace's equations. Potential function, stream function. Basic elementary flows: Uniform flows, source flow, Doublet flow and Vortex flow. Superimposition of elementary flows, Non-lifting and lifting flow over a circular cylinder, comparison with real flow over circular cylinder. Kutta-Jaukowski theorem, generation of lift.

Unit-IV

5. Introduction to Viscous Flow: Qualitative aspects of viscous flows, viscosity and thermal conductivity. Phenomenon of separation. Navier-Stokes equation; viscous flow energy equation. Some exact solutions of Navier-Stokes equations: plane Poiseuille flow, Couette flow, Hagen-Poiseuille flow and Hele-Shaw flow

6. Introduction to Incompressible Boundary Layer: BL concept, BL properties, derivation of Prandtl's BL equations, Blasius solution, Karman's Integral equation. Turbulent BL over a plate, skin friction drag, BL control.

RECOMMENDED BOOKS:

1. John D. Anderson (Jr.), 'Fundamentals of Aerodynamics', 2nd Edn., McGraw Hill.
2. Gupta and Gupta, 'Fluid Mechanics and its Applications', Wiley Eastern, **1960**
3. H. Schlichting, 'Boundary Layer Theory', 6th Edn., McGraw Hill, **1986.**
4. Frank M. White, 'Fluid Mechanics', 2nd Edn., McGraw Hill, **1986.**

MRSPTU

AIRCRAFT STRUCTURE-I

Subject Code: BAEE2-410 **L T P C**
1 0 4 3

Unit-I

Statically Determinate Structures:

Analysis of plane, Truss-Method of joints, 3 D Truss, Plane frames, Composite beam.

Statically Indeterminate Structures:

Propped Cantilever- Fixed-Fixed beams-Clapeyron's Three Moment Equation – Moment Distribution Method.

Unit-II

Energy Methods:

Strain Energy due to axial, bending and Torsional loads – Castigliano's theorems- Maxwell's Reciprocal theorem, Unit load method - application to beams, trusses, frames, rings, etc.

Unit-III

Columns:

Columns with various end conditions – Euler's Column curve – Rankine's formula - Column with initial curvature - Eccentric loading – South well plot – Beam column.

Unit-IV

Failure Theory:

Maximum Stress theory – Maximum Strain Theory – Maximum Shear Stress Theory – Distortion Theory – Maximum Strain energy theory – Application to aircraft Structural problems.

RECOMMENDED BOOKS:

1. B.K. Donaldson, 'Analysis of Aircraft Structures – An Introduction', McGraw-Hill, **1993**.
2. Timoshenko, Goodier, 'Theory of Elasticity', Tata McGraw Hill.
3. L.S. Srinath, 'Advanced Solid Mechanics', McGraw Hill.

AIRCRAFT PROPULSION-I

Subject Code: BAEE2-411 **L T P C**
1 0 4 3

Unit-I

Fundamentals of Gas Turbine Engines: Illustration of working of gas turbine engine – The thrust equation – Factors affecting thrust – Effect of pressure, velocity and temperature changes of air entering compressor – Methods of thrust augmentation – Characteristics of turboprop, turbofan and turbojet –Performance characteristics.

Unit-II

Subsonic and Supersonic Inlets for Jet Engines: Internal flow and Stall in subsonic inlets – Boundary layer separation – Major features of external flow near a subsonic inlet – Relation between minimum area ratio and eternal deceleration ratio – Diffuser performance – Supersonic inlets – Starting problem on supersonic inlets – Shock swallowing by area variation – External declaration – Models of inlet operation.

Unit-III

Combustion Chambers: Classification of combustion chambers – Important factors affecting combustion chamber design – Combustion process – Combustion chamber performance – Effect of operating variables on performance – Flame tube cooling – Flame stabilization – Use of flame holders – Numerical problems.

Nozzles: Theory of flow in isentropic nozzles – nozzles and choking – Nozzle throat conditions – Nozzle efficiency – Losses in nozzles – Over expanded and under – expanded nozzles - Ejector and variable area nozzles – Interaction of nozzle flow with adjacent surfaces –Thrust reversal.

Unit-IV

Compressors: Principle of operation of centrifugal compressor – Work done and pressure rise – Velocity diagrams – Diffuser vane design considerations – Concept of prewhirl, rotation stall and surge – Elementary theory of axial flow compressor – Velocity triangles – degree of reaction – Three dimensional – Air angle distributions for free vortex and constant reaction designs – Compressor blade design – Centrifugal and Axial compressor performance characteristics.

RECOMMENDED BOOKS

1. P.G. Hill & C.R. Peterson, 'Mechanics & Thermodynamics of Propulsion', Addison – Wesley Longman INC, **1999**.

REFERENCES

1. Cohen, H. Rogers, G.F.C. and Saravanamuttoo, H.I.H., 'Gas Turbine Theory', Longman, **1989**.
2. G.C. Oates, 'Aero thermodynamics of Aircraft Engine Components', AIAA Education Series, New York, **1985**.
3. 'Rolls Royce Jet Engine', 3rd Edn., **1983**.
4. M.L. Mathur and R.P. Sharma, 'Gas Turbine, Jet and Rocket Propulsion', Standard Publishers & Distributors, Delhi, **1999**.

MRSPTU

AIRCRAFT SYSTEM & INSTRUMENTATION

Subject Code: BAEE2-412 **L T P C** **Duration: 34 Hrs.**
3 0 0 3

Unit-I

1. Flight Control Systems: Primary and secondary flight control, flight control linkage systems, push-pull control rod system, cable and pulley systems, high lift control systems, flight control actuation, linear actuator, mechanical actuator, mechanical screw-jack actuator, direct drive actuation, fly-by-wire actuator, electro-hydrostatic actuator, electro-mechanical actuator.

Unit-II

2. Engine Control Systems: Engine technology and principle of operation, fuel flow control, air flow control, control systems, control system parameters, input signals, output signals, engine starting, fuel control, ignition control, engine rotation, throttle levers, starting sequence, engine oil systems.

Unit-III

3. Hydraulic and Environment Control Systems: Hydraulic circuit design, hydraulic actuation, hydraulic fluid, fluid pressure and temperature, fluid flow rate, hydraulic piping and pumps, need for controlled environment, heat sources, ram air cooling, fuel cooling, engine bleed, bleed flow and temperature control, air cycle, refrigeration, humidity control, hypoxia, tolerance.

MRSPTU

Unit-IV

4. Pitot Static Instruments & Systems: Pitot static system, air speed indicator, altimeter, mach-meter, mach/airspeed indicator, vertical speed indicator.

5. Gyroscopic Instruments: Gyroscope and its properties, gyro-horizon, turn and bank indicator, turn coordinator, direct reading magnetic compass, directional gyroscope.

6. Navigational Instruments: Very high and ultra-high frequency radio aids, VOR, TACAN, VORTAC, VHF direction finding, instrument landing system, and microwave landing system.

RECOMMENDED BOOKS

1. Ian Moir and Allan Seabridge, 'Aircraft Systems', John Wiley & Sons.
2. E.H.J. Pallet, 'Aircraft Instruments', Pearson.
3. 'Aviation Maintenance Technician Hand Book (General) (AC 65-9A)', Himalayan Books.
4. 'Civil Aircraft Inspection Procedure', English Books Store, Delhi (CAIP – CAA).
5. Scheppler Robert, 'Aircraft Oxygen System', Himalayan Books.

THEORY OF MACHINES

Subject Code: BAEE2-413 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

Unit-I

1. Basic Concept of Machines: Link mechanism, kinematic pair and chain, principles of inversion, inversion of a four bar chain, slider-crank-chain, double slider-crank-chain and their inversions, kinematic pairs, Graphical (relative velocity vector and instantaneous center methods) and Analytical methods for finding: Displacement, velocity, and acceleration of mechanisms (including Corliolis).

Unit-II

2. Lower Pairs: Universal joint, calculation of maximum torque, steering mechanisms including Ackerman and Davis approximate steering mechanism, engine indicator, Pentograph, Straight line mechanisms.

3. Belts, Ropes and Chains: Material, types of drives, idle pulley, intermediate or counter shaft pulley, angle and right angle drive, quarter turn drive, velocity ratio, crowning shaft pulley, loose and fast pulley, stepped or cone pulleys, ratio of tension on tight and slack sided of belts, HP transmitted by belts including consideration of creep and slip, centrifugal tensions and its effect on HP transmitted. Use of gravity, idle, flat, V-belts and rope materials, Length of belt, rope and chain drives, type and cone type.

Unit-III

4. Cams: Types of cams and follower, definitions of terms connected with cams, displacement velocity and acceleration diagrams for cam followers. Analytical and Graphical design of cam profiles with various motions (SHM, uniform acceleration and retardation, cycloidal). Analysis of follower motion for circular convex, tangent cam profiles. Calculation of pressure angle.

5. Friction Devices: Concepts of frictions and wear related to bearing and clutches. Types of brakes, Principle of function of Brakes of various types. Braking of front and rear tyres of a vehicle, Problems to determine braking capacity, Types of dynamometers (absorption & transmission).

Unit-IV

6. Flywheels: Turning moment and crank effort diagrams for reciprocating machines, Fluctuations of speed, coefficient of fluctuation of speed and energy, Determination of flywheel mass and dimensions for engines and Punching Machines.

7. Governors: Function, types and characteristics of governors, Watt, Porter and Proell governor, Hartnell and Willson-Hartnell, spring loaded governors, Simple numerical problems on these governors, Sensitivity, stability, isochronisms and hunting of governor, Governor effort and power controlling force curve, effect of sleeve friction

RECOMMENDED BOOKS:

1. Jagdish Lal, 'Theory of Mechanisms & Machines', Metropolitan Book Co. Pvt. Ltd., New Delhi.
2. S.S. Rattan, 'Theory of Machines', Tata McGraw Hill, New Delhi.
3. Thomas Beven, 'Theory of Machines', Longman's Green & Co., London.
4. W.G. Green, 'Theory of Machines', Blackie & Sons, London.
5. Shigley, W.G. Green, 'Theory of Machines', McGraw Hill, New York.

AIRCRAFT STRUCTURE LAB.

Subject Code: BAEE2-414 **L T P C**
0 0 4 2

LIST OF EXPERIMENTS (PERFORM ANY 8 EXPERIMENTS)

1. Determination of Young's modulus of aluminum using electrical extensometers
2. Determination of fracture strength and fracture pattern of ductile & brittle materials.
3. Deflection of beams with various end conditions for different load.
4. Verification of Maxwell's Reciprocal theorem & principle of superposition.
5. Compression tests on long and short columns, Critical buckling loads, South well plot.
6. Wagner beam – Tension field beam.
7. Shear centre location for open sections.
8. Shear centre location for closed sections.
9. Flexibility matrix for cantilever beam.

10. Beam with combined loading.
11. Experiment on Photo- elastic bench.

AIRCRAFT SYSTEMS LAB.

Subject Code: BAEE2-415 **L T P C**
0 0 4 2

Study of any eight of the following aircraft systems:

1. Aircraft “Jacking Up” procedure
2. Aircraft “Levelling” procedure
3. Control System “Rigging check” procedure
4. Aircraft “Symmetry Check” procedure
5. “Flow test” to assess of filter element clogging
6. “Pressure Test” To assess hydraulic External/Internal Leakage
7. “Functional Test” of Hydraulic Actuator for its proper operation, leakage and load test.
8. “Pressure Test” procedure on fuel system components
9. “Brake Torque Load Test” on wheel brake units
10. Maintenance and rectification of snags in pneumatic, hydraulic and fuel systems components and on Aircraft.
11. Functional Test of Fire detection system on aircraft.
12. Functional Test of Aircraft Pressurization System on aircraft.
13. Functional Test of aircraft landing gear retraction system and its relevant indications in the cockpit.
14. Identification of various components, pipelines with color coding on aircraft.
15. Study of combustion chambers of various engines
16. Study of hydraulic systems of various aircraft
17. Study of pneumatic systems of various aircraft
18. Study of brake systems of various aircraft

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AIRCRAFT STRUCTURE-II

Subject Code: BAEE2-516 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

Unit-I

UNSYMMETRICAL BENDING: General, Principal axis and neutral axis methods- bending stresses in beams of symmetric sections with skew loads- bending stresses in beams of unsymmetrical sections.

Unit-II

SHEAR FLOW IN OPEN SECTIONS: Thin walled beams, Concept of shear flow, shear centre, Elastic axis. With one axis of symmetry, with wall effective and ineffective in bending, unsymmetrical beam sections.

SHEAR FLOW IN CLOSED SECTIONS: Bredt – Batho formula, Single and multi – cell structures - Shear flow in single & multicell structures under torsion. Shear flow in single and multicell under bending with walls effective and ineffective.

Unit-III

BUCKLING OF PLATES: Rectangular sheets under compression, local buckling stress of thin walled section- Crippling stresses by Needham’s and Gerard’s methods, thin walled column strength sheet stiffener Panels-Effective width.

Unit-IV

STRESS ANALYSIS IN WING AND FUSELAGE: Shear resistant web Beams-Tension field web beams (Wagner's) – Shear and bending moment distribution for cantilever and semi-cantilever types of beams-loads on aircraft –lift Distribution-V-n Diagram-Gust loads.

Recommended Books:

1. T.H.G. Megson, 'Aircraft Structures for Engineering Students', Elsevier.
2. N.G.R. Iyengar, 'Structural Stability of Columns and Plates', Affiliated East-West Press (Pvt.) Ltd.
3. C. Chajis, 'Introduction to Structural Stability', Prentice Hall Inc. Engle Wood Cliff.
4. David J. Perry, 'Aircraft Structures', McGraw Hill.
5. R.M. Rivello, 'Theory and Analysis of Flight Structures', McGraw Hill.
6. T.R. Chandruplata and A.D. Belagundu, 'Introduction to Finite Elements in Engineering', PHI.

AIRCRAFT PROPULSION-II

Subject Code: BAEE2-517 **L T P C** **Duration: 45 Hrs.**

3 1 0 4

Unit-I

AIRCRAFT GAS TURBINES: Impulse and reaction blading of gas turbines – Velocity triangles and power output – Elementary theory – Vortex theory – Choice of blade profile, pitch and chord – Estimation of stage performance – Limiting factors in gas turbine design-Overall turbine performance – Methods of blade cooling – Matching of turbine and compressor.

Unit-II

RAMJET PROPULSION: Operating principle – Sub critical, critical and supercritical operation – Combustion in ramjet engine – Ramjet performance – Simple ramjet design calculations – Introduction to scramjet.

Unit-III

FUNDAMENTALS OF ROCKET PROPULSION: Operating principle – Specific impulse of a rocket – internal ballistics- Rocket nozzle classification – Rocket performance considerations.

Unit-IV

CHEMICAL ROCKETS: Solid propellant rockets – Selection criteria of solid propellants – Important hardware components of solid rockets – Propellant grain design considerations – Liquid propellant rockets – Selection of liquid propellants. Cooling in liquid rockets – Hybrid rockets.

ADVANCED PROPULSION TECHNIQUES: Electric rocket propulsion – Ion propulsion techniques– Nuclear rocket – Types – Solar sail- Preliminary Concepts in nozzleless propulsion.

RECOMMENDED BOOKS

1. G.P. Sutton, 'Rocket Propulsion Elements', 5th Edn., John Wiley & Sons Inc., New York, **1993**.
2. P.G. Hill & C.R. Peterson, 'Mechanics & Thermodynamics of Propulsion', Addison – Wesley Longman INC, **1999**.

REFERENCES

1. H. Cohen, G.F.C. Rogers and H.I.H. Saravanamuttoo, 'Gas Turbine Theory', Longman Co., ELBS Edn., **1989**.

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2. C.V. Gorden, 'Aero thermodynamics of Gas Turbine and Rocket Propulsion', AIAA Education Series, New York, **1989**.
3. M. Mathur and R.P. Sharma, 'Gas Turbines and Jet and Rocket Propulsion', Standard Publishers, New Delhi, **1988**.

AERODYNAMICS-II

Subject Code: BAEE2-518 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

Unit-I

One Dimensional Compressible Flow: Energy, Momentum, continuity and state equations. Velocity of sound, adiabatic steady state flow equations, Flow through converging, diverging passages. Performance under various back Pressures.

Unit-II

Normal, Oblique Shocks and Expansion Waves: Prandtl equation and Rankine – Hugonoit relation, Normal shock equations, Pitot static tube, Rayleigh and Fanno Flow. Flow past convex corners, corrections for subsonic and supersonic flows, Oblique shocks and correspond equations. Hodograph and pressure turning angle, shocks polars, flow past wedges and concave corners, strong, weak and detached shocks, Expansion hodograph, Reflection and interaction of shocks and expansion waves, Families of shocks, Methods of Characteristics, Two dimensional supersonic nozzle contours.

Unit-III

Differential Equations of Motion for Steady Compressible Flows: Small perturbation potential theory, solutions for supersonic flows, Mach waves and Mach angles, Prandtl-Glauert affine transformation, relations for subsonic flows, Linearized two dimensional supersonic flow theory, Lift, drag pitching moment and center of pressure of supersonic profiles.

Unit-IV

Airfoil in High: Lower and upper critical mach numbers, Lift and drag divergence, shock induced separation, Characteristics of swept wings, Effects of thickness, camber and aspect ratio of wings, Transonic area rule, Tip effects.

High Speed Wind Tunnel: Blow down, indraft and induction tunnel layouts and their design features, Transonic, supersonic and hypersonic tunnels and their peculiarities. Helium and gun tunnels, Shock tubes, Optical methods of flow visualization.

RECOMMENDED BOOK

1. E. Rathakrishnan, 'Gas Dynamics', Prentice Hall of India, **2003**.

REFERENCES

1. A.H. Shapiro, 'Dynamics and Thermodynamics of Compressible Fluid Flow', Ronald Press, **1982**.
2. M.J. Zucrow and J.D. Anderson, 'Elements of Gas Dynamics', McGraw-Hill Book Co., New York, **1989**.
3. Anderson Jr., D., 'Modern Compressible Flows', McGraw-Hill Book Co., New York, **1999**.

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CONTROL ENGINEERING

Subject Code: BAEE2-519 **L T P C** **Duration: 34 Hrs.**
3 0 0 3

Unit-I

1. INTRODUCTION: Concept of automatic controls, open and closed loop systems, concepts of feedback, requirement of an ideal control system. Types of controllers– Proportional, Integral, Proportional Integral, Proportional Integral Differential controllers.

2. MATHEMATICAL MODELS: Transfer function models, models of mechanical systems, models of electrical circuits, DC and AC motors in control systems, models of thermal systems, models of hydraulic systems. Pneumatic system. Analogous systems: Force voltage, Force current.

Unit-II

3. BLOCK DIAGRAMS AND SIGNAL FLOW GRAPHS: Transfer Functions definition, function, block representation of system elements, reduction of block diagrams, Signal flow graphs: Mason's gain formula.

4. TRANSIENT AND STEADY STATE RESPONSE ANALYSIS: Introduction, first order and second order system response to step, ramp and impulse inputs, concepts of time constant and its importance in speed of response. System stability: Routh's-Hurwitz Criterion.

Unit-III

5. FREQUENCY RESPONSE ANALYSIS: Polar plots, Nyquist Stability Criterion, Stability Analysis, Relative stability concepts, phase and gain margin, M & N circles.

6. FREQUENCY RESPONSE ANALYSIS USING BODE PLOTS: Bode attenuation diagrams, Stability Analysis using Bode plots, Simplified Bode Diagrams.

Unit-IV

7. ROOT LOCUS PLOTS: Definition of root loci, general rules for constructing root loci, Analysis using root locus plots.

8. CONTROL ACTION AND SYSTEM COMPENSATION: Series and feedback compensation, Physical devices for system compensation.

RECOMMENDED BOOKS:

1. Katsuhiko Ogata, 'Modern Control Engineering', Pearson Education, **2004**.
2. M. Gopal, 'Control Systems Principles and Design', TMH, **2000.**

REFERENCE BOOKS:

1. 'Feedback Control Systems', Schaum's Series, **2001**.
2. I.J. Nagarath & M. Gopal, 'Control Systems', New Age International Publishers, **2002**.
3. B.C. Kuo, F. Golnaraghi, 'Automatic Control Systems', John Wiley & Sons, **2003**.

FLIGHT DYNAMICS-I

Subject Code: BAEE2-520 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

Unit-I

ATMOSPHERE: International standard atmospheric, geopotential and geometric altitude, troposphere and stratosphere, stability of atmosphere. Pressure altitude, equivalent, calibrated, and indicated air speed, primary flight instruments, ASI, VSI, Turn-bank indicator.

MRSPTU

Unit-II

AERODYNAMIC CHARACTERISTICS-I: Drag aerodynamics, Drag polar, Estimation of drag. Forces and moments from dimensional analysis, Pressure distribution over airfoils, variation with angle of attack, aerodynamic centre of pressure related problems.
AERODYNAMIC CHARACTERISTIC-II: Estimation of CL, CD and CM from pressure distribution, variation of aerodynamic coefficients with Reynolds number and Mach number. Effect of span, aspect ratio, platform, sweep, taper and twist on aerodynamic characteristics V/STOL configurations

Unit-III

AIRPLANE PERFORMANCE IN STEADY & LEVEL FLIGHT: Equation of motion of aircraft, variation of drag with flight, power required and power available, minimum drag and minimum power conditions, climbing and gliding performance,

Unit-IV

AIRPLANE PERFORMANCE IN ACCELARATED FLIGHT: Take-off and landing, steady climb and descent, absolute and service ceiling, cruise, cruise climb, range and endurance, load factor, V-n diagram, jet assisted take-off, effect of head, tail and cross winds. Turning flight performance

Recommended Books:

1. J.D. Anderson, 'Introduction to Flight', McGraw Hill.
2. J.D. Anderson, 'Fundamentals of Aerodynamics', McGraw Hill.
3. E.L. Houghton and N.B. Carruthers, 'Aerodynamics for Engineering Students', Arnold Publisher.

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AIRCRAFT PROPULSION LAB.

Subject Code: BAEE2-521 **L T P C**
0 0 4 2

LIST OF EXPERIMENTS (PERFORM ANY 8 EXPERIMENTS)

1. Study of an aircraft piston engine. (Includes study of assembly of sub systems, various components, their functions and operating principles)
2. Study of magneto and ignition system.
3. Study of an aircraft jet engine compressor.
4. Study of jet engine combustion chamber.
5. Study of jet engine turbine.
6. Study of forced convective heat transfer over a flat plate.
7. Study of free convective heat transfer over a flat plate
8. Study of free jet.
9. Study of wall jet.
10. Study of ramjet.

AERODYNAMICS LAB.

Subject Code: BAEE2-522 **L T P C**
0 0 4 2

LIST OF EXPERIMENTS (PERFORM ANY 8 EXPERIMENTS)

1. Calibration of a subsonic wind tunnel: test section static pressure and total head distributions.
2. Smoke flow visualization studies on a two-dimensional circular cylinder at low speeds.

3. Smoke flow visualization studies on a two dimensional airfoil at different angles of incidence at low speeds
4. Tuft flow visualization on a wing model at different angles of incidence at low speeds: identify zones of attached and separated flows.
5. Surface pressure distributions on a two-dimensional circular cylinder at low speeds and calculation of pressure drag.
6. Surface pressure distributions on a two-dimensional symmetric airfoil at zero incidence at low speeds.
7. Surface pressure distributions on a two-dimensional cambered airfoil at different angles of incidence and calculation of lift and pressure drag.
8. Calculation of total drag of a two-dimensional circular cylinder at low speeds using pitot static probe wake survey.
9. Calculation of total drag of a two-dimensional cambered airfoil at low speeds at incidence using pitot-static probe wake survey.
10. Measurement of a typical boundary layer velocity profile on the tunnel wall (at low speeds) using a pitot probe and calculation of boundary layer displacement and momentum thickness.

EXPERIMENTAL STRESS ANALYSIS

Subject Code: BAEE2-624 **L T P C** **Duration: 45 Hrs.**

3 1 0 4

MRSPTU

Unit-I

MEASUREMENTS & EXTENSOMETER: Principles of measurements, Accuracy, Sensitivity and range of measurements. Mechanical, Optical Acoustical and Electrical extensometers and their uses, Advantages and disadvantages.

Unit-II

ELECTRICAL RESISTANCE STRAIN GAUGES: Principle of operation and requirements, Types and their uses, Materials for strain gauge. Calibration and temperature compensation, cross sensitivity, Rosette analysis, Wheatstone Bridge and potentiometer circuits for static and dynamic strain measurements, strain indicators.

Unit-III

PHOTOELASTICITY: Two dimensional photo elasticity, Concept of light – photoelastic effects, stress optic law, Interpretation of fringe pattern, Compensation and separation techniques, Photo elastic materials. Introduction to three dimensional photo elasticity.

Unit-IV

BRITTLE COATING AND MOIRE METHODS: Introduction to Moire techniques, brittle coating methods and holography.

NON – DESTRUCTIVE TESTING: Fundamentals of NDT, Radiography, ultrasonic, magnetic particle inspection, Fluorescent penetrant technique, Eddy current testing, Acoustic Emission Technique.

RECOMMENDED BOOKS

1. L.S. Srinath, M.R. Raghava, K. Lingaiah, G. Garagesha, B. Pant and K. Ramachandra, ‘Experimental Stress Analysis’, Tata McGraw-Hill, New Delhi, **1984**.

REFERENCES

1. J.W. Dally and W.F. Riley, ‘Experimental Stress Analysis’, 4th Edn., McGraw-Hill Inc., New York, **2005**.
2. M. Hetyenyi, ‘Hand book of Experimental Stress Analysis’, John Wiley and Sons Inc., New York, **1972**.

3. A.A. Pollock, 'Acoustic Emission in Acoustics and Vibration Progress', Ed. R.W.B. Stephens, Chapman and Hall, **1993.**

COMPUTATIONAL FLUID DYNAMICS

Subject Code: BAEE2-625 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

Unit-I

INTRODUCTION: Insight into power and philosophy of CFD. CFD ideas to understand. CFD application. Need for parallel computers for CFD algorithms. Models of flows. Substantial derivative, Divergence of velocity

GOVERNING EQUATIONS: Continuity, Momentum and Energy equations; derivation in various forms. Integral versus Differential form of equations. Comments on governing equations. Physical boundary conditions. Forms of the governing equations particularly suited for CFD work: Shock fitting and Shock capturing methods. Generic form of equations.

Unit-II

MATHEMATICAL BEHAVIUOR OF PARTIAL DIFFERENTIAL EQUATIONS: THE IMPACT ON CFD: Classification of partial differential equations. Cramer rule and Eigen value method. Hyperbolic, parabolic and elliptic forms of equations. Impact on physical and computational fluid dynamics; case studies: steady inviscid supersonic flow; unsteady invisid flow; steady boundary layer flow; and unsteady thermal conduction.

Unit-III

DISCRETIZATION: Essence of discretization. Taylor series approach for the construction of finite-difference quotients. Higher order difference quotients. Up-wind differencing. Midpoint leap frog method. Reflection boundary condition. Difference equations. Explicit and Implicit approach: definition and contrasts. Errors and analysis of stability. Error propagation. Stability properties of Explicit and Implicit methods.

GRID GENERATION: Body –fitted coordinate system. Need for grid generation. Essential properties of grids. Types of grids (O-type, C-type and H-type). Various grid generation techniques - Algebraic, and Numerical grid generation. Elliptic grid generation. Structured, Un-structured grids, Adaptive grids, Grid collapse. Multi-Grid methods. Grid accuracies.

Unit-IV

APPROPRIATE TRANSFORMATION: General transformation of equations. Metrics and Jacobians. Generic form of the governing flow equations with strong conservative form in the transformed space. Transformation of continuity equation from physical plane into computational plane; application of Grids stretching.

FINITE VOLUME TECHNIQUES: Finite Volume Discretization - Cell Centered Formulation. High resolution finite volume upwind Scheme. Runge – Kutta Time Stepping. Multi - Time –Step Integration scheme. Cell Vertex Formulation. Numerical dispersion.

CFD APPLICATION TO SOME PROBLEMS: Time and space marching. LAX-WENDROFF Technique. Relaxation technique. Point iterative method. Successive over relaxation/ under relaxation. Aspects of numerical dissipation and dispersion; artificial viscosity. The Alternating-Direction- (ADI) Implicit Technique. Approximate factorization scheme. Upwind schemes; Flux vector splitting.

RECOMMENDED BOOKS:

1. John D. Anderson Jr., 'Computational Fluid Dynamics - The Basics with Applications`, McGraw Hill International Edn, **1995**.
2. Tapan K. Sengupta, `Fundamentals of Computational Fluid Dynamics`, Universities Press (India) Private Limited, **2005**.

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REFERENCES BOOKS:

1. F. Wendt, 'Computational Fluid Dynamics - An Introduction', Springer – Verlag, Berlin, **1992**.
2. Charles Hirsch, 'Numerical Computation of Internal and External Flows', Vols. I, II, John Wiley & Sons, New York, **1988**.
3. Jiyuan Tu, Guan Heng Yeoh, and Chaoqun Liu, `Computational Fluid Dynamics - A Practical Approach`, Elsevier Inc., **2008**.

FLIGHT DYNAMICS-II

Subject Code: BAEE2-626 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

Unit-I

CRUISING FLIGHT PERFORMANCE: International Standard Atmosphere - Forces and moments acting on a flight vehicle - Equation of motion of a rigid flight vehicle - Different types of drag –estimation of parasite drag co-efficient by proper area method- Drag polar of vehicles from low speed to high speeds - Variation of thrust, power with velocity and altitudes for air breathing engines. Performance of airplane in level flight - Power available and power required curves. Maximum speed in level flight - Conditions for minimum drag and power required

Unit-II

MANOEUVERING FLIGHT PERFORMANCE: Range and endurance - Climbing and gliding flight (Maximum rate of climb and steepest angle of climb, minimum rate of sink and shallowest angle of glide) -Turning performance (Turning rate turn radius). Bank angle and load factor – limitations on turn - V-n diagram and load factor.

Unit-III

STATIC LONGITUDINAL STABILITY: Degree of freedom of rigid bodies in space - Static and dynamic stability - Purpose of controls in airplanes -Inherently stable and marginal stable airplanes – Static, Longitudinal stability - Stick fixed stability - Basic equilibrium equation - Stability criterion - Effects of fuselage and nacelle - Influence of CG location - Power effects - Stick fixed neutral point - Stick free stability-Hinge moment coefficient - Stick free neutral points-Symmetric manoeuvres - Stick force gradients - Stick _ force per 'g' - Aerodynamic balancing.

Unit-IV

LATERAL AND DIRECTIONAL STABILITY: Dihedral effect - Lateral control - Coupling between rolling and yawing moments – Adverse yaw effects - Aileron reversal - Static directional stability - Weather cocking effect – Rudder requirements - One engine inoperative condition - Rudder lock.

DYNAMIC STABILITY: Introduction to dynamic longitudinal stability: - Modes of stability, effect of freeing the stick - Brief description of lateral and directional. Dynamic stability - Spiral, divergence, Dutch roll, auto rotation and spin.

RECOMMENDED BOOKS

1. C.D. Perkins, and R.E. Hage, 'Airplane Performance stability and Control', John Wiley & Son., Inc, NY, **1988**.
2. R.C. Nelson, 'Flight Stability and Automatic Control', McGraw-Hill Book Co., **2004**.
3. Mc Cornick. W., 'Aerodynamics, Aeronautics and Flight Mechanics', John Wiley, NY, **1979**.

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REFERENCES

1. B. Etkin, 'Dynamics of Flight Stability and Control', 2nd Edn., John Wiley, NY, **1982**.
2. A.W. Babister, 'Aircraft Dynamic Stability and Response', Pergamon Press, Oxford, **1980**.
3. D.O. Dommasch, S.S. Sherby and T.F. Connolly, 'Aeroplane Aero Dynamics', 3rd Edn., Issac Pitman, London, **1981**.
4. B.W. Mc Cornick, 'Aerodynamics, Aeronautics and Flight Mechanics', John Wiley, NY, **1995**.

AVIONICS

Subject Code: BAEE2-627	**L T P C** **3 1 0 4**	**Duration: 45 Hrs.**

Unit-I

AVIONICS TECHNOLOGY: Processors, Memory Devices, Digital Data Buses –MIL-STD-1553B, ARINC 429, ARINC 629, Fiber Optic Buses, LRU architecture for avionics packaging, software, environmental effects, difference in avionics architecture of commercial and military aircraft.

Unit-II

SENSORS: Air Data Sensing – Use of pitot static probe, static probe to derive air data indications; Role of Air Data Computer (ADC), Magnetic Sensing – Magnetic Heading Reference System (MHRS), Inertial Sensing – Position Gyros, Rate Gyros, Accelerometers, Radar Sensing – Radar Altimeter (RADALT), Doppler Radar, Weather Radar.

Unit-III

DISPLAY: Comparison of earlier flight deck (Electromechanical type instruments) to modern flight deck (glass fight deck), Cathode Ray Tube (CRT), Active Matrix Liquid Crystal Display (AMLCD), Head Down Display (HDD), Head Up Display (HUD), Helmet Mounted Display (HMD), Integrated Standby Instrument System (ISIS).

Unit-IV

COMMUNICATION: HF, U/VHF, Satellite Communication, Air Traffic Control (ATC) Transponder, Traffic Collision & Avoidance System (TCAS), Identification of Friend & Foe (IFF).

NAVIGATION: Automatic Direction Finding, Very High Frequency Omni-Range (VOR), Distance Measuring Equipment (DME), Tactical Air Navigation (TACAN), VORTAC (VOR+TACAN) Satellite Navigation System-Global Positioning System (GPS), Differential GPS Instrument Landing System (ILS), Transponder Landing System (TLS), Microwave Landing System (MLS), Astronavigation.

AUTOMATIC FLIGHT CONTROL SYSTEM: Longitudinal, Lateral & Direction Autopilot.

Recommended Books:

1. Ian Moir, Allan Seabridge, 'Civil Avionics Systems', AIAA Education Series.
2. Ian Moir & Allan Seabridge, 'Aircraft System', John Wiley.
3. T.K. Eismin, 'Aircraft Electricity & Electronics', Macmillan.

MRSPTU

THEORY OF ELASTICITY

Subject Code: BAEE2-656 **L T P C** **Duration: 34 Hrs.**
3 0 0 3

Unit-I

2-D PROBLEMS IN RECTANGULAR COORDINATES: Solution by polynomials, bending of cantilever loaded at end, bending of beam by uniform load, Symmetrical stress distribution.

2-D PROBLEMS IN POLAR COORDINATES: Pure bending of curved bars, Strain components in polar coordinates, General equations in polar coordinates, Displacements for symmetrical stress distributions, rotating disks, Bending of curved bar by a force at the end, Effect of circular holes on stress distribution in plates.

Unit-II

PHOTOELASTICITY: Photoelastic stress measurement, Circular polariscope, Photoelastic stress determination, determination of principal stresses, 3-D Photoelasticiy.

Unit-III

3-D STRESS-STRAIN ANALYSIS: Introduction, Stress ellipsoid and stress-director surface, Determination of principal stresses, Stress invariants, Determination of maximum shearing stresses, Homogeneous deformation, Strain at a point, Principal axes of strain, Rotation.

3-D PROBLEMS OF ELASTICITY: Uniform stress, stretching of prismatic bar, Twist of circular shafts, Pure bending of prismatic bars and plates.

Unit-IV

TORSION: Torsion of straight bars, elliptic cross section and other elementary solutions, Membrane analogy, Torsion of bar with narrow rectangular cross section, Torsion of rectangular bars, Torsion of rolled profile sections, Torsion of hollow shafts, Torsion of thin tubes, Torsion of circular shafts of variable diameter.

Recommended Books:

1. S.P. Timoshenko & J.N. Goodier, 'Theory of Elasticity', McGraw Hill.
2. T.H.G. Megson, 'Aircraft Structures for Engineering Students', Elsevier.
3. A.E.H. Love, 'Theoretical Elasticity'.

MRSPTU

HELICOPTER ENGINEERING

Subject Code: BAEE2-657 **L T P C** **Duration: 34 Hrs.**
3 0 0 3

Unit-I

Theory of Flight: Rotary Wing Aerodynamics: Terminology; Effects of gyroscopic precession; Torque reaction and directional control; Dissymmetry of lift, Blade tip stall; Translating tendency and its correction; Coriolis effect and compensation; Vortex ring state, power settling, overpitching; Auto-rotation; Ground effect.

Unit-II

Flight Control Systems: Cyclic control; Collective control; Swashplate; Yaw control: Anti-Torque Control, Tail rotor, bleed air; Main Rotor Head: Design and Operation features; Blade Dampers: Function and construction; Rotor Blades: Main and tail rotor blade construction and attachment; Trim control, fixed and adjustable stabilisers; System operation: manual, hydraulic, electrical and flyby-wire; Artificial feel; Balancing and Rigging.

Unit-III

Blade Tracking and Vibration Analysis: Rotor alignment; Main and tail rotor tracking; Static and dynamic balancing; Vibration types, vibration reduction methods; Ground resonance

Transmissions: Gear boxes, main and tail rotors; Clutches, free wheel units and rotor brake. Tail rotor drive shafts, flexible couplings, bearings, vibration dampers and bearing Hangers

Unit-IV

Helicopter Structures: Airworthiness requirements for structural strength; Structural classification, primary, secondary and tertiary, fail safe, safe life, damage tolerance concepts; Zonal and station identification systems; Stress, strain, bending, compression, shear, torsion, tension, hoop stress, fatigue; Drains and ventilation provisions; System installation provisions; Lightning strike protection provision. Construction methods of: stressed skin fuselage, formers, stringers, longerons, bulkheads, frames, doublers, struts, ties, beams, floor structures, reinforcement, and methods of skinning and anti-corrosive protection. Pylon, stabiliser and undercarriage attachments

Recommended Books:

1. A.R.S. Bramwell, 'Helicopter Dynamics', John Wiley and Sons.
2. Lalit Gupta, 'Helicopter Engineering', Himalayan Publishers.
3. Jacob Shapiro, 'Principles of Helicopter Engineering', McGraw Hill.
4. M.E. Drier, 'Introduction to Helicopter and Tilt Rotor Flight Simulation', AIAAA Education Series.

MRSPTU

AEROELASTICITY

Subject Code: BAEE2-658 **L T P C** **Duration: 34 Hrs.**
3 0 0 3

Unit-I

INTRODUCTION: Definition and historical background, Static and dynamic aero elastic phenomenon, Integration of aerodynamic, elastic and inertia forces, Influence of aero elastic phenomenon on aircraft design, Comparison of critical speeds.

DIVERGENCE OF LIFTING SURFACE: The phenomenon of divergence, divergence of 2-D wing section, divergence of an idealized cantilever wing, Solution based on semi-rigid assumptions, Solution in generalized co-ordinates, Method of successive approximation, use of Numerical Methods.

Unit-II

STEADY STATE AERO-ELASTICITY PROBLEMS IN GENERAL: Loss and reversal of aileron Control, 2-D case, aileron reversal general case, Lift distribution on a rigid and elastic wing, Effect on Static Longitudinal stability of airplane.

Unit-III

INTRODUCTION TO FLUTTER AND BUFFETING: The phenomenon of flutter, flutter of a cantilever wing, approximate determination of critical speed by Galerkin's Method, Introduction to buffeting and stall flutter.

Unit-IV

NON-AERONAUTICAL PROBLEMS: Some typical example in civil engineering, Flow around an oscillating circular cylinder, applications to H-shaped sections, Prevention of aero-elastic instabilities.

Recommended Books:
1. Y.C. Fung, 'An Introduction to the Theory of Aero Alasticity', Dover Publications.
2. R.L. Bisplinghoff, Holt Ashley, R.L. Halfman, 'Aero Elasticity', Addison –Wesley Publishing Co. Reading Mass.
3. T.H.C. Megson, 'Aircraft Structures for Engineering Students', Elsevier.

CAD/CAM LAB.

Subject Code: BAEE2-628 **L T P C**
0 0 2 1

LIST OF EXPERIMENTS
1. Design and Modelling of rectangular plate with hole.
2. Design and Modelling of spar components.
3. Design and Modelling of Aerofoil structures.
4. Design and Modelling of cut section for wings.
5. Design and Modelling of Machine component.
6. Design and Modelling of Machine components.
7. Design and Analysis of a Truss.
8. Design and Analysis of Beam distributed load.
9. Facing.
10. Turning (Taper, Step)

MRSPTU

AIRCRAFT DESIGN

Subject Code: BAEE2-629 **L T P C**
0 0 2 1

LIST OF EXPERIMENTS
1. Comparative configuration study of different types of airplanes
2. Comparative study on specification and performance details of aircraft
3. Preparation of comparative data sheets
4. Work sheet layout procedures
5. Comparative graphs preparation and selection of main parameters for the design
6. Preliminary weight estimations, selection of main parameters,
7. Power plant selection, Aerofoil selection, Wing tail and control surfaces
8. Preparation of layouts of balance diagram and three view drawings
9. Drag estimation
10. Detailed performance calculations and stability estimates

MECHANICS OF COMPOSITE MATERIALS

Subject Code: BAEE2-730 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

Unit-I

Introduction to Composite Materials: Classification of composites, particulate composites, fibrous composites. Use of fiber reinforced composites; Fibers, matrices and manufacture of composites; properties of various type of fibers like glass, Kevlar, Carbon and Graphite, Methods of manufacture, surface treatment of fibers, various forms of fibers, matrix materials, polymers: Thermosetting and thermoplastic polymers, properties of polymers like epoxies, phenolics, polyester peek etc.

Unit-II

Manufacture of Composites: Hand layup technique, pressure bag and vacuum bag moulding techniques, puftrusion, resin-transfer moulding, injection moulding, Bulk moulding compound, sheet moulding compound. Application of composites in Aircraft Industry.

Behavior of Unidirectional Composites: Volume traction, weight traction, density of composites, Micromechanics approach, longitudinal strength and stiffness factors affecting longitudinal strength and stiffness, Transverse strength and stiffness, shear modulus and strength, Poisson's ratio, effect of fiber dimension and distribution on strength and stiffness, Halpin-Tsai equations.

Unit-III

Analysis and Strength of an Orthotropic Lamina: Strain relations and engineering constants, relation between engineering constants and stiffness coefficients, strength of an orthotropic lamina, failure theories, Analysis of laminated composites, laminate orientation code, stress and strain variation in a laminate, properties of symmetric, cross ply angle-ply and quasi isotropic analysis of laminate after initial failure, hygrothermal behaviour of laminates. Thermal and moisture expansion coefficients, transports properties, mass diffusion. Short fiber composites: approximate analysis of stress transfer, average fiber stress, modules and strength of short composites.

Unit-IV

Maintenance of Composites: Assessment and Repair – Classification of damage, Inspection Methodology, Repair operation, Repair procedures. Types of Repairs – Repair failures, typical repair procedures, Delaminations, Damage to laminate structures, Repair to sandwich structures, Repair to Honycomb structures, lightning protection, painting the composite part, Quality control.

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RECOMMENDED BOOKS

1. R.M. Jones, 'Mechanics of Composite Materials', Technomic Publication.
2. B.D. Agarwal and L.J. Broutman, 'Analysis and Performance of Fiber Composites', John Wiley & Sons.

REFERENCE BOOKS

1. R.F. Gibson, 'Principles of Composite Material Mechanics', McGraw Hill International Edition, **2004.**
2. Lalit Gupta, 'Advance Composite Materials', Himalyans Books, New Delhi**, 1998.**
3. Joppesen, 'Advance Composites'.

AEROSPACE QUALITY ASSURANCE

Subject Code: BAEE2-731 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

Unit-I

QUALITY CONCEPTS: Concepts and definition, design specifications, manufacture in conformance with design applications, role of quality assurance during usage of aircraft.

QUALITY ASSURANCE DURING OVERHAUL: Quality assurance during overall / repair of aircraft and its aggregates, concession and deviations. Production permits.

QUALITY CONTROL: Units of measure, measuring actual performance. Continuous process regulation. Strategic quality management. Role of quality director. Quality culture.

Unit-II

PROBABILITY CONCEPTS: Concept of variation. Quantitative methods of summarizing data. Normal curve, Exponential Probability distribution. Weibull probability distribution.

Poisson distribution. Binomial distribution. Scope for data analysis. Sample size. Regression analysis.

DESIGNING FOR QUALITY: Early warning concepts and design assurance. Designing for basic function requirements. Design for Time- Oriented performance. Designing for safety. Designing for maintainability.

Unit-III

MANUFACTURE & RELIABILITY PREDICTION: Initial planning for qualities. Failure patterns. Predicting reliability during design. Exponential formula. Setting specification limits. Process quality audits. Self-inspection.

INSPECTION, TEST & MEASUREMENTS: Sampling risk. Analysis of some rule to thumb. Sampling plot. Evaluation of parameters affecting field performance. Acceptance sampling plan. Feedback. Field data.

Unit-IV

QUALITY AND AIRWORTHINESS ASSURANCE: Zero defect analogy, FMECA, Fault Tree Analysis, bench marking, quality circles, quality audit. Quality standards ISO 9000, TQM, CMM, Six Sigma. Quality organizational set up in production / repair / operational set up.

RECOMMENDED BOOKS:

1. J.M. Juran, Frank M. Gryna, `Quality Planning and Analysis`, TMH Publications, **2005.**

REFERENCE BOOKS:

1. M. Fox, `Quality Assurance Management`, McGraw Hill Publications.
2. Oalela, `ISO 9000 A, Manual for TQM`, Pargaman Publishers.
3. S.C. Keshu and K.K. Ganapathi, `Aircraft Production Technology and Management`, Interline Publishers, **1993**

MRSPTU

FINITE ELEMENT METHODS

Subject Code: BAEE2-732 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

Unit-I

Introduction to FEM and its Applicability, Review of Mathematics: Matrix algebra, Gauss elimination method, Uniqueness of solution, banded symmetric matrix and bandwidth.

Structure Analysis: Two-force member element, Local stiffness matrix, coordinate transformation, Assembly, Global stiffness matrix, imposition of Boundary conditions, Properties of stiffness matrix.

Unit-II

One-dimensional Finite Element Analysis: Basics of structural mechanics, stress and strain tensor, constitutive relation, Principle of minimum Potential, General steps of FEM, Finite element model concept /Discretization, Derivation of finite elements equations using potential energy approach for linear and quadratic, 1-D bar element and beam element, shape functions and their properties, Assembly, Boundary conditions, Computation of stress and strain.

Unit-III

Two Dimensional Finite Element Analysis: Finite element formulation using three nodded triangular (CST) element and four nodded rectangular elements, Plane stress and Plain strain problems, Shape functions, node numbering and connectivity, Assembly, Boundary conditions, Isoparametric formulation of 1-D bar elements, Numerical integration using gauss quadrature formula, computation of stress and strain.

Finite Element Formulation from Governing Differential Equation: Method of Weighted Residuals, Collocation, Sub domain method, Least Square method and Galerkin's method, Application to one dimensional problems, one-dimensional heat transfer, etc. introduction to variation formulation (Ritz Method.)

Unit-IV

Higher Order Elements: Lagrange's interpolation formula for one and two independent variables, Convergence of solution, compatibility, element continuity, static condensation, p and h methods of mesh refinement, Aspect ratio and element shape, Application of FEM, Advantages of FEM, Introduction to concept of element mass matrix and Damping matrix in dynamic analysis, Calculation of natural frequencies and modes.

RECOMMENDED BOOKS

1. P. Seshu, 'Text Book of Finite Element Analysis', Prentice Hall India.
2. K.J. Bathe, 'Finite Element Procedure in Engineering Analysis', Prentice Hall India.

REFERENCE BOOKS

1. J.N. Reddy, 'An Introduction to the Finite Element Method', Tata McGraw-Hill, New Delhi, **2005.**
2. Cook, Malkus, Plesha and Witt, 'Concepts & Applications of Finite Element Analysis', Willey India, New Delhi, **2007.**
3. Chandupatla and Belegundu, 'Introduction to Finite Elements in Engineering', Prentice Hall India.

SPACE MECHANICS

Subject Code: BAEE2-759 **L T P C** **Duration: 34 Hrs.**

3 0 0 3

MRSPTU

Unit-I

BASIC CONCEPTS: The Solar System – References Frames and Coordinate Systems – The Celestial Sphere– The Ecliptic – Motion of Vernal Equinox – Sidereal Time – Solar Time – Standard Time – The Earth's Atmosphere.

THE GENERAL N-BODY PROBLEM: The many body Problem – Lagrange – Jacobian Identity –The Circular Restricted Three Body Problem – Libration Points- Relative Motion in the N-body Problem –Two –Body Problem – Satellite Orbits – Relations Between Position and Time – Orbital Elements.

Unit-II

SATELLITE INJECTION AND SATELLITE ORBIT PERTURBATIONS: General Aspects of satellite Injections – Satellite Orbit Transfer –Various Cases – Orbit Deviations Due to Injection Errors – Special and General Perturbations – Cowell's Method– Encke's Method – Method of vibrations of Orbital Elements – General Perturbations Approach.

Unit-III

INTERPLANETARY TRAJECTORIES: Two Dimensional Interplanetary Trajectories – Fast Interplanetary Trajectories – Three Dimensional Interplanetary Trajectories – Launch if Interplanetary Spacecraft –Trajectory about the Target Planet.

Unit-IV

BALLISTIC MISSILE TRAJECTORIES AND MATERIALS: The Boost Phase – The Ballistic Phase –Trajectory Geometry- Optimal Flights – Time of Flight – Re – entry Phase – The Position of the Impact Point – Influence Coefficients. Space Environment – Peculiarities – Effect of Space Environment on the Selection of Spacecraft Material.

RECOMMENDED BOOKS

1. J.W. Cornelisse, 'Rocket Propulsion and Space Dynamic', W.H. Freeman & Co., **1984**.

REFERENCES

1. G.P. Sutton, 'Rocket Propulsion Elements', John Wiley, **1993**.

2. P. Van de Kamp, 'Elements of Astro-Mechanics', Pitman, **1979**.
3. E.R. Parker, 'Materials for Missiles and Spacecraft', McGraw-Hill Book Co. Inc., **1982**.

GUIDANCE AND NAVIGATION

Subject Code: BAEE2-760 **L T P C** **Duration: 34 Hrs.**
3 0 0 3

Unit-I

INTRODUCTION: Concepts of navigation, guidance and control. Introduction to basic principles. Air data information.

RADAR SYSTEMS: Principle of working of radar. MTI and Pulse Doppler radar. Moving target detector. Limitation of MTI performance. MTI from a moving platform (AMTI).

TRACKING WITH RADAR: Mono pulse tracking. Conical scan and sequential lobbing. Automatic tracking with surveillance radar (ADT).

Unit-II

OTHER GUIDANCE SYSTEMS: Gyros and stabilised platforms. Inertial guidance and Laser based guidance. Components of Inertial Navigation System. Imaging Infrared guidance. Satellite navigation. GPS.

TRANSFER FUNCTIONS: Input-output Transfer function. Basic altitude reference. Concepts of Open loop and Close Loop.

Unit-III

MISSILE CONTROL SYSTEM: Guided missile concept. Roll stabilisation. Control of aerodynamic missile. Missile parameters for dynamic analysis. Missile autopilot schematics. Acceleration command and root locus.

MISSILE GUIDANCE: Proportional navigation guidance; command guidance. Comparison of guidance system performance. Bank to turn missile guidance.

Unit-IV

INTEGRATED FLIGHT/FIRE CONTROL SYSTEM: Director fire control system. Tracking control laws. Longitudinal flight control system. Lateral flight control system. Rate of change of Euler angle, Auto Pilot.

RECOMMENDED BOOKS:

1. Merrilh I. Skolnik, `Introduction to Radar Systems`, 3rd Edn., Tata McGraw Hill, **2001**.
2. John H. Blakelock, `Automatic Control of Aircraft & Missiles`, 2nd Edn., Wiley–Inter Science Publication, **1990**.

REFERENCE BOOKS:

1. R.B. Underdown & Tony Palmer, `Navigation`, Black Well Publishing, **2001.**

APPLIED GAS DYNAMICS

Subject Code: BAEE2-761 **L T P C** **Duration: 34 Hrs.**
3 0 0 3

Unit-I

ONE DIMENSIONAL COMPRESSIBLE FLOW: Basic equations of compressible flow. Steady one-dimensional flow. Discharge from reservoir. De Laval Nozzle. Flow through converging, diverging passages; Performance under various back pressures. Diffusers. Dynamic head measurements in compressible flow.

NORMAL, OBLIQUE SHOCKS AND EXPANSION WAVES: Governing Equations of Normal Shock Wave. Prandtl relation and Rankine - Hugoniot equation. Oblique shocks and corresponding relations. Shock polar & Hodograph plane. Supersonic flow over a wedge.

Supersonic compression and supersonic expansion. Detached shocks. Mach reflection. Intersection of waves of same and opposite families. Introduction to the Method of Characteristic.

Unit-II

FANNO FLOW: Flow with friction in constant area duct. Fanno lines. Fanno equation. Definition of friction constant, Friction loss. Effect of wall friction on flow properties. Friction parameter. Local flow properties in terms of local Mach number.

RAYLEIGH FLOW: Flow with heating or cooling in ducts. Governing equations. Heating relations for a perfect gas. Slope of Rayleigh line. Entropy considerations. Maximum heat transfer.

Unit-III

DIFFERENTIAL EQUATIONS OF MOTION FOR STEADY COMPRESSIBLE FLOWS: Basic potential equations for compressible flow. Linearization of potential equation-small perturbation theory. Methods for solution of nonlinear potential equation -Introduction. Boundary conditions. Pressure coefficient expression.

Unit-IV

SIMILARITY RULES: Two-dimensional flow. Prandtl - Glauert rule for subsonic and supersonic flow. Von-Karman rule for transonic flow. Gothert rules. Application to wings of finite span. Aerodynamic characteristics for actual and transformed bodies. Effect of thickness and camber. Lift and drag divergence. Shock induced flow separation. Prandtl – Meyer expansion fan. Lift, drag, pitching moment and center of pressure of supersonic profiles.

FLOW OF REAL FLUIDS: Shock Wave – Boundary layer interaction. Experimental characteristics of airfoils in compressible flow. Nature of pressure distribution.

MEASUREMENTS IN COMPRESSIBLE FLOW: High Speed Wind tunnels: In-draft, Induction, Continuous and Shock tubes. Optical methods of flow visualization. Wind tunnel Instrumentation and measurements.

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RECOMMENDED BOOKS:

1. E. Rathakrishnan, 'Gas Dynamics', Prentice Hall of India, **1995**.
2. S.M. Yahya, 'Fundamentals of Compressible Flow', Wiley Eastern, **2003**.

REFERENCE BOOKS:

1. John D. Anderson, 'Modern Compressible Flow', McGraw Hill, **1999**.

EXPERIMENTAL AERODYNAMICS

Subject Code: BAEE2-862	**L T P C** **3 0 0 3**	**Duration: 34 Hrs.**

Unit-I

WIND TUNNEL TESTING: Low speed wind tunnels-estimation of energy ratio and power required supersonic wind tunnels-calculation of running time and storage tank requirements.

Unit-II

EXPERIMENTS IN SUBSONIC WIND TUNNELS: Estimation of flow angularity and turbulence factor-calculation of CL and CD on aero foils from pressure distribution- CD from wake Survey-Test section average velocity using traversing rakes-span wise load distribution for different taper ratios of wing

Unit-III

EXPERIMENTS IN HIGH SPEED TUNNELS: Mach number estimation in test section by pressure measurement and using a wedge – preliminary estimates of blowing and running pressures, nozzle area ratios, and mass flow for a given test section size and Mach number-starting problem and starting loads.

Unit-IV

MEASUREMENT TECHNIQUES: Hot wire anemometer and laser Doppler anemometer for turbulence and velocity Measurements-Use of thermocouples and pyrometers for measurement of static and total Temperatures-Use of pressure transducers, Rotameters and ultrasonic flow meters.

SPECIAL PROBLEMS: Pitot-static tube correction for subsonic and supersonic Mach numbers-boundary layer velocity profile on a flat plate by momentum-integral method -Calculation of CD from wall shear Stress-Heating requirements in hypersonic wind Tunnels-Re-entry problems.

Recommended Books:

1. W.H. Rae and A. Pope, 'Low Speed Wind Tunnel Testing', John Wiley Publication, **1984.**
2. A. Pope and L. Goin, 'High Speed Wind Tunnel Testing', John Wiley, **1985.**
3. E. Rathakrishnan, 'Instrumentation, Measurement and Experiments in Fluids', CRC Press, London, **2007.**

ROCKET AND MISSILES

Subject Code: BAEE2-863 **L T P C** **Duration: 34 Hrs.**
3 0 0 3

Unit-I

ROCKET MOTION IN FREE SPACE AND GRAVITATIONAL FIELD: One Dimensional and Two Dimensional rocket Motions in Free Space and Homogeneous Gravitational Fields – description of Vertical, Inclined and Gravity Turn Trajectories – Determination of range and Altitude Simple Approximations to Burnout Velocity.

Unit-II

STAGING AND CONTROL OF ROCKETS AND MISSILES: Multistaging of rockets – Vehicle Optimization – Stage Separation Dynamics – Separation Techniques. Rocket Thrust Vector Control Methods.

Unit-III

AERODYNAMICS OF ROCKETS AND MISSILES: Airframe Components of Rockets and Missiles – Forces Acting on a Missile While Passing Through Atmosphere – Classification of Missiles – methods of Describing Aerodynamic Forces and Moments – Lateral Aerodynamic Moment – Lateral Damping Moment and Longitudinal Moment of a Rocket – lift and Drag Forces – Drag Estimation.

Unit-IV

ROCKET PROPULSION SYSTEMS: Ignition System in rockets – types of Igniters – Igniter Design Considerations – Design Consideration of liquid Rocket Combustion Chamber, Injector Propellant Feed Lines, Valves, Propellant Tanks Outlet and Helium Pressurized and Turbine Feed Systems – Propellant Slash and Propellant Hammer – Elimination of Geysering Effect in Missiles –

Combustion System of Solid Rockets.

MATERIALS FOR ROCKETS AND MISSILES: Selection of Materials – Special Requirements of Materials to Perform under Adverse Conditions.

RECOMMENDED BOOKS

1. G.P. Sutton, et al., 'Rocket Propulsion Elements', John Wiley & Sons Inc., New York, **1993**.

REFERENCES

1. M. Mathur and R.P. Sharma, 'Gas Turbines and Jet and Rocket Propulsion', Standard Publishers, New Delhi, **1998**.

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2. J.W. Cornelisse, 'Rocket Propulsion and Space Dynamics', J.W., Freeman & Co. Ltd., London, **1982**.
3. E.R. Parker, 'Materials for Missiles and Spacecraft', McGraw-Hill Book Co. Inc., **1982**.

AERO ENGINE MAINTENANCE & REPAIR

Subject Code: BAEE2-864 **L T P C** **Duration: 34 Hrs.**
3 0 0 3

Unit-I

CLASSIFICATION OF PISTON ENGINE COMPONENTS: Types of piston engines – Principles of operation – Function of components – Materials used – Details of starting the engines – Details of carburetion and injection systems for small and large engines – Ignition system components – Spark plug details – Engine operating conditions at various altitudes – Maintenance and inspection check to be carried out.

Unit-II

INSPECTIONS OF PISTON ENGINES: Inspection and maintenance and troubleshooting – Inspection of all engine components – Daily and routine checks – Overhaul procedures – Compression testing of cylinders – Special inspection schedules – Engine fuel, control and exhaust systems – Engine mount and super charger – Checks and inspection procedures.

OVERHAULING OF PISTON ENGINES: Symptoms of failure – Fault diagnostics – Case studies of different engine systems – l: Tools and equipment requirements for various checks and alignment during overhauling – Tools for inspection – Tools for safety and for visual inspection – Methods and instruments for non-destructive testing techniques – Equipment for replacement of part and their repair. Engine testing: Engine testing procedures and schedule preparation – Online maintenance.

Unit-III

CLASSIFICATION OF JET ENGINE COMPONENTS: Types of jet engines – Principles of operation – Functions of components – Materials used – Details of starting and operating procedures – Gas turbine engine inspection & checks –Use of instruments for online maintenance – Special inspection procedures: Foreign Object Damage – Blade damage – etc. Maintenance procedures of gas turbine engines – Trouble shooting and rectification procedures – Component maintenance procedures – Systems maintenance procedures. Gas turbine testing procedures – test schedule preparation – Storage of Engines – Preservation and de-preservation procedures.

Unit-IV

OVERHAUL PROCEDURES: Engine Overhaul procedures – Inspections and cleaning of components – Repairs schedules for overhaul – Balancing of Gas turbine components. Trouble Shooting - Procedures for rectification – Condition monitoring of the engine on ground and at altitude – engine health monitoring and corrective methods.

RECOMMENDED BOOKS

1. Kroes & Wild, 'Aircraft Power Plants', 7th Edn., McGraw Hill, New York, **1994**.

REFERENCES

1. Turbomeca, 'Gas Turbine Engines', The English Book Store, New Delhi, **1993**.
2. Pratt & Whitney, 'The Aircraft Gas Turbine Engine and its Operation', The English Book Store, New Delhi.

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B. TECH. ELECTRONICS & INSTRUMENTATION ENGINEERING

Total Contact Hours = 30 **Total Marks = 900** **Total Credits = 25**

SEMESTER 3rd		Contact Hrs			Marks			Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
BMAT0-F91	Mathematics -III	3	1	0	40	60	100	4
BECE1-301/ BECE2-301/ BECE3-301	Electronic Devices and Circuits - I	3	1	0	40	60	100	4
BECE1-303/ BECE2-303/ BECE3-302	Digital Electronics	3	1	0	40	60	100	4
BECE3-303	Electrical Measurements & Instruments	3	1	0	40	60	100	4
BECE1-302/ BECE2-302/ BECE3-304	Network Analysis & Synthesis	3	1	0	40	60	100	4
BECE1-305/ BECE2-305/ BECE3-305	Electronic Devices and Circuits - I Lab.	0	0	2	60	40	100	1
BECE1-306/ BECE2-306/ BECE3-306	Digital Electronics Lab.	0	0	2	60	40	100	1
BSOS0-F91	Soft Skills -I	0	0	2	60	40	100	1
BECE3-307	Training -I	0	0	4	60	40	100	2
Total	**Total 5 Theory & 3 Lab. Courses**	**15**	**5**	**10**	**440**	**460**	**900**	**25**

Total Contact Hours = 27 Total Marks = 900 Total Credits = 23

SEMESTER 4th		Contact Hrs			Marks			Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
BECE3-408	Linear Control System	3	1	0	40	60	100	4
BECE3-409	Transducers & Sensors	3	1	0	40	60	100	4
BECE3-410	Electrical and Electronics Instrumentation	3	1	0	40	60	100	4
BECE3-411	Microprocessors & Peripheral Devices	3	1	0	40	60	100	4
Departmental Elective-I (Select any one)		3	0	0	40	60	100	3
BECE1-456/ BECE2-456/ BECE3-456	Antenna &Wave Propagation							
BECE1-457/ BECE2-457/ BECE3-457	Data Structures and Algorithms							
BECE1-458/ BECE2-458/ BECE3-458	Electronic Instrumentation							
BECE1-459/ BECE2-459/ BECE3-459	Reliability Engineering							
BECE3-412	L Control System Lab.	0	0	2	60	40	100	1
BECE3-413	Instrumentation Lab.	0	0	2	60	40	100	1
BECE4-414	Microprocessor Lab	0	0	2	60	40	100	1
BSOS0-F92	Soft Skills -II	0	0	2	60	40	100	1
Total	**Total 5 Theory & 2 Lab. Courses**	**15**	**4**	**8**	**440**	**460**	**900**	**23**

In House / Industrial Training of 6 Weeks during Summer vacations

ENGINEERING MATHEMATICS-III

Subject Code: BMAT0-F91	**L T P C** **3 1 0 4**	**Contact Hrs.- 45**

UNIT-I (13 Hrs.)

Fourier Series: Periodic function, Fourier Seies, Dirichlet's conditions, Fourier series for even and odd functions, Change of interval, Half range Fourier series, Other forms of Fourier series.
Fourier Transforms: Dirichlet's conditions, Fourier integral formula (without proof), Fourier transform, Inverse Theorem for Fourier transform, Fourier sine and cosine transforms and their inversion formulae. Properties of Fourier transform, Convolution theorem of Fourier transforms, Parseval's identity.

UNIT-II (10 Hrs.)

Laplace Transforms: Laplace transforms of various standard functions (Exponential, Algebraic, Sine, Cosine), Properties of Laplace transforms, inverse Laplace transforms, transform of derivatives and integrals, Laplace transform of unit step function, impulse function,
Application of Laplace Transforms: Solution of ordinary linear differential equations with constant coefficients, and simultaneous differential equations.

UNIT-III (12 Hrs.)

Partial Differential Equations: Formation of partial differential equations, Linear partial differential equations, homogeneous partial differential equations with constant coefficients. Classification of partial differential equation.
Applications of PDEs: Wave equation and Heat conduction equation in one dimension.
Two dimensional Laplace equation in Cartesian Coordinates, solution by the method of separation of variables.

UNIT-IV (10 Hrs.)

Functions of Complex Variable: Limits, continuity and derivative of the function of complex variable, Analytic function, Cauchy-Riemann equations, conjugate functions, harmonic functions; Conformal Mapping: Definition, standard transformations, translation, rotation, inversion, bilinear. Complex Integration: Line integrals in the complex plane, Cauchy's theorem, Cauchy's integral formula and derivatives of analytic function. Taylor's and Laurent's expansions (without proofs), singular points, poles, residue, Integration of function of complex variables using the method of residues(Integration Of type $\int_0^{2\pi} F(Cos\theta, Sin\theta)d\theta,\ \ \int_{-\infty}^{\infty} \frac{f(x)}{F(X)} dx$)

Recommended Books:

1. E. Kreyszing, 'Advanced Engineering Mathematics', 8th Edn., John Wiley, New Delhi.
2. B.S. Grewal, 'Higher Engineering Mathematics', Khanna Publishers, New Delhi.
3. Ian N. Sneedon, 'Elements of Partial Differential Equations', McGraw- Hill, Singapore, **1957**.
4. Peter. V. O'Nil, 'Advanced Engineering Mathematics', Wadsworth Publishing Company.
5. H.C. Taneja, 'Engineering Mathematics', Volume-I & II, I.K. Publisher.

ELECTRONIC DEVICES AND CIRCUITS - I

Subject Code: BECE1-301/BECE2-301/ BECE3-301 **L T P C 3 1 0 4** **Duration: 48 Hrs.**

Course Objectives:
This course is meant to provide fundamental knowledge to ECE students for understanding of the basic semi-conductor devices and their behaviour under various conditions.

Learning Outcomes:
Student after undergoing this course student will be able to:

1. Understand the concepts of PN junction diode and their applications
2. Understand BJT characteristics and determine their behavior under low and high frequencies.
3. Understanding of FETs and their characteristics
4. To understand low and high frequency models

UNIT-I (12 Hrs)

Semiconductor Diodes: Semi-conductor materials and their characteristics, PN junction Diode - VI characteristics, qualitative and quantitative analysis of its behaviour, Diode resistance, Transition capacitance and Diffusion capacitance, clippers, clampers, rectifiers. Special purpose diodes - Zener diode, varactor diode, schottky diode.

UNIT-II (12 Hrs)

Bipolar Junction Transistor: BJT – Transistor current components, BJT configurations – CE, CB, CC and their characteristics. Transistor Biasing –Operating point determination, fixed bias, emitter bias, voltage-divider bias. Bias stability – Stabilization against variation in Ico, V_{BE} and β, Bias compensation.

UNIT-III (12 Hrs)

Field-Effect Transistor: The junction FET - construction, operation, characteristics, parameters, Biasing of JFET, Small signal analysis of JFET as an amplifier- common source and common drain amplifiers. Metal Oxide Semiconductor FET: MOSFET- construction, operation, characteristics, parameters, CMOS devices, CMOS inverter characteristics, metal semiconductor.

UNIT-IV (12 Hrs)

Low & High Frequency Transistor Model: Transistor Hybrid Model, h parameter equivalent circuit of transistor, Analysis of transistor amplifier using h-parameters in CB, CE and CC configuration, The high frequency T model, hybrid pi CE transistor model, hybrid pi conductance in terms of low frequency h parameters

Recommended Books

1. Millman, Jacob, Halkias Christos C. and Satyabratajit, ‘Electronic Devices and Circuits’, Tata McGraw- Hill, New Delhi.
2. Boylestad Nashelsky, ‘Electronic Devices and Circuit Theory’, Pearson Education.
3. Floyd, L. Thomas, ‘Electronic Devices’, 6th Edn., Pearson Education, **2002.**
4. Sedra, S. Adel and Smith, Kenneth C., ‘Microelectronic Circuits’, Oxford University Press, New York.
5. Streetman Ben J., Sanjay Banerjee, ‘Solid State Electronic Devices’, PHI.

DIGITAL ELECTRONICS

Subject Code: BECE1-303/BECE2-303/ BECE3-302 **L T P C 3 1 0 4** **Duration: 48 Hrs.**

Learning Objectives

1. To provide knowledge about basics of Digital Electronics.
2. To impart knowledge about designing of digital circuits.
3. Students will use schematics and symbolic Algebra to represent digital gates in the creation of solutions to design problems

Learning Outcomes

1. An ability to understand all types of combinational & sequential digital circuits and their designing.
2. Students will restate and simplify a digital design problem as part of the systematic approach to solving a problem.
3. To understand various sequential circuits & various Digital Logic families
4. Understand Analog to Digital and Digital to Analog converters and finite state machines

UNIT I (12 Hrs.)

Fundamentals of Digital Techniques: Digital signal, logic gates: AND, OR, NOT, NAND, NOR, EX-OR, EX-NOR, Boolean algebra. Review of Number systems. Binary codes: BCD, Excess-3, Gray, EBCDIC, ASCII, Error detection and correction codes.

UNIT II (12 Hrs.)

Combinational Design Using Gates: Design using gates, Karnaugh map and Quine Mcluskey methods of simplification.

Combinational Design Using MSI Devices: Multiplexers and Demultiplexers and their use as logic elements, Decoders, Adders / Subtractors, BCD arithmetic circuits, Encoders, Decoders / Drivers for display devices.

UNIT III (12 Hrs.)

Sequential Circuits: Flip Flops: S-R, J-K, T, D, master-slave, edge triggered, shift registers, sequence generators, Counters, Asynchronous and Synchronous Ring counters and Johnson Counter, Design of Synchronous and Asynchronous sequential circuits.

Digital Logic Families: Switching mode operation of p-n junction, bipolar and MOS. devices. Bipolar logic families: RTL, DTL, DCTL, HTL, TTL, ECL, MOS, and CMOS logic families. Tristate logic, Interfacing of CMOS and TTL families.

UNIT IV (12 Hrs.)

A/D and D/A converters: Sample and hold circuit, weighted resistor and R -2 R ladder D/A Converters, specifications for D/A converters. A/D converters: Quantization, parallel -comparator, successive approximation, counting type, dual-slope ADC, specifications of ADCs.

Programmable Logic Devices: ROM, PLA, PAL, FPGA and CPLDs.

Finite State Machines: Finite state model, Memory elements and their excitation functions, Synthesis of Synchronous sequential circuits, Capabilities and limitations of FSM, Design, Modelling and Simulation of Moore and Mealy machines.

Recommended Books

1. R.P. Jain, 'Modern Digital Electronics', Tata McGraw Hill.
2. Malvino & Leach, 'Digital Principles and Applications', McGraw Hill.
3. Taub & Schilling, 'Digital Integrated Electronics', McGraw Hill.

ELECTRICAL MEASUREMENTS & INSTRUMENTS

Subject Code: BECE3-303 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

Learning Objectives:

1. To aware the students about the basics of Measurements and Instrumentation systems.
2. To impart knowledge about different instruments for electrical parameters.
3. To provide them basic concepts of different types of sensors and transducers.

Learning Outcomes:

1. After the completion of course, students will be having skills to design, analyze and instruments.
2. Gain the skill knowledge of bridges and CRO operations.

UNIT I (12 Hrs.)

Introduction to measuring techniques, Necessity of measurements, block diagram of measurement system, Types of instruments, classification of standards, Fundamental Unit and Derived units. Instrument Characteristics; accuracy and precision, indications of precision, repeatability, Threshold, Sensitivity and span. Different types of errors in measurement, relative errors, limiting errors. Gross error, systematic errors, random error, Observational error, statistical analysis of data, arithmetic mean, deviation, average and standard deviation, probable error.

UNIT II (12 Hrs.)

Principle of operation and Constructional Features; D'Arsonval Galvanometer, Moving Coil PMMC & Moving Iron instrument (Repulsion and Attraction type), Electrodynamic instruments, Electrostatic instruments and Thermoelectric Instruments. Range Extension of Voltmeter and Ammeter (Without Mathematical Derivations).

UNIT III (12 Hrs.)

DC potentiometers; Basic potentiometer circuit, Compton type & multiple range potentiometer, constructional details & precision type potentiometers & their applications, AC potentiometer. Measurement of Power using two Wattmeter and three Wattmeter methods, Q meter.

UNIT IV (12 Hrs.)

Measurement of Resistance; Low, Medium and High using; Kelvin Double Bridge, Ammeter-Voltmeter method, substitution method, Wheat Stone Bridge, Loss of Charge and Megger. Measurement of Inductance and Capacitance using; Maxwell Inductance, Hay's, Anderson and Schering Bridges. Measurement of frequency by Wein bridge method.

Recommended Books:

1. Cooper Halfrick, 'Modern Electronic Instrumentation and Measurement Techniques', PHI, **1990**.
2. A.K. Sawhney, 'Electronic Instrumentation & Measurement', 19th Edn., Dhanpat Rai & Sons., **2011**.
3. Jones & Chin., 'Electronic Instruments and Measurement', 2nd Edn., **2010**.
4. J. Toppin, 'Theory of Errors', 4th Edn., Wessely Publishing, **2009**.

NETWORK ANALYSIS AND SYNTHESIS

Subject Code: ECE3-304 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

Learning Objectives:

1. To aware the students about the basics of networks.

2. To provide them basic concepts of different types of network theorems & their applications.
3. To impart knowledge about different circuits, analyzing and synthesizing methods of circuits.

Learning Outcomes:

1. After the completion of course, students will be having skills to design, analyze and synthesize the circuits.
2. Knowledge of mathematical forms such as Laplace transforms & designing of filters and circuits.

UNIT-I (12 Hrs.)

Circuit Concepts: Circuit elements; Independent and dependent sources, source transformation theory, Mesh & Nodal Analysis: Loop currents and loop equations, node voltages and node equations, Network Theorems: Superposition, Thevenin's, Norton's, Maximum power Transfer, Tellegen's, Reciprocity.

UNIT-II (12 Hrs.)

Network Functions: Terminal pairs or ports, network functions for one-port and two-port networks, pole and zeros of network functions, restrictions on pole and zero locations for driving point functions and transfer functions, time domain behavior from pole-zero plots. Stability criteria of active networks.

UNIT-III (12 Hrs.)

Transient Response: Transient Response of RC, RLC, RL circuits to various excitation signals such as step, ramp, impulse and sinusoidal excitations using Laplace transform. Network synthesis techniques for two terminal network, foster and cauer form of synthesis.

UNIT-IV (12 Hrs.)

Fundamental of filters, filter networks, equation of filter network, classification and characteristic impedance of low-pass, high-pass, band-pass & band-reject, constant K filters, m – derived. Network synthesis: Hurwitz Polynomial, positive real functions, synthesis of one port and two port networks, elementary idea of active networks and frequency response.

Recommended Books:

1. A. Sudhakar & S.P. Shyammohan, 'Network Analysis', 2nd Edn., TMH, **1994**.
2. Van Valkenburg, 'Introduction to Modern Network Synthesis', 1st Edn., PHI, **1960**.
3. Van Valkenburg, 'Network Analysis', 6th Edn., PHI, **1974**.
4. G.K. Mithal, 'Network Analysis', 5th Edn., Khanna Publication, **2008**.
5. D. Roy Choudhury, 'Networks and Systems', 2nd Edn., New Age Pub., **2009**.

ELECTRONIC DEVICES AND CIRCUITS LAB. - I

Subject Code: BECE1-305/BECE2-305/ L T P C
BECE3-305 0 0 2 1

Learning Objectives

1. To understand the Characteristics of various semiconductor devices and construction of different electronic circuits using the above devices.
2. To introduce variety of sources to obtain specifications of electronic devices & to impart knowledge about write technical reports related to basic electronic circuits using correct technical vocabulary.
3. Able to understand identification and selection of various electronic components.

Learning Outcomes

1. An ability to understand all types of electronics devices and circuits
2. An ability to design and conduct experiments, as well as to analyze and interpret data

CONTENTS

1. Study of Zener regulator as voltage regulator
2. Study of Half wave, full wave & Bridge rectifiers.
3. To plot the input and output characteristics of CE configuration.
4. To study the characteristics of a Class- A amplifier.
5. To study the characteristics of Class- B amplifier.
6. To study the characteristics of Class- B push-pull amplifier.
7. To study the characteristics of complementary symmetry amplifier.
8. To plot a load line for a CE amplifier and show effect of input signal on Q-point.
9. To demonstrate use of a BJT in a CE amplifier circuit configuration and study its frequency response.
10. To demonstrate use of a BJT in a CC amplifier circuit configuration and study its frequency response.
11. To demonstrate use of a power BJT as an amplifier.

Note: At least 08 experiments are required to be performed.

DIGITAL ELECTRONICS LAB.

Subject Code: BECE1-306/BECE2-306/ BECE3-306	**L T P C** **0 0 2 1**

Learning Objectives

1. To provide knowledge about basics of Digital Electronics.
2. To impart knowledge about designing of digital circuits.
3. Students will use schematics and symbolic Algebra to represent digital gates in the creation of solutions to design problems

Learning Outcomes

1. An ability to understand all types of combinational & sequential digital circuits and their designing.
2. Students will restate and simplify a digital design problem as part of the systematic approach to solving a problem.

CONTENTS

1. Study of Logic Gates: Truth-table verification of OR, AND, NOT, XOR, NAND and NOR gates;
2. Realization of OR, AND, NOT and XOR functions using universal gates.
3. Realization Half Adder / Full Adder using Logic gates.
4. Realization Half Subtractor / Full Subtractor using Logic gates
5. Design 4-Bit Binary-to-Gray & Gray-to-Binary Code Converter.
6. Design 4-Bit magnitude comparator using logic gates. Multiplexer: Truth-table verification and realization of Half adder and Full adder using MUX.
7. Demultiplexer: Truth-table verification and realization of Half subtractor and Full subtractor using DEMUX.
8. Flip Flops: Truth-table verification of RS, JK, D, JK Master Slave Flip Flops.
9. Design MOD-7 Synchronous up-counter using JK/RS/D Flip Flops.
10. Shift Register: Study of shift right, SIPO, SISO, PIPO, PISO & Shift left operations using IC7495 chip.

Note: At least 08 experiments are required to be performed.

LINEAR CONTROL SYSTEM

Subject Code: BECE3-408 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

Learning Objectives:

1. To obtained transfer functions for electrical circuits, translational/rotational mechanical systems and electromechanical systems.
2. To learn basic goals of control systems in terms of transient/steady state time response behaviour.
3. To update the knowledge about control components.

Learning Outcomes:

1. After the completion of the course, the students could have skills about the basics to model the control systems.
2. An ability to analyze the stability of designed systems

UNIT I (12 Hrs.)

Introduction to control systems; open loop and closed Loop systems-, Electrical to Mechanical and Mechanical to Electrical analogy. Block diagram reduction, Signal flow diagram & Meson`s gain formula

Time response analysis: Analysis of Test signals; step. Impulse, & ramp. Analysis of Zero, first & second order systems. Steady state errors, design of second order systems. Stability of control system, Routh Hurwitz’s stability criterion, static and dynamic errors coefficients, errors criteria.

UNIT II (12 Hrs.)

Introduction of Root Locus method; Root Locus plots, Rules for constructing root loci, stability analysis of systems using Root locus, concept of dominant, closed loop pole pair, Root contour plots, effect of addition of zeros & poles on root loci

UNIT III (12 Hrs.)

Introduction of frequency response, bode plots, log magnitude versus phase plots, stability margins on the Bode plot, stability analysis of systems using Bode plots, polar plots, Nyquist stability criterion, relative stability.

UNIT IV (12 Hrs.)

Concept of state, state space representation of systems, conversion of state variable models to transfer functions, conversion of transfer functions to state variable models, solution of state equations. controllability & observability.

Recommended Books:

1. Kuo, ‘Automatic Control System’, Princeton Univ. Press. Edition, **2010.**
2. D'Azzo and Houpis, ‘Feedback Control System’, McGraw Hill Pub. International Edition, **2010.**
3. Oagata, ‘Modern Control Engineering’, Prentice Hall Pub. Reprint, **2009.**
4. Nagrath & Gopal, ‘Control Systems Engineering’, New Age International Pub., **2011.**

TRANSDUCERS & SENSORS

Subject Code: BECE3-409 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

Learning Objectives:
The main aim of this course is to understand the role of sensors and transducers for different communication systems. In this different transducers for Temperature, pressure, Liquid level measurement will be discussed in detail.

Learning Outcomes:
For different process control industries sensors and transducers play a vital role. For DCS, SCADA or PLC operation basic idea about measurement will be boosted in the students.

UNIT-I (12 Hrs.)

Introduction to transducers and their classifications.

Pressure transducers: Manometers, Elastic transducers, High Pressure transducers, Mcloed Gauge, Pirani-gauge, Ionization gauge, Knudsen Gauge, pressure smart transmitters.

Temperature Transducers: Resistive transducers (Platinum Resistance Thermometer), Thermistor, Thermoelectric sensors, Solid-state Sensors & Pyrometers.

UNIT-II (12 Hrs.)

Flow Transducers: Classification of flow meter, Volume flow Sensors (orifice, Nozzle, Venture, Pitot type) Turbine type, Rotometers, Anemometers, Ultrasonic, Mass flow meters, Positive displacement type flow-meter, Open channel flow measurement, E.M. Flow-meter.

Level Transducers: Thermal effect type, Electric methods (Resistive method, Conductance probe method, Inductive level gauging and capacitive method), Ultrasonic method.

UNIT-III (12 Hrs.)

Force Transducers: Load Cell, Hydraulic Load Cell Torque Transducers: Absorption type, transmission Type, Stress Type, Deflection type.

Acoustics sensors: ceramic microphones, capacitor microphones, electric microphones, magnetic microphone, Humidity sensors: Hair hygrometer, electrode hygrometer, moisture sensors.

UNIT-IV (12 Hrs.)

Introduction to sensors. **Nano & Bio Sensors**: Structure of Protein, role of protein in nanotechnology, using protein in nanodevices, antibodies in sensing, antibody in nano particle conjugates, enzymes in sensing, enzyme nanoparticle hybrid sensors, Motor proteins in sensing, transmembrane sensors, Nan sensors based on Nucleotides and DNA; Structure of DNA, DNA decoders and microarrays; DNA protein conjugate based sensors, Bioelectronic sensors, biomagnetic sensors.

Recommended Books

1. A.K. Sawhney, 'Electrical & Electronic Measurement and Instrumentation', Dhanpat Rai & Sons.
2. Douglas M. Considine, 'Process/Industrial Instruments & Controls Handbook', 6th Edn., McGraw Hill.
3. H.S. Kalsi, 'Electronic Instrumentation', TMH.
4. J.B. Gupta, 'Electrical, Electronics Measurement & Instrumentation', S.K. Kataria & Sons.
5. Kouroush Kalantar – Zadeh, Benjamin Fry, 'Nanotechnology enabled Sensors', Springer Verlag, New York, **2007**, ISBN-13: 978038732473.
6. D.V.S. Murthy, 'Transducers and Instrumentation', PHI, **2004**.

ELECTRICAL & ELECTRONICS INSTRUMENTATION

Subject Code: BECE3-410 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

Learning Objectives:

The subject aims to enrich the students about different analog and digital instruments of electrical and electronics domain. To understand various measurements with different instruments.

Learning Outcomes:

Subject will provide skills about handling different instruments. They will be able to measurement various unknown signals.

UNIT I (12 Hrs.)

Oscilloscope: Basic principle & construction, CRT, sweep modes, applications in measurement of voltage, freq. (Lissajous pattern), Dual Trace Oscilloscope, sweep modes, active, passive probes, delay line, analog storage oscilloscope, principle of secondary emission, Digital Storage Oscilloscope, sampling rate, sampling oscilloscope, application of the CRO in instrumentation and measurement, sampling oscilloscope. Comparison between analog and digital oscilloscope,

UNIT II (12 Hrs.)

Wave analyzer, Frequency selective wave analyzer, Heterodyne wave analyzer, applications of wave analyzer, Distortion analyzer, spectrum analyzer. **Digital Voltmeter**: Types of DVM; Ramp, Integrating, Successive approximation and Atomization in DVM. **Digital Frequency Meter**: Basic circuit, Frequency Measurement Circuit, High Frequency Measurement.

UNIT III (12 Hrs.)

Recorders: Strip Chart Recorders, X-Y Recorders, Ultraviolet Recorders, Magnetic Tape Recorders. **Display Devices**: Digital display methods, Seven Segment LED display, Dot Matrix display and LCD Display.

Nuclear Instrumentation: Geiger Muller Tube, Ionization Chamber, Scintillation Counter.

UNIT IV (12 Hrs.)

Basic Concept of measurement system, Transducer and its classifications, basic requirements of Transducer/Sensors. Displacement Transducers: LVDT, RVDT and Piezo Electric. Resistance Thermometer, Thermistors, Thermocouples and Strain Gauge Transducer: Basic principle of operation of Resistance strain gauge.

Recommended Books:

1. A.K. Sawhney, ‘Electrical & Electronic Measurement and Instrumentation’, 4th Edn., Dhanpat Rai & Sons, **2012**.
2. Douglas M. Considine, ‘Process/Industrial Instruments & Controls Handbook’, 4th Edn., McGraw Hill, **2009**.
3. H.S. Kalsi, ‘Electronic Instrumentation’, 3rd Edn., TMH, **2010**.
4. J.B. Gupta, ‘Electrical, Electronics Measurement & Instrumentation’, 3rd Edn., S.K. Kataria & Sons, **2011**.

MICROPROCESSORS & PERIPHERAL DEVICES

Subject Code: BECE3-411 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

Learning Objectives:
This course aims to provide detailed description of 8-bit microcontrollers, its architecture, programming, and interfacing. This course also briefly introduce the Next focus is to get student familiarize with architecture and programming of microcontrollers. Besides that, embedded systems are introduced.

Learning Outcomes:
1. The students will acquire teaching skills about embedded life
2. They will be able to control various hardware devices with software.
3. Students will learn interfacing skills for different devices

UNIT-I (12 Hrs.)

Introduction:
Introduction to microprocessor, Intel 8085 microprocessor architecture and its operations, various functions, Data flow to/from memory, from/to microprocessor unit, multiplexing and de-multiplexing of address data bus. Comparative study of 8-bit microprocessors: 8085, Motorola 6800, Zilog Z-80.

UNIT-II (12 Hrs.)

Programming with 8085
Addressing modes, Bus timings, T state, machine cycle, timing diagram, Detail study of 8085 instruction set. Memory mapping. Interrupt: necessity, types and structure, stack and subroutines, Programming techniques: looping, counting. Efficient programming in view of memory and speed.

UNIT-III (12 Hrs.)

Interfacing with 8085:
Concept of programmable devices, architecture and programming of 8155/8156 (programmable I/O port timer), 8254/8253 (programmable interval timer), 8255 (programmable peripheral interface), its interfacing with 8085 microprocessors. 8279 (keyboard display controller), 8237 (direct memory access controller), 8251(universal synchronous, asynchronous receiver transmitter) with 8085 microprocessor

UNIT-IV (12 Hrs.)

8086 Microprocessor:
Block diagram, Architecture & Pin diagram of 8086, pipelining process, flag register. Register details of 8086, operation, different addressing modes.

Recommended Books
1. R.S. Gaonkar, 'Microprocessor Architecture Programming and Applications with the 8085', 5th Edn., Penram International Pub., **2009**.
2. D.V. Hall, 'Microprocessor and Interfacing Programming and Hardware', 3rd Edn., McGraw Hill Co, **2012**.
3. Intel Data Books.

ANTENNA & WAVE PROPAGATION

Subject Code: BECE1-456/BECE2-456/ BECE3-456 **L T P C 3 0 0 3** **Duration: 34 Hrs.**

Learning Objectives

1. To provide knowledge about the propagation of electromagnetic wave along different mediums like guided, unguided medias and in space with basic understanding of transmission lines and the method of solving different problems related to it.
2. Study of physical concept of radiation patterns and all the important Fundamental Parameters of antennas with antenna Arrays in the antenna terminology

Learning Outcome

1. An ability and development of skill of students to design highly effective communication system.
2. After completion of the course, students will be aware with the various performance parameters of the antenna system design and antenna arrays.
3. Understand various types of antennas such as micro strip and Yagi-uda antennas.
4. To understand Ground wave propagation.

UNIT-I (12 Hrs.)

ANTENNA BASICS: Directional properties of antennas, Radiation patterns, antenna gain and aperture, antenna terminal impedance, self and mutual impedance, front to back ratio, antenna beam width and bandwidth, antenna efficiency, antenna beam area, polarization, antenna temperature and Reciprocity properties of antennas.

UNIT-II (12 Hrs.)

ANTENNA ARRAYS: Classification of arrays, linear arrays of two point sources, linear arrays of n-point sources, pattern multiplication, array factor, linear arrays of equal amplitude and spacing (Broadside and end fire arrays) of n-point sources, directivity and beam width, non-uniform arrays excitation using Binomial series.

UNIT-III (12 Hrs.)

SPECIAL ANTENNAS: VLF and LF antennas (Hertz and Marconi antennas), effects of antenna height and effect of ground on performance of antenna, Rhombic antennas, Loop antennas, receiving antenna and radio direction finders. Folded dipole antennas, Yagi-uda antenna, horn antennas, microwave dish, helical antennas, frequency independent antennas, micro strip antennas, fractal antennas.

UNIT-IV (12 Hrs.)

GROUND WAVE PROPAGATION: Characteristics for ground wave propagation, reflection at the surface of a finitely conducting plane and on earth, Attenuation Calculation of field strength at a distance.

IONOSPHERE PROPAGATION: The ionosphere, formation of the various layers, their effective characteristics, reflection and refraction of waves by ionosphere, virtual height, maximum frequency, skip distance, regular and irregular variation of ionosphere, Fading and Diversity reception, ordinary and extraordinary waves.

SPACE WAVE PROPAGATION: Space wave, range and effect of earth, Troposphere waves-reflection, refraction, duct propagation, Troposphere scatter propagation link

Recommended Book

1. J.D. Kraus, ‘Antennas’, McGraw Hill.
2. C.A. Balanis ‘Antennas Theory and Design’, Willey.

3. K.D. Prasad, 'Antenna & Wave Propagation', Satya Parkashan, New Delhi.

DATA STRUCTURES AND ALGORITHMS

Subject Code: BECE1-457/BECE2-457/ BECE3-457	**L T P C** **3 0 0 3**	**Duration: 34 Hrs.**

Learning Objectives

1. To use object oriented programming to implement data structures.
2. To introduce linear, non-linear data structures and their applications.

Learning Outcomes

Upon completion of the course, students will be able to:

1. Explain the concepts of algorithms, trees and graphs.
2. Write simple applications of data structures.
3. Discuss the different methods of organizing large amount of data.

UNIT-I (12 Hrs.)

INTRODUCTION: Data types, data structures, abstract data types, the running time of a program, the running time and storage cost of algorithms, complexity, asymptotic complexity, big O notation, obtaining the complexity of an algorithm.

DEVELOPMENT OF ALGORITHMS: Notations and Analysis, Storage structures for arrays - sparse matrices - structures and arrays of structures, Stacks and Queues: Representations, implementations and applications.

UNIT-II (12 Hrs.)

LINKED LISTS: Singly linked lists, linked stacks and queues, operations on Polynomials, Doubly Linked Lists, Circularly Linked Lists, Operations on linked lists- Insertion, deletion and traversal, dynamic storage management – Garbage collection and compaction.

TREES: Basic terminology, General Trees, Binary Trees, Tree Traversing: in-order, pre-order and post-order traversal, building a binary search tree, Operations on Binary Trees - Expression Manipulations - Symbol Table construction, Height Balanced Trees (AVL), B-trees, B+ -trees.

UNIT-III (12 Hrs.)

GRAPHS: Basic definitions, representations of directed and undirected graphs, the single-source shortest path problem, the all-pair shortest path problem, traversals of directed and undirected graphs, directed acyclic graphs, strong components, minimum cost spanning tress, articulation points and bi-connected components, graph matching.

UNIT-IV (12 Hrs.)

SORTING AND SEARCHING TECHNIQUES: Bubble sorting, Insertion sort, Selection sort, Shell sort, Merge sort, Heap and Heap sort, Quick sort, Radix sort and Bucket sort, Address calculation, Sequential searching, Binary Searching, Index searching, Hash table methods.

Recommended Books

1. J.P. Tremblay and P.G. Sorenson, 'An Introduction to Data Structures with Applications', Tata McGraw Hill.
2. S. Sahni, 'Data Structures, Algorithms ad Applications in C++', WCB/McGraw Hill.
3. Aho, Ullman and Hopcroft, 'Data Structures and Algorithms'.
4. Y. Langsam, M.J. Augenstein and A.M. Tenenbaum, 'Data Structures using C', Pearson Education.

ELECTRONIC INSTRUMENTATION

Subject Code: BECE1-458/BECE2-458/ BECE3-458 **L T P C 3 0 0 3** **Duration: 34 Hrs.**

Learning Objectives

1. To provide knowledge about different types of measuring, waveform generation, and analysis electronics instruments.
2. Exposure to various methods of data transmission and transduction.
3. Elaborate discussion about recorder & display devices.

Learning Outcomes

1. Able to understand operation of different instruments and able to describe different terminology related to measurements.
2. A recognition and understanding of various analog measuring instruments.
3. Measurement of Resistance and understanding of CRO.

UNIT–I (12 Hrs.)

Units, Dimensions and Standards: SI Units, Determination of absolute units of current and resistance, Standards of EMF, Resistance, Capacitance, Mutual inductance and their construction, Equivalent circuit representation, Figures of Merit, Construction of variable standards and Decade Boxes.

General Theory of Analog Instruments: Primary and secondary instruments, indicating recording and integrating types, operating torques damping and controlling torques, Torque/ weight ratio, pointers and scales

UNIT –II (12 Hrs.)

Analog Measuring Instruments: Principles of operation, Construction, Errors, calibration, areas of application of the following types of instruments for measurement of voltage, current, power, energy, frequency and power factor: (a) PMMC (b) Dynamometer (c) Moving Iron (d) Induction (e) Thermal (f) Electrostatic Extension of Ranges by Shunts. Multipliers: Power and Energy Measurements in Poly Phase Circuits.

Potentiometers (Only Principles, Operation & applications of DC & AC potentiometer) (a) Simple concepts of potentiometers. (b) Principle of DC potentiometer, applications. (c) Principle operation of AC potentiometer with advantages/ Disadvantages/applications.

UNIT – III (12 Hrs.)

Measurement of Resistances: Low, Medium & High Resistance their measurement.

Bridges: Measurement of R, L, C, M, O by Wheatstone, Kelvin, Maxwell Hay, Anderson, Owen, Heaviside, Campbell, Schering, Wien bridges, Bridge sensitivity, Errors, Detectors, Shielding and screening, Wanger, Earthing.

UNIT-IV (12 Hrs.)

Cathodes Ray Oscilloscopes: Principles and working of CRO, CRO– probes, Measurement of voltage, frequency and phase angle with CRO.

Recommended Books

1. A.K. Sawhney, 'Electrical & electronic Measurement and Instrumentation', Dhanpat Rai & Sons.
2. J.B. Gupta, 'A Course in Electrical and Electronics Measurement & Instrumentation', S.K. Kataria & Sons.

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RELIABILITY ENGINEERING

Subject Code: BECE1-459/BECE2-459/ BECE3-459	L T P C 3 0 0 3	Duration: 34 Hrs.

Learning Objectives

1. To provide students with a comprehensive understanding on various aspects of reliability engineering
2. To enable students to understand reliability considerations in designing machine components, elements and systems
3. To ensure sound maintenance of machines and systems and bring about reliability improvement
4. To perform reliability engineering analysis and its management throughout the product life cycle.

Learning Outcomes

After successful completion of this course the students will be able to:

1. Demonstrate understanding of basic reliability measures such as failure rate, availability, MTTR, etc.
2. Compute and evaluate reliability for redundant, series, and parallel systems
3. Develop fault trees and apply various reliability models to identify and analysis possible faults in machine systems and assess their impact on overall system reliability & maintainability.
4. Use reliability improvement techniques and undertake product testing.

UNIT-I (12 Hrs.)

Introduction: Definition for Reliability, Static and Dynamic Reliability Need for reliability Engineering, success and failure models, Causes of failures, catastrophic failures and degradation failures Characteristic types of failures, useful life of components, Exponential case of chance failure, Reliability Measures; MTBF, MTTR, hazard rate, probability distribution function, Derivation for exponential distribution function, other kinds of distributions, Binomial, Poisson uniform, Raleigh, Weibull, Gamma distribution, marks, Chains, failures data analysis.

UNIT-II (12 Hrs.)

Series Parallel Systems: Reliability Block Diagrams, series systems, parallel systems, K-out of-M systems, open and short circuits failures, standby systems.

Reliability Analysis of Non-Series Parallel System: Boolean algebra Method, Outset approach, delta star method, logical signal relation method, Bay's Theorem Method.

Reliability Prediction: objective of reliability prediction, classification, and information sources for failure rate data, prediction methodologies, general requirements, Role and limitations of Reliability prediction.

UNIT-III (12 Hrs.)

Reliability Allocation: subsystems reliability improvement, allocation for new units, criticality.

Maintainability and Availability: forms of maintenance, measures of Maintainability and availability, maintainability function, availability function, two-unit parallel system with repair, Markov Model for two unit systems, preventive maintenance, provisioning of spares.

UNIT-IV (12 Hrs.)

Reliability Testing: kinds of testing, component reliability measurements, parametric methods, confidence limits, accelerated testing, equipment acceptance testing, standard life testing plans, accelerated life testing, system safety analysis-FMECA, risk priority number and its allocation.

Economics of Reliability Engineering: Reliability cost, Life Cycle Costing, effect of reliability on cost, reliability achievement cost models, reliability Utility cost models, Replacement policies.

Recommended Books

1. K.K. Agarwal, 'Reliability Engineering', Kluwer Academic Press, USA, **1993.**
2. E. Balagurusamy, 'Reliability Engineering', Tata McGraw Hill, 4th Reprint, **2003.**
3. L.S. Srinath, 'Reliability Engineering', East West Press Pvt. Ltd, 3rd Edn., **1991.**
4. Brijendra Singh, 'Quality Control and Reliability Analysis', Khanna Publishers, **1998.**
5. E.E. Lewis, 'Introduction to Reliability Engineering', John Wiley and Sons, **1987.**

CONTROL SYSTEM LAB.

Subject Code: BECE3-412 **L T P C**
0 0 2 1

Learning Objectives:

1. To understand the basics of MATLAB software.
2. To introduce variety of control system strategies.
3. To comment about the stability of designed systems.

Learning Outcomes:

1. To acquire skills to understand all types of control components
2. An ability to analyze the stability of control systems

LIST OF EXPERIMENTS

1. Familiarization with MATLAB control system toolbox, MATLAB Simulink toolbox
2. Determination of step response for first order & second order system with unity feedback and their display on CRO. Calculation and verification of time constant, peak overshoot, setting time etc. from the response.
3. To locate ploe zero locations of a control system.
4. Determination of Root Locus of a control system
5. Determination of Bode plot of a control system.
6. Determination of Nyquist Plot of a control system
7. Evaluation of steady state error, setting time, percentage peak overshoot, gain margin, phase margin, with addition of lead compensator & by compensator in forward path transfer function for unity feedback control system.
8. Determination of control system specifications for variations of system parameters in practical position control system.
9. Design of a second order linear time invariant control system and study of system response with unit step input.
10. To study the characteristics of potentiometers and to use 2- potentiometers as an error detector in a control system.
11. To study the synchro Transmitter-Receiver set and to use it as an error detector
12. To study the Speed – Torque characteristics of an AC Servo Motor and to explore its applications.
13. To study the Speed – Torque characteristics of a DC Servo Motor and explore its applications.
14. To study various electro-mechanical transducers i.e. resistive, capacitive and inductive transducers
15. To study a LVDT (AC-AC, DC-DC) as a transducer and its processing circuits
16. To obtain the transfer function of a D.C. motor – D.C. Generator set using Transfer Function Trainer.

INSTRUMENTATION LAB.

Subject Code: BECE3-413 **L T P C**
0 0 2 1

Learning Objectives:

1. To understand the working principal and construction of the measuring instruments and recorders.
2. To measuring various electrical parameters using meters and transducers.
3. To calibrate the measuring devices such as meters and transducers.

Learning Outcomes:

1. After the completion of the course, the students could have skills about the basic measurement circuits, their operational characteristics and their applications.
2. An ability to use the techniques and skills to CRO.

LIST OF EXPERIMENTS

1. Study of principle of operation of various types of electromechanical measuring instruments.
2. To measure high value of DC current and voltage using shunt and Multiplier.
3. To measurement of low resistance using wheat stone bridge.
4. To measure active and reactive power in 3-phase balanced load by one wattmeter method.
5. To measure the active power in 3-phase balanced and unbalanced load by two wattmeter method and observe the effect of power factor variation on wattmeter reading.
6. To study and calibrate Energy Meter.
7. Measurement of resistance using Kelvin's Bridge.
8. Measurement of self-inductance using Anderson's Bridge.
9. Measurement of capacitance using Schering Bridge.
10. Plotting of Hysteresis loop for a magnetic material using flux meter.
11. Measurement of frequency using Wein's Bridge.
12. To study the connections and use of Current and Potential transformers and to find out ratio error.
13. Determination of frequency and phase angle using CRO.
14. Measurement of unknown voltage using potentiometer.

MICROPROCESSOR LAB.

Subject Code: BECE3-414 **L T P C**
0 0 2 1

1. Study of 8085 and 8086 Microprocessor Kits.
2. Write a program to add two 8-bit number using 8085.
3. Write a program to add two 16-bit number using 8085.
4. Write a program to subtract two 8-bit number using 8085.
5. Write a program to subtract two 16-bit number using 8085.
6. Write a program to multiply two 8 bit numbers by repetitive addition method using 8085.
7. Write a program to sort series using bubble sort algorithm using 8085.
8. Write a program to copy 12 bytes of data from source to destination using 8086.
9. Write a program to find maximum and minimum from series using 8086.
10. Write a program to control the operation of stepper motor using 8085/8086 microprocessors and 8255 PPI.

11. Write a program to control speed of DC motor using 8085/8086 microprocessors and 8255 PPI

B. TECH. ELECTRONICS & TELECOMMUNICATION ENGINEERING
(2nd Year)

Total Contact Hours = 30 **Total Marks = 900** **Total Credits = 25**

SEMESTER 3rd		Contact Hrs			Marks			Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
BMAT0-F91	Mathematics -III	3	1	0	40	60	100	4
BECE1-301/ BECE2-301	Electronic Devices and Circuits - I	3	1	0	40	60	100	4
BECE1-302/ BECE2-302	Network Analysis & Synthesis	3	1	0	40	60	100	4
BECE1-303/ BECE2-303	Digital Electronics	3	1	0	40	60	100	4
BECE1-304/ BECE2-304	Signal & Systems	3	1	0	40	60	100	4
BECE1-305/ BECE2-305	Electronic Devices and Circuits - I Lab	0	0	2	60	40	100	1
BECE1-306/ BECE2-306	Digital Electronics Lab.	0	0	2	60	40	100	1
BSOS0-F91	Soft Skills -I	0	0	2	60	40	100	1
BECE1-307/ BECE2-307	Training -I	0	0	4	60	40	100	2
Total	**Total 5 Theory & 3 Lab. Courses**	**15**	**5**	**10**	**440**	**460**	**900**	**25**

Total Contact Hours = 27 Total Marks = 900 Total Credits = 23

SEMESTER 4th		Contact Hrs			Marks			Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
BECE1-408/ BECE2-408	Electronic Devices & Circuits -II	3	1	0	40	60	100	4
BECE1-409/ BECE2-409	Analog Communication Systems	3	1	0	40	60	100	4
BECE1-410/ BECE2-410	Object Oriented Programming	3	1	0	40	60	100	4
BECE1-411/ BECE2-411	Electromagnetic Field Theory	3	1	0	40	60	100	4
Departmental Elective-I		3	0	0	40	60	100	3
BECE1-456/ BECE2-456	Antenna &Wave Propagation							
BECE1-457/ BECE2-457	Data Structures and Algorithms							
BECE1-458/ BECE2-458	Electronic Instrumentation							
BECE1-459/ BECE2-459	Reliability Engineering							
BECE1-412/ BECE2-412	Electronic Devices & Circuits -II Lab.	0	0	2	60	40	100	1
BECE1-413 BECE2-413	Analog Communication Systems Lab.	0	0	2	60	40	100	1
BECE1-414/ BECE2-414	Object Oriented Programming Lab.	0	0	2	60	40	100	1
BSOS0-F92	Soft Skills -II	0	0	2	60	40	100	1
Total	**Total 5 Theory & 2 Lab. Courses**	**15**	**4**	**8**	**440**	**460**	**900**	**23**

In House / Industrial Training of 6 Weeks during Summer vacations

ENGINEERING MATHEMATICS-III

Subject Code: BMAT0-F91 **L T P C** **Contact Hrs.- 45**
3 1 0 4

UNIT-I (13 Hrs)

Fourier Series: Periodic function, Fourier Seies, Dirichlet's conditions, Fourier series for even and odd functions, Change of interval, Half range Fourier series, Other forms of Fourier series.
Fourier Transforms: Dirichlet's conditions, Fourier integral formula (without proof), Fourier transform, Inverse Theorem for Fourier transform, Fourier sine and cosine transforms and their inversion formulae. Properties of Fourier transform, Convolution theorem of Fourier transforms, Parseval's identity.

UNIT-II (10 Hrs)

Laplace Transforms: Laplace transforms of various standard functions (Exponential, Algebraic, Sine, Cosine), Properties of Laplace transforms, inverse Laplace transforms, transform of derivatives and integrals, Laplace transform of unit step function, impulse function,
Application of Laplace Transforms: Solution of ordinary linear differential equations with constant coefficients, and simultaneous differential equations.

UNIT-III (12 Hrs)

Partial Differential Equations: Formation of partial differential equations, Linear partial differential equations, homogeneous partial differential equations with constant coefficients. Classification of partial differential equation.
Applications of PDEs: Wave equation and Heat conduction equation in one dimension.
Two dimensional Laplace equation in Cartesian Coordinates, solution by the method of separation of variables.

UNIT-IV (10 Hrs)

Functions of Complex Variable: Limits, continuity and derivative of the function of complex variable, Analytic function, Cauchy-Riemann equations, conjugate functions, harmonic functions; Conformal Mapping: Definition, standard transformations, translation, rotation, inversion, bilinear. Complex Integration: Line integrals in the complex plane, Cauchy's theorem, Cauchy's integral formula and derivatives of analytic function. Taylor's and Laurent's expansions (without proofs), singular points, poles, residue, Integration of function of complex variables using the method of residues(Integration Of type $\int_0^{2\pi} F(Cos\theta, Sin\theta)d\theta, \quad \int_{-\infty}^{\infty} \frac{f(x)}{F(X)}dx$)

Recommended Books:

1. E. Kreyszing, 'Advanced Engineering Mathematics', 8th Edn., John Wiley, New Delhi.
2. B.S. Grewal, 'Higher Engineering Mathematics', Khanna Publishers, New Delhi.
3. Ian N. Sneedon, 'Elements of Partial Differential Equations', McGraw- Hill, Singapore, **1957**.
4. Peter. V. O'Nil, 'Advanced Engineering Mathematics', Wadsworth Publishing Company.
5. H.C. Taneja, 'Engineering Mathematics', Volume-I & II, I.K. Publisher.

ELECTRONIC DEVICES AND CIRCUITS - I

Subject Code: BECE1-301/ BECE2-301 **L T P C** **Duration: 48 Hrs.**
3 1 0 4

Course Objectives:

This course is meant to provide fundamental knowledge to ECE students for understanding of the basic semi-conductor devices and their behaviour under various conditions.

Learning Outcomes:

Student after undergoing this course student will be able to:

1. Understand the concepts of PN junction diode and their applications
2. Understand BJT characteristics and determine their behavior under low and high frequencies.
3. Understanding of FETs and their characteristics
4. To understand low and high frequency models

UNIT-I (12 Hrs)

Semiconductor Diodes: Semi-conductor materials and their characteristics, PN junction Diode - VI characteristics, qualitative and quantitative analysis of its behaviour, Diode resistance, Transition capacitance and Diffusion capacitance, clippers, clampers, rectifiers. Special purpose diodes - Zener diode, varactor diode, schottky diode.

UNIT-II (12 Hrs)

Bipolar Junction Transistor: BJT – Transistor current components, BJT configurations – CE, CB, CC and their characteristics. Transistor Biasing –Operating point determination, fixed bias, emitter bias, voltage-divider bias. Bias stability – Stabilization against variation in Ico, V_{BE} and β, Bias compensation.

UNIT-III (12 Hrs)

Field-Effect Transistor: The junction FET - construction, operation, characteristics, parameters, Biasing of JFET, Small signal analysis of JFET as an amplifier- common source and common drain amplifiers. Metal Oxide Semiconductor FET: MOSFET- construction, operation, characteristics, parameters, CMOS devices, CMOS inverter characteristics, metal semiconductor.

UNIT-IV (12 Hrs)

Low & High Frequency Transistor Model: Transistor Hybrid Model, h parameter equivalent circuit of transistor, Analysis of transistor amplifier using h-parameters in CB, CE and CC configuration, The high frequency T model, hybrid pi CE transistor model, hybrid pi conductance in terms of low frequency h parameters

Recommended Books

1. Millman, Jacob, Halkias Christos C. and Satyabratajit, 'Electronic Devices and Circuits', Tata McGraw- Hill, New Delhi.
2. Boylestad Nashelsky, 'Electronic Devices and Circuit Theory', Pearson Education.
3. Floyd, L. Thomas, 'Electronic Devices', 6th Edn., Pearson Education, **2002.**
4. Sedra, S. Adel and Smith, Kenneth C., 'Microelectronic Circuits', Oxford University Press, New York.
5. Streetman Ben J., Sanjay Banerjee, 'Solid State Electronic Devices', PHI.

NETWORK ANALYSIS & SYNTHESIS

Subject Code: BECE1-301/BECE2-301 **L T P C** **Duration: 48 Hrs.**
3 1 0 4

Course Objectives

- To aware the students about the basics of networks.
- To provide them basic concepts of different types of network theorems & their applications.
- To impart knowledge about different circuit analyzing and synthesizing methods of circuits

Learning Outcomes

- An ability to design, analyze and synthesize the circuits.
- Knowledge of mathematical forms such as Laplace transforms & designing of filters and circuits.
- Understand fundamental concepts of network synthesis.
- To understand design and analysis of filters.

UNIT-I (12 Hrs)

Laws and Basic Theorems: Fundamental Laws and Concepts – Kirchhoff's current and voltage laws, Node and mesh analysis using classical method and Laplace transform, Concept of independent and dependent sources, Analysis of special signal waveforms, Duality in networks. Network Theorems – Superposition, Reciprocity, Thevenin's, Norton's, Millman's, Maximum power transfer, Tellegan's, Circuit analysis using these theorems.

UNIT-II (12 Hrs)

Transient Analysis: Fundamental signals and their mathematical expressions, Transient response analysis of RL, RC and RLC for various signals using differential equations and Laplace transform

UNIT-III (12 Hrs)

Two Port Networks: Fundamental concepts of network synthesis, Hurwitz Polynomials, Positive real functions, Properties of RC, RL & LC networks, Foster and Cauer forms of realization, Transmission zeroes, Synthesis of transfer functions.

UNIT-IV (12 Hrs)

Passive Filter: Design and analysis of Butterworth and Chebyshev approximations, Normalized specifications, Frequency transformations, Frequency and impedance denormalisation, Types of frequency selective filters, Linear phase filters.

Recommended Books

1. Vanvalkenburg, 'Network Analysis', Prentice Hall of India Pvt. Ltd., New Delhi.
2. D. Roy Choudhary, 'Network and Systems', New Age International Publisher.
3. Franklin F. Kuo, 'Network Analysis and Synthesis', John Wiley Publications.

DIGITAL ELECTRONICS

Subject Code: BECE1- 303/BECE2- 303 **L T P C** **Duration: 48 Hrs.**
3 1 0 4

Course Objectives

- To provide knowledge about basics of Digital Electronics.
- To impart knowledge about designing of digital circuits.
- Students will use schematics and symbolic Algebra to represent digital gates in the creation of solutions to design problems

Learning Outcomes

- An ability to understand all types of combinational & sequential digital circuits and their designing.
- Students will restate and simplify a digital design problem as part of the systematic approach to solving a problem.
- To understand various sequential circuits & various Digital Logic families
- Understand Analog to Digital and Digital to Analog converters and finite state machines

UNIT I (12 Hrs)

Fundamentals of Digital Techniques: Digital signal, logic gates: AND, OR, NOT, NAND, NOR, EX-OR, EX-NOR, Boolean algebra. Review of Number systems. Binary codes: BCD, Excess-3, Gray, EBCDIC, ASCII, Error detection and correction codes.

UNIT II (12 Hrs)

Combinational Design Using Gates: Design using gates, Karnaugh map and Quine Mcluskey methods of simplification.

Combinational Design Using MSI Devices: Multiplexers and Demultiplexers and their use as logic elements, Decoders, Adders / Subtractors, BCD arithmetic circuits, Encoders, Decoders / Drivers for display devices.

UNIT III (12 Hrs)

Sequential Circuits: Flip Flops: S-R, J-K, T, D, master-slave, edge triggered, shift registers, sequence generators, Counters, Asynchronous and Synchronous Ring counters and Johnson Counter, Design of Synchronous and Asynchronous sequential circuits.

Digital Logic Families: Switching mode operation of p-n junction, bipolar and MOS. devices. Bipolar logic families: RTL, DTL, DCTL, HTL, TTL, ECL, MOS, and CMOS logic families. Tristate logic, Interfacing of CMOS and TTL families.

UNIT IV (12 Hrs)

A/D and D/A converters: Sample and hold circuit, weighted resistor and R -2 R ladder D/A Converters, specifications for D/A converters. A/D converters: Quantization, parallel -comparator, successive approximation, counting type, dual-slope ADC, specifications of ADCs.

Programmable Logic Devices: ROM, PLA, PAL, FPGA and CPLDs.

Finite State Machines: Finite state model, Memory elements and their excitation functions, Synthesis of Synchronous sequential circuits, Capabilities and limitations of FSM, Design, Modelling and Simulation of Moore and Mealy machines.

Recommended Books

1. R.P. Jain, 'Modern Digital Electronics', Tata McGraw Hill.
2. Malvino & Leach, 'Digital Principles and Applications', McGraw Hill.
3. Taub & Schilling, 'Digital Integrated Electronics', McGraw Hill.

SIGNAL & SYSTEMS

Subject Code: BECE1-304/BECE2-304 **L T P C** **Duration: 48 Hrs.**
3 1 0 4

Learning Objectives

- To introduce the students about the theoretical concepts associated with processing continuous & discrete time signals & systems.
- To be able to think critically & to apply problem solving & reasoning strategies to the analysis of

various types of signals & systems.
- To impart them knowledge of various types of noises.

Learning Outcomes
- An ability to analyze various types of signals in communication system.
- Developing skills to understand random signals
- To understand various types of noises
- Understand signal transmission through linear networks.

UNIT-I (12 Hrs)

Systems and Signal Analysis: Detailed Classification of Signals and Systems, Fourier Series and its properties, Fourier transform and its properties along with applications, Discrete Time Fourier Series (DTFS) and Discrete Time Fourier Transform (DTFT).

Correlation and Spectral Density: Definition of Correlation and Spectral Density, Analogy between correlation, covariance and convolution, conceptual basis, auto-correlation, cross correlation, energy/power spectral density, properties of correlation and spectral density, inter relation between correlation and spectral density.

UNIT-II (12 Hrs)

Random Signal Theory: Introduction to Probability Theory, Definition of Probability of Random Events. Joint and Conditional Probability, Probability Mass Function, Statistical Averages. Probability Density Functions (PDF) and Statistical Averages, mean, moments and expectations, standard deviation and variance. Probability models: Uniform, Gaussian, Binomial. Examples of PDF, Transformation of Random Variables. Random Processes, Stationary and Ergodicity.

UNIT-III (12 Hrs)

Introduction To Noise: Thermal Noise, Shot noise, Partition noise, Flicker noise, Gaussian Noise, Noise in Bipolar Junction Transistors (BJTs), FET noise. Equivalent input noise, Signal to Noise Ratio (SNR), Noise Temperature, Noise equivalent Bandwidth, Noise Figure. Experimental determination of Noise Figure, Pulse Response and Digital Noise and its elimination.

UNIT-IV (12 Hrs)

Signal Transmission Through Linear Networks: Convolution Theorem and its graphical interpretation. The Sampling Theorem, Low Pass and Band Pass Networks, Matched Filter, Enveloped detector.

Recommended Books

1. B.P. Lathi, ‘Digital and Analog Communication System’, 4th Edn,, Oxford University Press, **2000.**
2. Ravi Kumar, ‘Signals and Systems’, PHI Learning, **2009.**
3. Simon Haykin, ‘Signals and Systems’, 2nd Edn., Wiley Publications, **2008.**
4. D. Ganesh Rao and Satish Tunga, ‘Signals and Systems’, Pearson Publications, **2000.**

ELECTRONIC DEVICES AND CIRCUITS LAB - I

Subject Code: BECE1-305/BECE2-305 **L T P C** **Duration: 24 Hrs.**
0 0 2 1

Learning Objectives
- To understand the Characteristics of various semiconductor devices and construction of different electronic circuits using the above devices.
- To introduce variety of sources to obtain specifications of electronic devices & to impart knowledge about write technical reports related to basic electronic circuits using correct technical vocabulary.

- Able to understand identification and selection of various electronic components.

Learning Outcomes

- An ability to understand all types of electronics devices and circuits
- An ability to design and conduct experiments, as well as to analyze and interpret data

CONTENTS

1. Study of Zener regulator as voltage regulator
2. Study of Half wave, full wave & Bridge rectifiers.
3. To plot the input and output characteristics of CE configuration.
4. To study the characteristics of a Class- A amplifier.
5. To study the characteristics of Class- B amplifier.
6. To study the characteristics of Class- B push-pull amplifier.
7. To study the characteristics of complementary symmetry amplifier.
8. To plot a load line for a CE amplifier and show effect of input signal on Q-point.
9. To demonstrate use of a BJT in a CE amplifier circuit configuration and study its frequency response.
10. To demonstrate use of a BJT in a CC amplifier circuit configuration and study its frequency response.
11. To demonstrate use of a power BJT as an amplifier.

Note: At least 08 experiments are required to be performed.

DIGITAL ELECTRONICS LAB

Subject Code: BECE1-306/BECE2-306	**L T P C** **0 0 2 1**	**Duration: 24 Hrs.**

Learning Objectives

- To provide knowledge about basics of Digital Electronics.
- To impart knowledge about designing of digital circuits.
- Students will use schematics and symbolic Algebra to represent digital gates in the creation of solutions to design problems

Learning Outcomes

- An ability to understand all types of combinational & sequential digital circuits and their designing.
- Students will restate and simplify a digital design problem as part of the systematic approach to solving a problem.

CONTENTS

1. Study of Logic Gates: Truth-table verification of OR, AND, NOT, XOR, NAND and NOR gates;
2. Realization of OR, AND, NOT and XOR functions using universal gates.
3. Realization Half Adder / Full Adder using Logic gates.
4. Realization Half Subtractor / Full Subtractor using Logic gates
5. Design 4-Bit Binary-to-Gray & Gray-to-Binary Code Converter.
6. Design 4-Bit magnitude comparator using logic gates. Multiplexer: Truth-table verification and realization of Half adder and Full adder using MUX.
7. Demultiplexer: Truth-table verification and realization of Half subtractor and Full subtractor using DEMUX.
8. Flip Flops: Truth-table verification of RS, JK, D, JK Master Slave Flip Flops.

9. Design MOD-7 Synchronous up-counter using JK/RS/D Flip Flops.
10. Shift Register: Study of shift right, SIPO, SISO, PIPO, PISO & Shift left operations using IC7495 chip.

Note: At least 08 experiments are required to be performed.

ELECTRONIC DEVICES AND CIRCUITS - II

Subject Code: BECE1-408/BECE2-408 **L T P C** **Duration: 48 Hrs.**
3 1 0 4

Learning Objectives

- To aware the students about Basic Electronic Components.
- To update the Knowledge about amplification circuits to amplify the signal.
- Various types of circuits to generate signals.
- How electronic components are specified and selected for industrial applications.

Course outcomes:

- After the completion of the course, the students could have learnt about the basic Electronic Circuits, their operational characteristics and their applications.
- To generate an ability to understand various amplifiers including push pull and complementary symmetry.
- Understand types of feedback amplifiers and oscillator circuits.
- To understand a stable multivibrators

UNIT-I (12 Hrs)

Single Stage Amplifiers: Classification of Amplifiers - Distortion in Amplifiers, Analysis of CE, CC, and CB Configurations with simplified hybrid Model, Analysis of CE amplifier with Emitter Resistance and Emitter follower, Miller's Theorem and its dual, Design of Single Stage RC Coupled Amplifier using BJT.

Multistage Amplifiers: Frequency response – Single stage amplifiers, multistage amplifiers. Couplings – Various coupling methods for multistage amplifiers.

UNIT-II (12 Hrs)

Transformer coupled audio amplifier: construction, working, efficiency & distortion analysis; Classifications: Class-A, Class-B, class-AB and Class-C amplifiers, efficiency.

Push-Pull Amplifiers – operation of Class-B push-pull amplifier, crossover distortion, transistor phase inverter, complementary symmetry amplifier.

UNIT-III (12 Hrs)

Feedback amplifiers – Feedback concept, advantages and disadvantages of negative and positive feedback.

Oscillators: Classification of Oscillators, frequency and frequency stability of oscillatory circuits, Tuned Oscillators, Hartley Oscillator, Colpitts Oscillators Clapp Oscillator, Crystal Oscillator, Phase Shift Oscillator, Wein Bridge Oscillator.

UNIT-IV (12 Hrs)

Astable Multivibrators: Astable Collector coupled and emitter coupled multivibrator, complementary Transistor Astable multivibrator.

Switching Characteristics of Devices: Diode and transistor as electronic switch, Breakdown mechanism in diode, Effect of temperature on diode, Charge storage phenomena, switching times in diode and transistor, Delay time, Rise time, Storage time and fall time.

Recommended Books

1. Millman, Jacob, Halkias Christos C. and Satyabratajit, 'Electronic Devices and Circuits', 3rd Edn., Tata McGraw- Hill, New Delhi, **2010.**
2. Boylestad Nashelsky, 'Electronic Devices and Circuit Theory', Pearson Education, **2004.**
3. Thomas L. Floyd, 'Electronic Devices', 6th Edn., Pearson Education, **2002.**
4. Adel S. Sedra and Kenneth C. Smith, 'Microelectronic Circuits', 4th Edn., Oxford University Press, New York, **1997**.
5. Streetman Ben J., Sanjay Banerjee, 'Solid State Electronic Devices'. 5th Edn., Prentice Hall of India, **2004.**

ANALOG COMMUNICATION SYSTEMS

Subject Code: BECE1-409/BECE2-409 **L T P C** **Duration: 48 Hrs.**
3 1 0 4

Learning Objectives

- To study & understand the building blocks of analog communication system in general and understand bandwidth consideration
- Inter-symbol Interference allows the students to understand the interference causes and the corrective measures taken by base band Pulse shaping solutions
- To study coherent and non-coherent detection techniques and Simulation of these techniques using Mat lab.

Learning Outcomes

- An ability to understand analog communication system and modulation techniques
- An ability to learn design of useful circuits required in analog communication system.
- An ability to explore knowledge about various transmitter and receiver circuits used in communication.
- An ability to provide students with tools for communication signal analysis

UNIT-I (12 Hrs)

Wave Propagation: Free space equation, Reflection from earth's surface, Surface and Space wave propagation, Range of space wave propagation, Effective earth's radius, Duct propagation, Troposphere propagation. Structure of ionosphere, propagation of radio waves through ionosphere, Critical frequency, Maximum usable frequency, Optimum working frequency, lowest usable high frequency, virtual height, Skip Distance, Effect of earth's magnetic field

UNIT II (12 Hrs)

Analog Modulation Techniques: Introduction, Theory of Amplitude Modulation; AM Power Calculations, AM Modulation with a Complex wave, Theory of Frequency Modulation (FM); Spectra of FM Signals, Narrow Band and Wide Band FM, Theory of Phase Modulation, Comparison of AM and FM, Comparison of PM and FM, Noise and Frequency Modulation, Pre-emphasis and De-emphasis.

UNIT-III (12 Hrs)

AM Transmission/AM Reception: Introduction, Generation of Amplitude Modulation, Basic Principles of AM Generation; Square law Diode Modulation, Vander Bijl Modulation, Suppressed Carrier AM

Generation, Ring Modulator, Balanced Modulator. Tuned Radio Frequency (TRF) Receiver, Basic Elements of AM Super-heterodyne receiver; RF Amplifiers Characteristics-Sensitivity, Selectivity, Image Frequency Rejection, Mixers Tracking and Alignment, Local Oscillator, IF Amplifier, AM Detectors; Envelope or

Diode Detector, AGC, AM Receiver using Transistors Communication Receiver, Applications of AM with different Band ranges

UNIT-IV (12 Hrs)

FM Transmission/FM Reception: Generation of FM by Direct Methods. Indirect Generation of FM; The Armstrong Method, FM Stereo Transmission.FM Receiver Direct Methods of Frequency Demodulation; Slope Detector, Travis Detector Foster Seely or Phase Discriminator, Indirect methods of FM Demodulation; FM Detector using PLL and Stereo FM Multiplex Reception. SSB Transmission/SSB Reception: Advantages of SSB transmission, Generation of SSB; Independent Side-Band Systems (ISB), Vestigial Side-Band Modulation (VSB). SSB Product Demodulator, Balanced Modulator as SSB Demodulator, ISB/Suppressed Carrier receiver, Applications of FM with Band ranges.

Recommended Books

1. George Kennedy, 'Electronic Communication System', McGraw- Hill, **2000.**
2. Gary M. Miller and Jeffery S. Beasley, 'Modern Electronic Communications' PHI, **2009.**
3. Simon Haykin, 'Communication Systems' 3rd Edn., Wiley Publishers, **2007.**
4. Wayne Tomasi, 'Electronics Communication Systems', 5th Edn., Pearson Publishers, **2008.**

OBJECT ORIENTED PROGRAMMING

Subject Code: BECE1-410/BECE2-410 **L T P C** **Duration: 48 Hrs.**
3 1 0 4

Learning Objectives

- To provide knowledge regarding the Object oriented programming C++, data types and about classes.
- To provide understanding of inheritance and memory management in C++.
- To describe how to represent pointers, and understanding the concept of binding and polymorphism.
- To make the students familiar with the File handling and generic functions.

Learning outcomes

- An ability to learn programming in C++ using OOPs in a better way.
- Enable students to develop their skills in programing with C++.

UNIT-I (12 Hrs)

Object-Oriented Programming Concepts: Introduction, comparison between procedural programming paradigm and object-oriented programming paradigm, basic concepts of object-oriented programming — concepts of an object and a class, interface and implementation of a class, operations on objects, relationship among objects, abstraction, encapsulation, data hiding, inheritance, overloading, polymorphism, messaging.

Standard Input/Output: Concept of streams, hierarchy of console stream classes, input/output using overloaded operators >> and << and members functions of i/o stream classes, formatting output, formatting using ios class functions and flags, formatting using manipulators.

Classes and Objects: Specifying a class, creating class objects, accessing class members, access specifiers, static members, use of *const* keyword, friends of a class, empty classes, nested classes, local classes, abstract classes, container classes, bit fields and classes.

UNIT-II (12 Hrs)

Pointers and Dynamic Memory Management: Declaring and initializing pointers, accessing data through pointers, pointer arithmetic, memory allocation (static and dynamic), dynamic memory management using *new* and *delete* operators, pointer to an object, *this* pointer, pointer related problems - dangling/wild pointers, null pointer assignment, memory leak and allocation failures.

Constructors and Destructors: Need for constructors and destructors, copy constructor, dynamic constructors, explicit constructors, destructors, constructors and destructors with static members, initializer lists.

Operator Overloading and Type Conversion: Overloading operators, rules for overloading operators, overloading of various operators, type conversion - basic type to class type, class type to basic type, class type to another class type.

UNIT-III (12 Hrs)

Inheritance: Introduction, defining derived classes, forms of inheritance, ambiguity in multiple and multipath inheritance, virtual base class, object slicing, overriding member functions, object composition and delegation, order of execution of constructors and destructors.

Virtual functions & Polymorphism: Concept of binding - early binding and late binding, virtual functions, pure virtual functions, abstract classes, virtual destructors.

UNIT-IV (12 Hrs)

Exception Handling: Review of traditional error handling, basics of exception handling, exception handling mechanism, throwing mechanism, catching mechanism, rethrowing an exception, specifying exceptions.

Templates and Generic Programming: Template concepts, Function templates, class templates, illustrative examples.

Files: Fill streams, hierarchy of file stream classes, reading/writing of files, error handling during file operations, accessing records, randomly, updating files.

Recommended Books

1. E. Balagurusamy, 'Object Oriented Programming with C++', Tata McGraw Hill.
2. R.S. Salaria, 'Mastering Object-Oriented Programming with C++', Salaria Publishing House.
3. R. Lafore, 'Object Oriented Programming in C++', Waite Group.

ELECTROMAGNETIC FIELD THEORY

Subject Code: BECE1-411/BECE2-411 **L T P C** **Duration: 48 Hrs.**
3 1 0 4

Learning Objectives

- To provide knowledge about the propagation of electromagnetic wave along different mediums like guided, unguided medias and in space with basic understanding of transmission lines and the method of solving different problems related to it.
- Study of physical concept and all the important fundamental parameters of transmission lines and waveguides.

Learning Outcome

- After the completion of the course, the students will be familiar with the concepts of electromagnetic field theory and fundamental equations fields.
- An ability to Understand Maxwell's equations in differential and integral form,
- To understand transmission lines and smith chart

UNIT-I (12 Hrs)

Introduction: Fundamental of vector algebra, Scalar & vector fields, Introduction and transformation on different coordinate systems: (rectangular, cylindrical and spherical co-ordinate system). Introduction to line, surface and volume integrals, definition of gradient, divergent and curl of a vector and their physical significance.

UNIT-II (12 Hrs)

Electrostatics: Principal of Coulomb's law, definition of electric field intensity from point charges, field due to continuous distribution of charges on an infinite and finite line, Electric Field due to an infinite uniformly charged sheet. Gauss's law and its applications, Electric flux density, potential fields duo to electric dipole, Laplace and poisons equations.

Magnetostatics: Definition and explanation on Magnetic Field intensity due to a finite and infinite wire carrying current. Magnetic field intensity on rectangular loop carrying current, Ampere's Circuital law and its applications, Biot-savart law, the Lorentz force equation for a moving charge, Magnetic Vector Potential

UNIT-III (12 Hrs)

Time Varying EM Fields: Maxwell's equation in differential and integral vector form and their interpretations, continuity of currents, conduction and displacement current, boundary conditions, Helmholtz equations, uniform plane wave in dielectric and conductor media, skin effect and depth of penetration, reflection and refraction of plane waves at boundaries for normal incidence and surface impedance. Energy Flow and Poynting theorem, interpretation of E×H, Simple application, complex pointing vector.

UNIT-IV (12 Hrs)

Transmission Lines: Transmission line model, parameters and properties of transmission line equations, reflections in transmission lines; voltage, current and impedance relations-open, short circuit and matched lines, Standing wave ratio; impedance matching, quarter and half wave lines, single stub and double stub matching; circle diagram – Smith chart.

Recommended Books

1. Matthew N.O. Sadiku, 'Elements of Engineering Electromagnetics', Oxford University Press.
2. William Hayt, 'Engineering Electromagnetics', Tata McGraw-Hill.
3. Narayana Rao, 'Elements of Engineering Electromagnetics', Pearson Education.
4. R.F. Jorden, 'Electromagnetic Waves & Radio System', Prentice Hall India.
5. J.D. Kraus, 'Electromagnetics', McGraw-Hill.

ELECTRONIC DEVICES AND CIRCUITS LAB - II

Subject Code: BECE1-412/BECE2-412 **L T P C** **Duration: 24 Hrs.**
0 0 2 1

Learning Objectives

- To understand the Characteristics of various semiconductor devices and construction of different electronic circuits using the above devices.
- To introduce variety of sources to obtain specifications of electronic devices & to impart knowledge about write technical reports related to basic electronic circuits using correct technical vocabulary.
- Able to understand identification and selection of various amplifiers and oscillators.

Learning Outcomes

- An ability to understand all types of electronics devices and circuits
- An ability to design and conduct experiments, as well as to analyze and interpret data

Course Content

1. To study frequency response of a tuned amplifier.
2. To demonstrate and study a two stage RC coupled amplifier.
3. To demonstrate and study a Transformer coupled amplifier.
4. To study the response of RC phase shift oscillator and determine frequency of oscillation.
5. To study the response of Hartley oscillator and determine frequency of oscillation.
6. To study the response of Colpitt's oscillator and determine frequency of oscillation.
7. To study the response of Wien Bridge oscillator and determine frequency of oscillation
8. To demonstrate working of a JFET and study its V-I characteristics.
9. To experimentally study working of a CS JFET amplifier.
10. To demonstrate working of a LED and calculate appropriate value of series Resistance RS for it.

Note: At least 08 experiments are required to be performed.

ANALOG COMMUNICATION SYSTEMS LAB

Subject Code: BECE1-413/BECE2-413 **L T P C** **Duration: 24 Hrs.**
0 0 2 1

Learning Objectives

- The main objective of this lab is to motivate the students to familiarize with modulation & Demodulation Techniques and study their waveforms on Digital storage oscilloscope.
- To give students a working knowledge to perform wired and wireless communication in lab.
- The objective of the Analog Communications Course is to familiarize students with the functions of oscillators, filters, amplifiers, LC networks, modulators, limiters, mixers, and detectors in AM, FM, PM, SSB, and PLL circuit

Learning Outcomes

- An ability to perform transmission of signals from transmitter to receiver using various analog modulation and demodulation techniques.
- Study of transmission through different types of antenna.

Course Content

1. To study Amplitude Modulation using a transistor and determine depth of modulation.
2. To study envelope detector for demodulation of AM signal and observe diagonal peak clipping effect.

3. Frequency Modulation using Voltage Controlled Oscillator.
4. Generation of DSB-SC signal using Balanced Modulator.
5. Generation of Single Side Band (SSB) signal.
6. Study of Phase Lock Loop (PLL) and detection of FM Signal using PLL.
7. Measurement of Noise Figure using a noise generator.
8. Study functioning of Super heterodyne AM Receiver.
9. Familiarization of PLL, measurement of lock/captures range, frequency demodulation, and frequency multiplier using PLL.
10. Measurement of Sensitivity, Selectivity and Fidelity of radio receivers.

Note: At least 08 experiments are required to be performed.

OBJECT ORIENTED PROGRAMMING LAB

Subject Code: BECE1-414/BECE2-414 **L T P C** **Duration: 24 Hrs**
0 0 2 1

Learning Objectives

- To provide the basic knowledge about control statements, looping statements, various I/O statements and various data structures.
- To describe how to create classes in C++ for understanding of basic OOPS features.
- To discuss various concepts of data hiding, function overloading and operator overloading

Learning Outcome

- Enable students to develop their skills in programing with C++.
- To describe functions of creating constructors, destructor, inheritance, polymorphism and file handling programs

Course Content

1. [Classes and Objects] Write a program that uses a class where the member functions are defined inside a class.
2. [Classes and Objects] Write a program that uses a class where the member functions are defined outside a class.
3. [Classes and Objects] Write a program to demonstrate the use of static data members.
4. [Classes and Objects] Write a program to demonstrate the use of const data members.
5. [Constructors and Destructors] Write a program to demonstrate the use of zero argument and
6. parameterized constructors.
7. [Constructors and Destructors] Write a program to demonstrate the use of dynamic constructor.
8. [Constructors and Destructors] Write a program to demonstrate the use of explicit constructor.
9. [Initializer Lists] Write a program to demonstrate the use of initializer list.
10. [Operator Overloading] Write a program to demonstrate the overloading of increment and decrement operators.
11. [Operator Overloading] Write a program to demonstrate the overloading of binary arithmetic operators.
12. [Operator Overloading] Write a program to demonstrate the overloading of memory management operators.
13. [Typecasting] Write a program to demonstrate the typecasting of basic type to class type.
14. [Typecasting] Write a program to demonstrate the typecasting of class type to basic type.

15. [Typecasting] Write a program to demonstrate the typecasting of class type to class type.
16. [Inheritance] Write a program to demonstrate the multilevel inheritance.
17. [Inheritance] Write a program to demonstrate the multiple inheritances.
18. [Inheritance] Write a program to demonstrate the virtual derivation of a class.
19. [Polymorphism] Write a program to demonstrate the runtime polymorphism.
20. [Exception Handling] Write a program to demonstrate the exception handling.
21. [Templates and Generic Programming] Write a program to demonstrate the use of function template.
22. [Templates and Generic Programming] Write a program to demonstrate the use of class template
23. **[File Handling]** Write a program to copy the contents of a file to another file byte by byte. The name of the source file and destination file should be taken as command-line arguments,
24. **[File Handling]** Write a program to demonstrate the reading and writing of mixed type of data.

Note: At least 15 experiments are required to be performed

ANTENNA & WAVE PROPAGATION

Subject Code: BECE1-456/BECE2-456 **L T P C** **Duration: 48 Hrs.**
3 0 0 3

Learning Objectives

- To provide knowledge about the propagation of electromagnetic wave along different mediums like guided, unguided medias and in space with basic understanding of transmission lines and the method of solving different problems related to it.
- Study of physical concept of radiation patterns and all the important Fundamental Parameters of antennas with antenna Arrays in the antenna terminology

Learning Outcome

- An ability and development of skill of students to design highly effective communication system.
- After completion of the course, students will be aware with the various performance parameters of the antenna system design and antenna arrays.
- Understand various types of antennas such as micro strip and Yagi-uda antennas.
- To understand Ground wave propagation.

UNIT-I (12 Hrs)

ANTENNA BASICS: Directional properties of antennas, Radiation patterns, antenna gain and aperture, antenna terminal impedance, self and mutual impedance, front to back ratio, antenna beam width and bandwidth, antenna efficiency, antenna beam area, polarization, antenna temperature and Reciprocity properties of antennas.

UNIT-II (12 Hrs)

ANTENNA ARRAYS: Classification of arrays, linear arrays of two point sources, linear arrays of n-point sources, pattern multiplication, array factor, linear arrays of equal amplitude and spacing (Broadside and end fire arrays) of n-point sources, directivity and beam width, non-uniform arrays excitation using Binomial series.

UNIT-III (12 Hrs)

SPECIAL ANTENNAS: VLF and LF antennas (Hertz and Marconi antennas), effects of antenna height and effect of ground on performance of antenna, Rhombic antennas, Loop antennas, receiving antenna and radio direction finders. Folded dipole antennas, Yagi-uda antenna, horn antennas, microwave dish, helical antennas, frequency independent antennas, micro strip antennas, fractal antennas.

UNIT-IV (12 Hrs)

GROUND WAVE PROPAGATION: Characteristics for ground wave propagation, reflection at the surface of a finitely conducting plane and on earth, Attenuation Calculation of field strength at a distance.

IONOSPHERE PROPAGATION: The ionosphere, formation of the various layers, their effective characteristics, reflection and refraction of waves by ionosphere, virtual height, maximum frequency, skip distance, regular and irregular variation of ionosphere, Fading and Diversity reception, ordinary and extraordinary waves.

SPACE WAVE PROPAGATION: Space wave, range and effect of earth, Troposphere waves-reflection, refraction, duct propagation, Troposphere scatter propagation link

Recommended Book

1. J.D. Kraus, 'Antennas', McGraw Hill.
2. C.A. Balanis 'Antennas Theory and Design', Willey.
3. K.D. Prasad, 'Antenna & Wave Propagation', Satya Parkashan, New Delhi.

DATA STRUCTURES AND ALGORITHMS

Subject Code: BECE1-457/BECE2-457 **L T P C** **Duration: 48 Hrs.**
3 0 0 3

Learning Objectives

- To use object oriented programming to implement data structures.
- To introduce linear, non-linear data structures and their applications.

Learning Outcomes

Upon completion of the course, students will be able to:

- Explain the concepts of algorithms, trees and graphs.
- Write simple applications of data structures.
- Discuss the different methods of organizing large amount of data.

UNIT-I (12 Hrs)

INTRODUCTION: Data types, data structures, abstract data types, the running time of a program, the running time and storage cost of algorithms, complexity, asymptotic complexity, big O notation, obtaining the complexity of an algorithm.

DEVELOPMENT OF ALGORITHMS: Notations and Analysis, Storage structures for arrays - sparse matrices - structures and arrays of structures, Stacks and Queues: Representations, implementations and applications.

UNIT-II (12 Hrs)

LINKED LISTS: Singly linked lists, linked stacks and queues, operations on Polynomials, Doubly Linked Lists, Circularly Linked Lists, Operations on linked lists- Insertion, deletion and traversal, dynamic storage management – Garbage collection and compaction.

TREES: Basic terminology, General Trees, Binary Trees, Tree Traversing: in-order, pre-order and post-order traversal, building a binary search tree, Operations on Binary Trees - Expression Manipulations - Symbol Table construction, Height Balanced Trees (AVL), B-trees, B+ -trees.

UNIT-III (12 Hrs)

GRAPHS: Basic definitions, representations of directed and undirected graphs, the single-source shortest path problem, the all-pair shortest path problem, traversals of directed and undirected graphs, directed acyclic graphs, strong components, minimum cost spanning tress, articulation points and bi-connected components, graph matching.

UNIT-IV (12 Hrs)

SORTING AND SEARCHING TECHNIQUES: Bubble sorting, Insertion sort, Selection sort, Shell sort, Merge sort, Heap and Heap sort, Quick sort, Radix sort and Bucket sort, Address calculation, Sequential searching, Binary Searching, Index searching, Hash table methods.

Recommended Books

1. J.P. Tremblay and P.G. Sorenson, 'An Introduction to Data Structures with Applications', Tata McGraw Hill.
2. S. Sahni, 'Data Structures, Algorithms ad Applications in C++', WCB/McGraw Hill.
3. Aho, Ullman and Hopcroft, 'Data Structures and Algorithms'.
4. Y. Langsam, M.J. Augenstein and A.M. Tenenbaum, 'Data Structures using C', Pearson Education.

ELECTRONIC INSTRUMENTATION

Subject Code: BECE1-458/BECE2-458 **L T P C** **Duration: 48 Hrs.**
3 0 0 3

Learning Objectives

- To provide knowledge about different types of measuring, waveform generation, and analysis electronics instruments.
- Exposure to various methods of data transmission and transduction.
- Elaborate discussion about recorder & display devices.

Learning Outcomes

- Able to understand operation of different instruments and able to describe different terminology related to measurements.
- A recognition and understanding of various analog measuring instruments.
- Measurement of Resistance and understanding of CRO

UNIT – I (12 Hrs)

Units, Dimensions and Standards: SI Units, Determination of absolute units of current and resistance, Standards of EMF, Resistance, Capacitance, Mutual inductance and their construction, Equivalent circuit representation, Figures of Merit, Construction of variable standards and Decade Boxes.

General Theory of Analog Instruments: Primary and secondary instruments, indicating recording and integrating types, operating torques damping and controlling torques, Torque/ weight ratio, pointers and scales

UNIT –II (12 Hrs)

Analog Measuring Instruments: Principles of operation, Construction, Errors, calibration, areas of application of the following types of instruments for measurement of voltage, current, power, energy, frequency and power factor: (a) PMMC (b) Dynamometer (c) Moving Iron (d) Induction (e) Thermal (f) Electrostatic Extension of Ranges by Shunts. Multipliers: Power and Energy Measurements in Poly Phase Circuits.

Potentiometers (Only Principles, Operation & applications of DC & AC potentiometer) (a) Simple concepts of potentiometers. (b) Principle of DC potentiometer, applications. (c) Principle operation of AC potentiometer with advantages/ Disadvantages/applications.

UNIT – III (12 Hrs)

Measurement of Resistances: Low, Medium & High Resistance their measurement.

Bridges: Measurement of R, L, C, M, O by Wheatstone, Kelvin, Maxwell Hay, Anderson, Owen, Heaviside, Campbell, Schering, Wien bridges, Bridge sensitivity, Errors, Detectors, Shielding and screening, Wanger, Earthing.

UNIT-IV (12 Hrs)

Cathodes Ray Oscilloscopes: Principles and working of CRO, CRO– probes, Measurement of voltage, frequency and phase angle with CRO.

Recommended Books

1. A.K. Sawhney, 'Electrical & electronic Measurement and Instrumentation', Dhanpat Rai & Sons.
2. J.B. Gupta, 'A Course in Electrical and Electronics Measurement & Instrumentation', S.K. Kataria & Sons.

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RELIABILITY ENGINEERING

Subject Code: BECE1-459/BECE2-459 **L T P C** **Duration: 48 Hrs.**
3 0 0 3

Learning Objectives

1. To provide students with a comprehensive understanding on various aspects of reliability engineering
2. To enable students to understand reliability considerations in designing machine components, elements and systems
3. To ensure sound maintenance of machines and systems and bring about reliability improvement
4. To perform reliability engineering analysis and its management throughout the product life cycle.

Course Outcomes

After successful completion of this course the students will be able to:

1. Demonstrate understanding of basic reliability measures such as failure rate, availability, MTTR, etc.
2. Compute and evaluate reliability for redundant, series, and parallel systems
3. Develop fault trees and apply various reliability models to identify and analysis possible faults in machine systems and assess their impact on overall system reliability & maintainability.
4. Use reliability improvement techniques and undertake product testing.

UNIT-I (12 Hrs)

Introduction: Definition for Reliability, Static and Dynamic Reliability Need for reliability Engineering, success and failure models, Causes of failures, catastrophic failures and degradation failures Characteristic types of failures, useful life of components, Exponential case of chance failure, Reliability Measures; MTBF, MTTR, hazard rate, probability distribution function, Derivation for exponential distribution function, other kinds of distributions, Binomial, Poisson uniform, Raleigh, Weibull, Gamma distribution, marks, Chains, failures data analysis.

UNIT-II (12 Hrs)

Series Parallel Systems: Reliability Block Diagrams, series systems, parallel systems, K-out of-M systems, open and short circuits failures, standby systems.

Reliability Analysis of Non-Series Parallel System: Boolean algebra Method, Outset approach, delta star method, logical signal relation method, Bay's Theorem Method.

Reliability Prediction: objective of reliability prediction, classification, and information sources for failure rate data, prediction methodologies, general requirements, Role and limitations of Reliability prediction.

UNIT-III (12 Hrs)

Reliability Allocation: subsystems reliability improvement, allocation for new units, criticality.

Maintainability and Availability: forms of maintenance, measures of Maintainability and availability, maintainability function, availability function, two-unit parallel system with repair, Markov Model for two unit systems, preventive maintenance, provisioning of spares.

UNIT-IV (12 Hrs)

Reliability Testing: kinds of testing, component reliability measurements, parametric methods, confidence limits, accelerated testing, equipment acceptance testing, standard life testing plans, accelerated life testing, system safety analysis-FMECA, risk priority number and its allocation.

Economics of Reliability Engineering: Reliability cost, Life Cycle Costing, effect of reliability on cost, reliability achievement cost models, reliability Utility cost models, Replacement policies.

Recommended Books

1. K.K. Agarwal, 'Reliability Engineering', Kluwer Academic Press, USA, **1993.**
2. E. Balagurusamy, 'Reliability Engineering', Tata McGraw Hill, 4th Reprint, **2003.**
3. L.S. Srinath, 'Reliability Engineering', East West Press Pvt. Ltd, 3rd Edn., **1991.**
4. Brijendra Singh, 'Quality Control and Reliability Analysis', Khanna Publishers, **1998.**
5. E.E. Lewis, 'Introduction to Reliability Engineering', John Wiley and Sons, **1987.**

MRSPTU UNDER GRADUATE OPEN ELECTIVES-I 2016 BATCH ONWARDS
(UPDATED ON 23.4.2017)

UG OPEN ELECTIVES-I 2016 BATCH ONWARDS		
Internal	External	Total
40	60	100

NOTE: MORE COURSES MAY BE ADDED IN THIS LIST LATER ON

UG OPEN ELECTIVES-I 2016 BATCH ONWARDS		
COURSE CODE	**COURSE**	**NOT APPLICABLE FOR PROGRAMMES**
BFOT0-F91	Plant Utilities & Control	B.Tech. Food Technology
BBAD0-F91	Fundamentals of Management	BBA
BBAD0-F92	Personnel & Industrial Management	
BBAD0-F93	Corporate Governance & Ethics	
BECE0-F91	Optical Communication	B.Tech. Electronics & Comm. Engg., B.Tech. Electronics & Telecomm. Engg., B.Tech. Electronics & Instrumentation Engg.
BECE0-F92	Cellular and Mobile Communication	
BECE0-F93	Biomedical Electronics and Instrumentation	
BEEE0-F91	Power Plant Engineering	EEE
BEEE0-F92	Analog & Digital Circuit Analysis	
BEEE0-F93	Digital Signal Processing	

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PLANT UTILITIES & CONTROL

Subject Code: BFOT0-F91	**L T P C** **3 0 0 3**	**Contact Hrs.**

UNIT-I

Properties of Steam: Introduction – steam formation – Thermodynamic properties of steam – Sensible heat, latent heat, dryness fraction, wet fraction – superheated steam – steam table, expansion of steam

Steam Generators: Introduction, Classification & Boilers, Water tube, Fire tube type, Vertical tabular boilers, types of fire and water tube boilers, boiler mounting & accessories, Performance of steam generator, Evaporation rate. Performance, boiler efficiency, Factors influencing Boiler efficiency problems.

UNIT-II

Fuels & Combustion: Introduction, solid, liquid & gaseous fuel, Calorific value of fuel, flue gases per kg. of fuel, Minimum Air required per kg. of fuel, Excess Air Problems.

Condensers The function of a condenser in a Steam Power Plant, Vacuum, Classification, Comparison of Jet & Surface Condensers, Advantages/Disadvantages Mass of Circulating Water required in a condenser, Air Removal.

Fitting, Safety & Maintenance: Selection of size of steam pipes – layout of pipe lines – Energy audit of steam boilers – economy of heat utilization – boiler codes – Indian boiler regulation act – safety in steam plant maintenance

UNIT-III

Gears: Introduction, Classification of Gears, Parallel Shafts, Spur Gears Spur Rack & Pinion, Helical Gears, Intersecting Shafts, Straight Bevel Gears, Spiral Bevel Gears, Skew Shafts, Crossed Helical Gears, Worm Gear, Hypoid Gears, Gear Terminology, Pitch Circle, Pitch dia, Pitch, Circular Pitch.

UNIT-IV

Lubrication: Introduction, Physical & Chemical Test of Lubricants, Methods of Applying Lubrication, Hand oiling, drop feed cup, ring type of lubrication etc.

Corrosion Corrosion & its control, General Corrosion, Localized Corrosion, Pitting Corrosion etc. Factors influencing Corrosion, Combating Corrosion, Selection of material.

Recommended Books

1. Antonio López-Gómez Gustavo V. Barbosa-Cánovas, 'Food Plant Design', CRC Press, Boca Raton, **2005**.
2. C.P. Mallet, 'Frozen Food Technology', Blackie Academic & Professional an imprint of Chapman & Hall, **1993**.
3. J. Lal & Prof. J.M. Shah, 'Theory of Machine', Publishers Metropolitan Book & Co. Pvt. Ltd, Delhi-6.
4. S.S. Rattan, 'Theory of Machine', Tata McGraw Hill Publishing Co. Ltd, New Delhi, **2009**.
5. P.L. Ballaney, 'Thermal Engineering', Khanna Publishers, New Delhi, **1995**.

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FUNDAMENTALS OF MANAGEMENT

Subject Code: BBAD0-F91 **L T P C** **Duration: 40 Hrs**
3 0 0 3

Learning Objectives: This course aims to provide a thorough and systematic coverage of management theory and practice. The course aims at providing fundamental knowledge and exposure of the concepts, theories and practices in the field of management. It focuses on the basic roles, skills and functions of management, with special attention to managerial responsibility for effective and efficient achievement of goals.

UNIT-I (10 Hrs)

Introduction to Management: Definition, Nature, Significance and Scope. Functions of Manager, An Overview of Management Functions. Is managing a science or art? Evolution of Management Thought: Classical Approach, Scientific Management

UNIT-II (10 Hrs)

Planning and Decision Making: Types of Plans and Process of Planning, Nature of Objectives, Setting Objectives. Importance and Steps in Decision Making, Types of Decision and Decision Making Under Different Conditions. Group Decision Making. Decision Making Styles

Organizing: Nature and Significance, Process of Organizing, Bases of Departmentation, Delegation and Decentralization, Line & Staff relationship

UNIT-III (10 Hrs)

Delegation: Concept and Elements. Authority, Responsibility, Accountability

Coordination: Concept and Importance, Factors which Make Coordination Difficult, Techniques or Methods to Ensure Effective Coordination.

UNIT-IV (10 Hrs)

Control: Concept, Planning-Control Relationship, Process of Control, Traditional & Modern Techniques of Control

Management by Objectives: Concept, Benefits and Weaknesses

Course Outcomes: After completing the course student will be able to understand and explain the concept of management and its managerial perspective. It will equip students to map complex managerial aspect arise due to ground realities of an organization. They will Gain knowledge of contemporary issues in Management principles and various approaches to resolve those issues.

Recommended Books

1. Heinz Weihrich, Cannice & Koontz, ‘Management (A Global Perspective)’, Tata McGraw Hill.
2. Harold Koontz, and Heinz Weihrich, ‘Essentials of Management: An international Perspective’, Tata McGraw Hill.
3. Stephen Robbins & Mary coulter, ‘Management’, Pearson Education.
4. VSP Rao & VH Krishna, ‘Managemen't’, Excel Books.
5. P. Subba Rao, ‘Principles of Management’, Himalaya Publishing.

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PERSONNEL & INDUSTRIAL MANAGEMENT

Subject Code: BBAD0-F92	L T P C 3 0 0 3	Duration: 45 Hrs

Course Objectives: The objective of the paper is to make student aware of the various functions and importance of the HR department in any organization. It is basically concerned with managing the human resources, whereby the underlying objective is to attract retain and motivate the human resources in any organization, which is the most challenging and daunting look for any organization today.

UNIT-I (10 Hrs)

Human Resources Management: Meaning, Scope, Objective, Functions, Roles and Importance. Interaction with other functional areas. HRM & HRD a comparative analysis, Human Resource Planning: Meaning, Process & Methods of Human Resources Planning, Job Analysis: Job Description, Job Specification.

UNIT-II (10 Hrs)

Recruitment & Selection: Concept, Process & Methods. Concept of Induction & Placement, Training & Development: Concept & Methods, Difference Between Training & Development, Internal Mobility: Promotion, Transfer, Demotion, Separation.

UNIT-III (10 Hrs)

Performance Appraisal: Concept, methods & Process. Compensation Management- Wage & Salary Administration, Elements & Methods of Wage & Salary, Incentive Plans & Fringe Benefits

UNIT IV (10 Hrs)

Industrial Relations: Meaning and importance. Collective Bargaining, Participative Management, Employee Grievances and their Resolution, Quality Circles.

Course Outcome: After completing this course the students should be able to understand the concepts, principles and processes of HRM, understand the crucial role that HRM plays in helping organizations all over the world adapt to the endless change today.

Recommended Books

1. Edwin B. Flippo, 'Personal Management', Tata McGraw Hill.
2. Bohlander, Snell &Vohra, 'Human Resource Management', Cengage Learning.
3. Gary Dessler, Human Resource Management, McMillan.
4. V.S.P. Rao, 'Human Resource Management', Excel Books.
5. C.B. Mamoria, 'Personal Management', Himalaya Publications.
6. T.N. Chabbra, 'Human Resource Management', Dhanpat Rai & Sons.
7. C.B. Gupta, 'Human Resource Management', Sultan Chand and Sons.
8. R.S. Dwivedi, 'HRD in India Companies', Himalaya Publications.

CORPORATE GOVERNANCE & ETHICS

Subject Code: BBAD0- F93	L T P C 3 0 0 3	Duration: 40 Hrs.

UNIT-I (10 Hrs.)

Introduction to Ethics and Values and their importance in business: Ethical issues in Capitalism and Market System, Ethical and Social System. The Social Responsibility of Business, Ethical Conflict, Whistle Blowing.

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UNIT-II (10 Hrs.)

Ethics and Organization, Ethics in Human Resource Management and Organizational Culture, Ethics in Marketing, Ethics in Finance, Ethical Codes and Incentives in Corporate Sector.

UNIT-III (10 Hrs)

Broader Ethical issues in Society – Corruption, Ecological Concern, Discrimination on the Basis of Gender, Caste or Race, Ethics and Information Technology.

UNIT-IV (10 Hrs)

Impact of Group Policies and Laws of Ethics, Resolving Ethical dilemma.

Corporate Governance: Issues, Need, Transparency & Disclosure, Role of Auditors, Board of Directors and Shareholders, Corporate Social Responsibility.

Recommended Books

1. R.C. Shekhar, 'Ethical Choices in Business', Response Book, New Delhi.
2. S.C. Chakraborty, 'Managerial Transformation by Value', Sage Publications, New Delhi, **1993.**
3. Ananta K. Giri, 'Values, Ethics and Business: Challenges for Education and Management', Rawat Publication, Jaipur.

OPTICAL COMMUNICATION

Subject Code: BECE0-F91 **L T P C** **Duration: 38 Hrs.**
3 0 0 3

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Learning Objectives

1. To facilitate the knowledge about optical fiber sources and transmission techniques
2. To Enrich the idea of optical fiber networks algorithm such as SONET/SDH and optical
3. CDMA.
4. To explore the trends of optical fiber measurement systems.

Learning Outcomes:

Upon completion of the Course, students will be able to:

1. Discuss the various optical fiber modes, configurations and various signal degradation factors associated with optical fiber.
2. Explain the various optical sources and optical detectors and their use in the optical communication system.
3. Analyze the digital transmission and its associated parameters on system performance.

UNIT-I

Overview: The Electromagnetic Spectrum, Properties of Light, Dual Nature of Light Concept of a photon, Wave Model, Characteristics of light waves. Concepts of information, general communication systems, evolution of Basic fiber Optic Communication System, Benefits and disadvantages of fiber Optics. Transmission Windows. Transmission Through Optical fiber, The Laws of Reflection and Refraction, Light rays and light waves, Reflection of light from optical surfaces, Refraction of light from optical interfaces, Numerical Aperture (NA).

UNIT-II

Losses in Optical Fiber: Attenuation, Material absorption losses, linear and nonlinear scattering losses, fiber bend loss, dispersion viz. inter modal dispersion and intra modal dispersion, overall fiber dispersion and polarization, attenuation and dispersion limits in fibers, self-phase modulation, combined effect of dispersion and self-phase modulation.

Fiber Material, Couplers and Connectors: Preparation of optical fiber: liquid-phase techniques, vapor phase deposition techniques, Connector Principles, fiber End Preparation, splices, connectors.

UNIT-III

Optical Sources and Detectors: Sources: Basic principle of surface emitter LED and edge emitter LED- material used, structure, internal quantum efficiency and characteristics, LASER Diode - material used, structure, internal quantum efficiency and characteristics, working Principle and characteristics of Distributed feedback (DFB) laser. Detectors: PIN photodiode - material used, working principle & characteristics, Avalanche Photodiode: - material used, working principle and characteristics

UNIT-IV

Advanced Topics: Optical TDM, SCM, WDM and Hybrid multiplexing methods, Fiber Optic Networks, Transreceivers for Fiber-Optic Networks, Semiconductor Optical Amplifiers, Erbium Doped Fiber Amplifiers (EDFAs).

Optical Networks: Elements and Architecture of Fiber-Optic Network, SONET/SDH, ATM, IP, Optical Line Terminals (OLT), Optical Add-Drop Multiplexers, Optical Cross Connects.

Recommended Books

1. John M. Senior, ‘Optical Fiber Communication Principles & Practice’, PHI Publication.
2. John Gowar, ‘Optical Communication Systems’, PHI Publications.
3. Gerd Keiser, ‘Optical Fiber Communication’, McGraw Hill International Publications.
4. BishnuP. Pal, ‘Fundamentals of Fibre Optics in Telecommunication and Sensor Systems’, New Age International (P) Ltd.
5. Rajiv Ramaswami, Kumar N. Sivarajan, ‘Optical Networks Practical Perspective’, Elsevier.

MRSPTU

CELLULAR AND MOBILE COMMUNICATION

Subject Code: BECE0-F92 **L T P C** **Duration: 37 Hrs.**
3 0 0 3

Learning Objectives

The student should be made to:

1. Know the characteristic of cellular mobile systems
2. Learn the various elements of cellular radio systems design and interference
3. Understand the concepts behind various digital signaling schemes for fading channels
4. Be familiar the various multipath mitigation techniques.
5. Understand the various handoff techniques.

Learning Outcomes

At the end of the Course, the student should be able to

1. Understand cellular wireless communication systems.
2. Learn about elements of cellular radio systems.
3. Compare multipath mitigation techniques and analyze their performance.
4. Describe about hand offs and call drops.

UNIT-I

Introduction to Cellular Mobile Systems: A basic cellular system, performance criteria, Uniqueness of mobile radio environment, operation of cellular systems, planning a cellular system, analog & digital cellular systems.

Cellular Wireless Communication Systems: Second generation cellular systems: GSM specifications and Air Interface - specifications of various units, 2.5 G systems: GPRS/EDGE specifications and features, 3G systems: UMTS & CDMA 2000 standards and specifications.

UNIT-II

Elements of Cellular Radio Systems Design: General description of the problem, concept of frequency reuse channels, co-channel interference reduction factor, desired C/I from a normal case in an omni directional antenna system, cell splitting, consideration of the components of cellular systems.

Interference: Introduction to co-channel interference, real time co-channel interference, cochannel measurement design of antenna system, antenna parameter and their effects, diversity receiver in co-channel interference – different types.

UNIT-III

Cell Coverage for Signal & Traffic: General introduction, obtaining the mobile point to point mode, propagation over water or flat open area, foliage loss, propagation near in distance, long distance propagation, point to point prediction model- characteristics, cell site, antenna heights and signal coverage cells, mobile to mobile propagation.

Cell Site Antennas and Mobile Antennas: Characteristics, antenna at cell site, mobile antennas, Frequency Management and Channel Assignment, Frequency management, fixed channel assignment, non-fixed channel assignment, traffic & channel assignment.

UNIT-IV

Hand Off, Dropped Calls: Why hand off, types of handoff and their characteristics, dropped call rates & their evaluation.

Operational Techniques: Parameters, coverage hole filler, leaky feeders, cell splitting and small cells, narrow beam concept.

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Recommended Books:

1. C.Y. Lee William, ‘Mobile Cellular Telecommunications’, McGraw Hill.
2. Kamilo Feher, ‘Wireless and Digital Communications’, PHI.
3. T.S. Rappaport, ‘Wireless Communication, Principles & Practice’, PHI.

BIOMEDICAL ELECTRONICS AND INSTRUMENTATION

Subject Code: BECE0-F93	L T P C 3 0 0 3	Duration: 38 Hrs.

Learning Objectives

This Course introduces general biological concepts

1. It helps students to understand importance of biological concepts in engineering fields.
2. To understand application of engineering concepts in medical instrumentation.

Learning Outcomes

Upon successful completion of the Learning , students will be able to

1. Use bioinstrumentation, required in cellular or molecular biology investigations
2. Apply the concepts of engineering in different streams of biomedical field.

UNIT-I

Biomedical Signals: Origins of Bioelectric Signals, Human body, Heart and Circulatory System, Electrodes, Transducers, ECG, EMG.

UNIT-II

Recording & Monitoring Instruments : Recording Electrodes, Physiological Transducers, Biomedical Recorders, Biomedical Recorders , Heart rate measurement, Temperature measurement, Foetal Monitoring System, Foetal Monitoring System, Foetal Monitoring System, Foetal Monitoring System, Biomedical Telemetry.

UNIT-III

Imaging System: Working with X-Rays, CT scanner, NMR, NMR, Ultrasonic System, Ultrasonic System, Ultrasonic System.

UNIT-IV

Therapeutic & Physiotherapy Equipment's: Cardiac Pacemakers, Cardiac defibrillator, SW Diathermy & MW Diathermy.

Patient Safety: Electric Shock Hazards, Test Instruments, Biomedical Equipment's, Biomedical Equipment's.

Recommended Books

1. R.S. Khandpur., 'Handbook of Biomedical Instrumentation'

2. Leslie Cromwell, 'Biomedical Instrumentation and Measurements', PHI.

3. T.K. Attuwood, 'Introduction to bioinformatics', Pearson Education.

4. Joseph J. Carr & John M Brown, 'Introduction to biomedical equipment Technology', Pearson Education.

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UG OPEN ELECTIVES-II 2016 BATCH ONWARDS		
Internal	External	Total
40	60	100

NOTE: MORE COURSES MAY BE ADDED IN THIS LIST LATER ON

UG OPEN ELECTIVES-II 2016 BATCH ONWARDS		
COURSE CODE	**COURSE**	**NOT APPLICABLE FOR PROGRAMMES**
BFOT0-F92	Data Process Analysis	B.Tech. Food Technology
BBAD0-F94	Engineering Economics & Management	BBA
BBAD0-F95	Entrepreneurship	
BBAD0-F96	Finance for Engineers	
BEEE0-F94	Non-Conventional Energy Resources	EEE
BEEE0-F95	High Volatge Engineering	
BEEE0-F96	Nano Science and Nano Technology	
BECE0-F94	Communication Systems	ECE
BECE0-F95	Robotics and Automation	
BECE0-F96	Electronic System Design	

DATA PROCESS ANALYSIS

Subject Code: BFOT0-F92 **L T P C** **Contact Hrs.**
3 0 0 3

UNIT-I

Introduction: The meaning of quality and quality improvement, Statistical methods for quality control and improvement.

Food Quality System: The link between quality and productivity, Quality costs, Legal aspects of quality, implementing quality improvement.

Control Charts for Variables: Statistical basis of the charts, Development and use of x and R, Charts based on standard values, Interpretation of x and R charts, The effect of non-normality on x and R charts.

UNIT-II

Sampling: Population and sampling distributions, Sampling and non-sampling errors, Mean and standard deviation of x, Shape of the sampling distribution of x, Applications of the sampling distribution of x, Population and sample proportions, Mean, standard deviation.

Test Methods: Hypothesis tests, Estimation and hypothesis testing: two populations, Chi-square tests, Analysis of Variance, Simple linear regression, Non-parametric methods.

UNIT-III

Statistical Process Control (SPC) Techniques: SPC for short production runs, Modified and acceptance control charts, SPC with auto correlated process data, Economic design of control charts.

Multivariate Process Monitoring and Control: Description of multivariate data, The Hoteling T2 control chart, The multivariate EWMA (Exponentially Weighted Moving Average) control chart, Latent structure methods.

UNIT-IV

Process Capability Analysis (PCA): PCA using probability plot, Process capability ratios, PCA using a control chart, PCA using designed experiments.

Design of Experiments and Process Optimization: Guidelines for designing experiments, Factorial experiments, the 2k factorial design, Fractional replication of the 2k design, Response surface methods and designs

Six Sigma: Introduction, Six-sigma control chart, Six-sigma quality performance.

Recommended Books:

1. Jerome D. Braverman, ‘Fundamentals of Statistical Quality Control’, Brady and Prentice Hall, **1981**.
2. P.S. Mann, ‘Introductory Statistics’, John Wiley and Sons, **2010**.
3. D.C. Montgomery, ‘Statistical Quality Control’, 7th Edn., John Wiley & Sons, **2012**.
4. M. Jaya Chandra, ‘Statistical Quality Control’, CRC Publisher, **2001**.

ENGINEERING ECONOMICS & MANAGEMENT

Subject Code: BBAD0-F94 **L T P C** **Duration: 40 Hrs.**
3 0 0 3

Objectives: To run an organization, Finance and Human resources are the key factors. Their proper utilization decides its success. This course will give the basic understanding of both these resources.

UNIT-I (8 Hrs)

Introduction: Scope of economics for engineers; Concept of: Goods, Utility, Value, Price, Capital, Money, Income; Law of Demand & Supply, Basic Management Principles

UNIT-II (11 Hrs)

Cost Analysis: Cost classification: Prime cost, Overhead cost, Selling and Distribution Cost, Fixed cost, Variable cost, Implicit cost, Explicit cost, Replacement cost, Opportunity cost, Marginal cost and Sunk cost; Break Even Analysis; Economic order quantity.

Depreciation: Causes and Methods: Straight line method, Reducing balance method, Repair provision method, Annuity method, Sinking fund method, Revaluation method, Sum of the digit method.

UNIT-III (10 Hrs)

Replacement Analysis: Reasons and factors for replacement; Determination of economic life of an asset.

Inventory Management: Introduction, Factors & Techniques.

UNIT-IV (11 Hrs)

Human Resource Management: Definition; Functions of HRM; Process of Human Resource Planning**;** Methods of Recruitment; Meaning of Placement and Induction, Difference between Training and Development; Methods of Training and Development.

Recommended Books

1. T.R. Jain, ‘Micro Economics’, V.K. Publication.
2. P. Khanna, ‘Industrial Engineering and Management’, Dhanpat Rai Publication (P) Ltd.
3. M.S. Mahajan, ‘Industrial Engineering and Production Management’, Dhanpat Rai & Co. Pvt. Ltd.
4. T.N. Chhabra, ‘Human Resource Management’, Dhanpat Rai & Co.
5. P.L. Mehta, ‘Managerial Economics’, Sultan Chand & Sons.

ENTERPRENEURSHIP

Subject Code: BBAD0-F95 **L T P C** **Duration: 40 Hrs.**
3 0 0 3

Objectives: The purpose of this paper is to prepare a ground where the students view Entrepreneurship as a desirable and feasible career option. In particular, the paper seeks to build the necessary competencies and motivation for a career in Entrepreneurship.

UNIT-I

Foundations of Entrepreneurship: Concept, Need, Definition & Role of Entrepreneurship, Definition, Characteristics & Scope of Entrepreneur, Concepts of Entrepreneur, Intrapreneur, Entrepreneurial Culture, Reasons for The Failure of Entrepreneurial Ventures, Various Case Studies, Successful, Failed and Turnaround Ventures.

UNIT-II

Women Entrepreneurs & Entrepreneurship Development: Meaning, Role, Problems & Reasons for Less Women Entrepreneurs, Role of The Following Agencies in The Entrepreneurship Development DIC, SISI, EDII & NIESBUD.

UNIT-III

Small& Medium Enterprises - Small & Medium Industry: Meaning and Importance, Role & importance of SME in India Economy, Search for a Business Idea, Source of Ideas, Idea

Processing, Selection Idea, Input Requirements, Nature and Components of SME Environment, SME Funding

UNIT-IV

Financial Schemes Offered by Various Financial Institutions like Commercial Banks, IDBI, ICICI, SIDBI, SFCs, Role of Central Government and State Government in Promoting Entrepreneurship Relevant case studies related to the topics should be discussed.

Recommended Books

1. Vasant Desai, 'Management of Small Scale Industries', Himalaya Publishing.
2. Angadi, Cheema, Das, 'Entrepreneurship, Growth, and Economic Integration', Himalaya Publication.
3. Rizwana and Janakiran, 'Entrepreneurship Development', Excel Books.
4. Murthy, 'Small Scale Industry and Entrepreneurial Development', Himalaya Publishing.

FINANCE FOR ENGINEERS

Subject Code: BBAD0-F96 **L T P C** **Duration – 40 Hrs**
3 0 0 3

Course Objective: To provide an understanding of the function, the roles, the goals and the Processes of corporate financial management, covering the sourcing of finances and their issues in investment and operations. Problem-solving methodology will be used to illustrate the theories and tools in financial decision making.

Unit-I (10 Hrs.)

Nature, Scope and Objectives of Financial Management, Profit Maximization Vs Wealth Maximization, Financial Planning, Forms of Business Organization, Role of Financial Manager.

Unit-II (10 Hrs.)

Capital Structure – Introduction, Factors Affecting Capital Structure, Liquidity Ratios

Capital Structure Theories: Net Income Approach, Net Operating Income Approach, Traditional Approach, Modigliani-Miller Model (MM), Criticisms of MM Models, Financial Distress & Agency Cost, Asymmetric Information Theory.

Unit-III (10 Hrs.)

Working Capital Decision: Meaning, Nature and Scope of Working Capital - Component of Working Capital – Factors affecting Working Capital, Working Capital Strategies,

Capital Budgeting Techniques: Discounted and Non-Discounted Methods (Pay Back, ARR, NPV, IRR, Benefit Cost Ratio), Long Term and Short Term Sources of Funds

Unit-IV (10 Hrs.)

Long Term Sources of Funds: Equity share, Preference shares, Debentures, Bonds, Warrants, Venture capital and Ploughing back of profits

Short Term Sources of Funds: Commercial Paper, Certificate of Deposit, Treasury Bills

Financial Markets: Nature and Significance of Primary and Secondary Markets, Objectives and Functions

Course Outcome: After completing this course the students should be able to make optimum decisions pertaining to raising funds, making investments & managing the assets of a corporation, big or small, with an ultimate goal of creating value.

Recommended Books

1. Brigham, 'Financial Management: Text & Cases', Cengage Learning.

2. Brealy & Myres, 'Principles of Corporate Finance', Tata McGraw Hill.
3. Ambrish Gupta. 'Financial Accounting for Management', 2nd Edn., Pearson Education.
4. I.M. Pandey, 'Financial Management', Vikas Publishers.
5. S.P. Jain and K.L. Narang, 'Principles of Accounting', Kalyani Publishers, New Delhi, **2004**

COMMUNICATION SYSTEMS

Subject Code: BECE0-F94 **L T P C** **Duration: 37 Hrs.**
3 0 0 3

Learning Objectives

1. To understand the basic concept of communication and amplitude modulation.
2. To understand the concept of angle modulation.
3. To understand theory of digital modulation.
4. To understand working of radio receivers.

Learning Outcomes

At the end of the Course the student shall be able to:

1. Understand the fundamentals of communication systems and to perform amplitude and angle modulation and demodulation of analog signals
2. Perform and analyze PAM, PCM and PWM
3. Analyze FDM and TDM systems.
4. Design and conduct experiments, using modern communication tools necessary for various engineering applications.

UNIT-I

Introduction: Basic elements of communications. Noise Modulation and frequency translation, Need for modulation.

Amplitude Modulation (AM): Expression for AM, modulation index for AM, amplitude waveform and bandwidth of amplitude modulated signal, power distribution in amplitude modulated signal. Double sideband suppressed carrier (DSB-SC), single sideband (SSB), and vestigial sideband (VSB) AMs.

AM Modulators: Introduction. Circuit diagrams and operational principles of square law modulator, switching modulator, balanced modulator, ring modulator.

AM Demodulators: Introduction. Circuit diagrams and explanations of envelope detector and square law detector.]

UNIT-II

Angle Modulation: Introduction to Phase modulation (PM) and frequency modulation (FM). Relationship between PM and FM. Phase and frequency deviation. Power distribution in angle modulated signal. Spectral characteristics of angle modulated signals. Effect of noise on angle modulation, role of limiter, pre-emphasis and de-emphasis in FM. Comparison of FM with AM in communication systems.

UNIT-III

Introduction to Digital Signals: Comparison of Analog and Digital Signals; Advantages and disadvantages of Digital Communications, Elements of Digital Communication Systems. Pulse Amplitude Modulation, Pulse Code Modulation (PCM); Quantization Noise, Commanding Sampling Theorem, Concept of aliasing & flat top sampling, PCM bandwidth, Differential PCM, Delta Modulation(DM), Pulse width Modulation(PWM), Adaptive Delta Modulation(ADM).

UNIT-IV

Line Coding Schemes: Introduction, properties, general methods for derivation of power spectral density of a broad class of line coding scheme: ON-OFF signalling, polar signalling, bipolar and comparison among them. Pulse shaping, introduction to equalizer and eye diagram.

Recommended Books

1. Taub and Schilling, 'Principles of Communication Systems', McGraw Hill.
2. G. Kennedy, 'Electronic Communication System', PHI.
3. Roddy and Coolen, 'Electronic Communications', PHI
4. Thiagrajan Vishwanathan, 'Communication Switching Systems and Networks', PHI Pub.
5. Proakis, 'Communication System Engineering', Pearson.

ROBOTICS AND AUTOMATION

Subject Code: BECE0-F95	**L T P C** **3 0 0 3**	**Duration: 36 Hrs.**

Learning Objectives

The student should be made to:

1. Learn the fundamentals of robotics and robot kinematics
2. Be familiar with robot dynamic analysis and forces
3. Learn about the concepts of actuators and sensors.
4. Learn robot programing and applications.

Learning Outcomes

Upon completion of the Ciourse, the student should be able to:

1. Apply various robot kinematics.
2. Analyse the robot dynamic, differential motions and inverse manipulator kinematics.
3. Understand methods of trajectory planning, actuators and sensors.
4. Understand the lead through programming methods.

UNIT-I

Fundamentals: historical information, robot components, Robot characteristics, Robot anatomy, Basic structure of robots, Resolution, Accuracy and repeatability

Robot Kinematics: Position Analysis forward and inverse kinematics of robots, Including frame representations, Transformations, position and orientation analysis and the Denavit Hartenberg representation of robot kinematics, The manipulators, The wrist motion and grippers.

UNIT-II

Differential motions, Inverse Manipulator Kinematics: Differential motions and velocity analysis of robots and frames.

Robot Dynamic Analysis and Forces: Analysis of robot dynamics and forces, Lagrangian mechanics is used as the primary method of analysis and development.

UNIT-III

Trajectory Planning: Methods of path and trajectory planning, both in joint space and in Cartesian space.

Actuators and Sensors: Actuators, including hydraulic devices, Electric motors such as DC servomotors and stepper motors, Pneumatic devices, as well as many other novel actuators, It also covers microprocessor control of these actuators, Mechatronics, Tactile sensors, Proximity and range sensors, Force and torque sensors, Uses of sensors in robotics.

UNIT-IV

Robot Programming, Systems and Applications: Robot languages, Method of robots programming, Lead through programming methods, A robot programs as a path in space, Motion interpolation, WAIT, SIGNAL and DELAY commands, Branching capabilities and limitation of lead through methods and robotic applications.

Recommended Books

1. Stauguard A.C. & Eagle wood clif, 'Robotic & AI', Prentice Hall.
2. Lee C.S.G., Fu K.S., Gonzalez R.C, 'Robotic control, Sensing and Intelligence', Mcgraw Hill.
3. Parent M. and Laugreau C, 'Robot Technology, Logic 7 Programming', Kogan Page, London.

ELECTRONIC SYSTEM DESIGN

Subject Code: BECE0-F96 **L T P C** **Duration: 38 Hrs.**
3 0 0 3

Learning Objectives

1. To understand the stages of product (hardware/ software) design and development.
2. To learn the different considerations of analog, digital and mixed circuit design.
3. To understand the importance of sinusoidal oscillators. `
4. To understand the constant current sources.

Learning Outcomes

1. After successfully completing the Course students will be able to:
2. Understand various stages of hardware, software in electronic system design.
3. Designing of Class A, AB, Audio power amplifier.
4. Special design considerations of filters.

UNIT-I

Design of Power supply system: Unregulated D.C. power supply system with rectifiers and filters. Design of emitter follower regulator, series regulators, overload protection circuits for regulators. Design of SMPS: Step up and step down.

UNIT-II

Design of Class A Small Signal Amplifiers: Emitter follower, Darlington pair amplifiers with and without Bootstrapping, Two stage direct coupled amplifier. Design of class A, Class AB audio power amplifier with drivers.

UNIT-III

Design of sinusoidal oscillators: OPAMP based Wein bridge and Phase Shift oscillators with AGC circuits, Transistor based Hartley, Colpits and Crystal oscillators, Evaluation of figure of merit for all above oscillator circuits.

UNIT-IV

Design of constant current sources, Design of function generators, Design of tuned amplifiers. Design of Butterworth, Chebyshev filters up to sixth order with VCVS and IGMF configuration.

Recommended Books

1. Anielo. 'Electronics: BJT's, FETS and Microcircuits'.
2. Goyal & Khetan, 'Monograph on Electronic Circuit Design'.
3. 'Regulated Power Supply Handbook', Texas Instruments.

UG OPEN ELECTIVES-III 2016 BATCH ONWARDS		
Internal	External	Total
40	60	100

NOTE: MORE COURSES MAY BE ADDED IN THIS LIST LATER ON

UG OPEN ELECTIVES-III 2016 BATCH ONWARDS		
COURSE CODE	**COURSE**	**NOT APPLICABLE FOR PROGRAMMES**
BECE0-F97	Advance Process Control	ECE
BECE0-F98	Digital Signal Processing	
BECE0-F99	Antenna and Wave Propagation	

ADVANCE PROCESS CONTROL

Subject Code: BECE0-F97 **L T P C** **Duration: 36 Hrs.**
3 0 0 3

Learning Objectives

1. To outline the review& limitations of single loop control, need for multi-loop systems
2. To introduce the concept of advanced process control techniques.
3. To illustrate the concept of programmable logic controls.

Learning Outcomes

Students will be able to:

1. Represent and read the instrumentation scheme using P / I diagrams.
2. Analyze and implement selective & auctioneering control system.
3. Design of control systems for multivariable process.

UNIT-I

Introduction: Review& limitations of single loop control, need for multi-loop systems P/ I diagrams, standard instrumentation symbols for devices, signal types, representation & reading of instrumentation scheme using P / I diagrams.

UNIT-II

Advanced Process Control Techniques: principle, analysis & applications of cascade, ratio, feed forward, override, split range, selective & auctioneering control system with multiple loops, dead time compensation, adaptive control, inferential control.

UNIT-III

Design of Control Systems for Multivariable Process: multivariable control system, interaction in multiple loops, RGA method for minimizing interactions, Distillation column, absorbers, heat exchangers, furnaces and reactors.

UNIT-IV

Introduction to Computer Control Systems in Process Control: DCS configuration, control console equipment, communication between components, local control units, DCS flow sheet symbols, DCS I/O hardware & set point stations. Supervisory control& data acquisition system

Programmable logic controls: Introduction, relative merits over DCS & relay, programming languages, hardware & system sizing, PLC installation, maintenance & troubleshooting.

Recommended Books

1. C.D. Johnson, 'Process Control Instrumentation Technology', PHI.
2. Krishan Kant, 'Computer based Industrial Control', PHI.
3. Andrew Parr, 'Pneumatic & Hydraulic', PHI.
4. D. Considine, 'Process Industrial Instruments & Control Handbook', McGraw Hill.
5. B.G liptak, 'Instrument Engineers Handbook', CRC Press.

DIGITAL SIGNAL PROCESSING

Subject Code: BECE0-F98 **L T P C** **Duration: 37 Hrs.**
3 0 0 3

Learning Objectives

1. To study the concept of digital signal processing and its characteristics.
2. To learn discrete Fourier transform and its properties

3. To know the characteristics of IIR and FIR filters and learn the design of infinite and finite impulse response filters for filtering undesired signals
4. To understand Discrete Time Fourier Transform and Fast Time Fourier Transform

Learning Outcomes

Upon completion of the Course, students will be able to

1. Apply DFT for the analysis of digital signals & systems.
2. Design IIR and FIR filters.
3. Design the Multi rate Filters.
4. Apply Adaptive Filters to equalization.

UNIT-I

Introduction to DSP, Time and Frequency domain description of different type of signals & systems, Discrete time sequences systems, Linearity unit sample response, Convolution, Time invariant system, Stability criteria for discrete time systems.

UNIT-II

Introduction to Fourier transform of Discrete Time Signal and its properties, Inverse Fourier transform, Sampling of continuous time signal, Reconstruction of continuous time signal from sequences, Z-Transform and its properties, complex Z-plane, ROC. Relationship between Fourier Transform and Z-Transform, Inverse Z-Transform.

UNIT-III

Discrete Time Fourier Transform and its properties, Linear convolution, Circular convolution, convolution from DFT, FFT, Inverse Fast Fourier Transform, Decimation in time and frequency algorithm.

UNIT-IV

Filter categories, Finite impulse response filters, various design techniques of FIR filters, FIR filter design by Windowing method, Rectangular, Triangular and Blackman window, Kaiser window. Design of IIR by Approximation of derivatives, Impulse invariant method and Bilinear Transformation method. Steps in Filter Design of Butter worth, Elliptic filter, Chebyshev filters, Frequency Transformation, Applications of DSP.

Recommended Books

1. Oppenhavm & Scheffer, ‘Discrete time Processing’, PHI.
2. Proakis & D.G. Monolakis, ‘Digital Signal Processing’, PHI.
3. S.K. Mitra, ‘Digital Signal Processing’, PHI.
4. E.C. Ifeacher, B.W. Jervis, ‘Digital Signal Processing’, Addison Wesely.

ANTENNA AND WAVE PROPAGATION

Subject Code: BECE0-F99 **L T P C** **Duration: 38 Hrs.**
3 0 0 3

Learning Objectives

1. To provide knowledge about the propagation of electromagnetic wave along different mediums like guided, unguided medias and in space with basic understanding of transmission lines and the method of solving different problems related to it.
2. Study of physical concept of radiation patterns and all the important Fundamental Parameters of antennas with antenna Arrays in the antenna terminology

Learning Outcome

1. An ability and development of skill of students to design highly effective communication system.

2. After completion of the Course, students will be aware with the various performance parameters of the antenna system design and antenna arrays.
3. Understand various types of antennas such as microstrip and Yagi-uda antennas.
4. To understand Ground wave propagation.

UNIT-I

Antenna Basics Directional properties of antennas, Radiation patterns, antenna gain and aperture, antenna terminal impedance, self and mutual impedance, front to back ratio, antenna beam width and bandwidth, antenna efficiency, antenna beam area, polarization, antenna temperature and Reciprocity properties of antennas.

UNIT-II

Antenna Arrays: Classification of arrays, linear arrays of two point sources, linear arrays of n-point sources, pattern multiplication, array factor, linear arrays of equal amplitude and spacing (Broadside and end fire arrays) of n-point sources, directivity and beam width, non-uniform arrays excitation using Binomial series.

UNIT-III

Special Antennas: VLF and LF antennas (Hertz and Marconi antennas), effects of antenna height and effect of ground on performance of antenna, Rhombic antennas, Loop antennas, receiving antenna and radio direction finders. Folded dipole antennas, Yagi-uda antenna, horn antennas, microwave dish, helical antennas, frequency independent antennas, microstrip antennas, fractal antennas.

UNIT-IV

Ground Wave Propagation: Characteristics for ground wave propagation, reflection at the surface of a finitely conducting plane and on earth, Attenuation Calculation of field strength at a distance.

Ionosphere Propagation: The ionosphere, formation of the various layers, their effective characteristics, reflection and refraction of waves by ionosphere, virtual height, maximum frequency, skip distance, regular and irregular variation of ionosphere, Fading and Diversity reception, ordinary and extraordinary waves.

Space Wave Propagation: Space wave, range and effect of earth, Troposphere waves-reflection, refraction, duct propagation, Troposphere scatter propagation link

Recommended Books

1. J.D. Kraus, ‘Antennas’, McGraw Hill.
2. C.A. Balanis, ‘Antennas Theory and Design’, Willey.
3. K.D. Prasad, ‘Antenna & Wave Propagation’, Satya Parkashan, New Delhi.
4. E.C. Jorden & B.C. Balmann, ‘Electromagnetic waves & radiating System’, P.H.I.
5. R.E. Collins, ‘Antennas and Radio Propagation’, McGraw Hill.

B. Tech. Agricultural Engineering

Total Contact Hours = 30 **Total Marks = 900** **Total Credits = 25**

SEMESTER 3rd		Contact Hrs			Marks			Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
BAGE2-301	Agriculture for Engineers	3	1	0	40	60	100	4
BAGE2-302	Farm Machinery	3	1	0	40	60	100	4
BAGE2-303	Thermodynamics and Heat Engine	3	1	0	40	60	100	4
BAGE2-304	Wasteland Development	3	1	0	40	60	100	4
BAGE2-305	Irrigation Engineering	3	1	0	40	60	100	4
BAGE2-306	Agriculture for Engineers Lab	0	0	2	60	40	100	1
BAGE2-307	Farm Machinery Lab	0	0	2	60	40	100	1
BSOS0-F91	Soft Skills-I	0	0	2	60	40	100	1
BAGE2-308	4-Weeks Institutional Training (after 2nd semester)	0	0	4	60	40	100	2
Total		15	5	10	320	380	900	25

Total Contact Hours = 27 **Total Marks = 900** **Total Credits = 23**

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SEMESTER 4th		Contact Hrs			Marks			Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
BAGE2-409	Surveying and Levelling	3	1	0	40	60	100	4
BAGE2-410	Theory of Machines	3	1	0	40	60	100	4
BAGE2-411	Engineering Economics	4	0	0	40	60	100	4
BAGE2-412	Soil & Water Conservation Engineering	3	0	0	40	60	100	3
BAGE2-413	Farm Power	3	1	0	40	60	100	4
BAGE2-414	Surveying and Levelling Lab	0	0	2	60	40	100	1
BAGE2-407	Theory of Machines Lab	0	0	2	60	40	100	1
BAGE2-415	Soil & Water Conservation Engineering Lab	0	0	2	60	40	100	1
BSOS0-F92	Soft Skills-II	0	0	2	60	40	100	1
Total		16	3	8	380	420	900	23

Overall

Semester	**Marks**	**Credits**
1st	1000	25
2nd	900	25
3rd	900	25
4th	900	23
Total	**3700**	**98**

AGRICULTURE FOR ENGINEERS

Subject Code: BAGE2-301 **L T P C** **Duration: 48 Hrs.**
3 1 0 4

Unit–I (12 Hrs.)

Soil Characteristics- Nature and origin of soil, Soil forming rocks and minerals, their classification and composition, Soil forming processes, Classification of soils, Soil taxonomy orders, Important soil physical properties; and their importance, Soil particle distribution, Soil inorganic colloids – their composition, Properties and origin of charge, Ion exchange in soil and nutrient availability.

Unit – II (12 Hrs.)

Soil Organic Matter- Its composition and decomposition, effect on soil fertility, saline and sodic soils Quality or irrigation water, Essential plants nutrients, Functions and deficiency symptoms in plants Important inorganic fertilizers and their reactions in soils.

Unit - III (14 Hrs.)

Agronomy- Definition and scope of agronomy, Classification of crops, Effect of different weather parameters on crop growth and development, Principles of tillage, Tilth and its characteristics Soil water plant relationship and water requirement of crops, Crop rotation, cropping systems, Mixed cropping, Relay cropping

Horticulture- Scope of horticultural and vegetable crops, Soil and climatic requirements for fruits Soil and climatic requirements for Vegetables, Soil and climatic requirements for Floriculture crops, improved varieties of horticulture crops High-tech horticulture- Poly-houses for flowers and vegetables.

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Unit –IV (10 Hrs.)

Criteria for Site Selection of Horticulture Crops - Layout and planting methods, Nursery raising, Macro and micro propagation methods, Pant growing structures, Pruning and training, Fertilizer application process, Fertigation, Irrigation methods, Harvesting, Grading and packaging, Post-harvest practices, Garden tools, management of orchard, Extraction and storage of vegetables seeds.

Recommended Books

1. T.D. Biswas and S.K. Mukherjee, 'Soil Science,' TMH Publication.
2. T. Yellamanda and G.H. Sankara Reddy, 'Principle of Agronomy', Kalyani Publication.
3. Jitendra Singh, 'Basic Horticulture,' Kalyani Publisher.
4. K.K. Mehta, 'Reclamation of Alkali Soil in India,' Oxford & IBH.
5. Maharaj Singh, 'Education for Sustainable Agriculture,' Indian J. Agronomy.

FARM MECHINERY

Subject Code: BAGE2-302 **L T P C** **Duration: 48 Hrs.**
3 1 0 4

Unit – I (12 Hrs.)

Tillage; primary and secondary tillage equipment, Zero and conservation tillage equipment Forces acting on tillage tools, Hitching systems and controls, Measurement of forces of tillage tools, Draft measurement of tillage equipment Types of dynamometer; spring, hydraulic, and strain gauge types.

Unit – II (10 Hrs.)

Objectives of farm mechanization, Classification of farm machines, Materials of construction and heat treatment, Principles of operation and selection of machines used for production of crops, field capacities and economics.

Unit – III (12 Hrs.)

Earth moving equipment - their construction & working principles, Bulldozer, Elevators, Scraper and Digger, Sowing, planting & transplanting equipment, various type Zero till ferti-drill Seed and planting metering devices, their calibration and adjustments. Furrow openers and covering devices, Fertilizer application equipment and their metering devices.

Unit – IV (14 Hrs.)

Weed control and Plant protection equipment - sprayers and dusters, their calibration, selection, constructional features of different components and adjustments. Crop harvesting machinery, Principles and types of cutting mechanisms, Construction & adjustments of shear & impact-type cutting mechanisms, Brief description of mowers, windrowers, reapers, reaper binders and forage harvesters, forage chopping & handling equipment. Description working principle of threshing machineries, grain and straw combine.

Recommended Books

1. R.A Kepner, Roy Bainer, 'Principle of Farm Machinery,' CBS Publication.
2. Radhey Lal, 'Agricultural Engineering', Saroj Publication.
3. Jagdishwar Sahay, 'Elements of Agricultural Engineering', Standard Publishers. Distributors.
4. R. Suresh, 'Farm Power and Machinery Engineering', Standard Publishers Distributors.
5. Triveni Singh Prasad, 'Farm Machinery,' PHI, **2016.**

THERMODYNAMICS AND HEAT ENGINE

Subject Code: BAGE2-303 **L T P C** **Duration – 46 Hrs.**
3 1 0 4

MRSPTU

Unit – I (10 Hrs.)

Thermodynamics Properties- Closed and open system Flow and non-flow processes Gas laws of thermodynamics Internal Energy Application of first law in heating and expansion of gases in non-flow processes First law applied to steady flow processes.

Unit – II (10 Hrs.)

Second Law of Thermodynamics - Kelvin-Planck statement**,** Clausius Statement, Reversible processes, Carnot cycle, Carnot theorem.

Unit – III (12 Hrs.)

Entropy-Physical concept of entropy, Change of entropy of gases at constant volume, Change of entropy of gases at constant Pressure, Change of entropy of gases at constant Temperature, Change of entropy of gases at reversible adiabatic process Change of entropy of gases at poly tropic process

Unit – IV (14 Hrs.)

Steam Generator- Classification of steam boilers, Lancashire boiler, Locomotive boiler, Boiler mountings, Boiler accessories, Desirable properties of working fluid used for power plants, Rankine cycle, Introduction to compound steam engines.

Thermodynamic air Cycle- Air Standard efficiency, Engine efficiencies and terms, Otto cycle, Diesel cycle, Dual cycle, mean effective pressure, Measurement of IP and BP, Heat balance calculations.

Recommended Books

1. D.S. Kumar, 'Thermodynamics,' Katson Publication 1st Edn., **2009**.
2. R.S. Khurmi & J.K. Gupta, 'A Text Book of Thermal Engineering,' S. Chand & Company Limited, reprint **2002**.
3. D.K. Jha, 'A Text Book of Thermodynamics,' Discovery Publishing House.
4. P.K. Nag,'Engineering Thermodynamics,' TMH Publication.

5. R. Yadav, 'Thermodynamics and Heat Engines', Central Publishing House, **2002**.

WASTELAND DEVELOPMENT

Subject Code: BAGE2-304 **L T P C** **Duration: 46 Hrs.**
3 1 0 4

Unit – I (10 Hrs.)

Land Degradation – Concept, classification - arid, semiarid, humid and sub-humid regions, denuded range land and marginal lands. Wastelands - factors causing, classification and mapping of wastelands, planning of wastelands development - constraints, agro-climatic conditions, development options, contingency plans.

Unit – II (12 Hrs.)

Conservation Structures - Gully stabilization, ravine rehabilitation, sand dune stabilization, water harvesting and recycling methods (In brief).

Afforestation-Agro-horti-forestry-Silvopasture methods forage and fuel crops– socioeconomic constraints, Shifting cultivation, optimal land use options.

Unit – III (12 Hrs.)

Wasteland Development – Hills, semi-arid, coastal areas, water scarce areas, reclamation of waterlogged and salt-affected lands. Mine spoils- impact, land degradation and reclamation and rehabilitation, slope stabilization and mine environment management

Unit-IV (12 Hrs.)

Micro-irrigation in wastelands development, Sustainable wasteland development – drought situations, socio-economic perspectives. Government policies, Participatory approach. Preparation of proposal for wasteland development and benefit-cost analysis.

Recommended Books-

1. I.P. Abrol and V.V. Dhruva Narayana, 'Technologies for Wasteland Development,' ICAR, New Delhi, **1998.**
2. S.K. Ambast, S.K. Gupta and Gurbachan Singh, 'Agricultural Land Drainage – Reclamation of Waterlogged Saline Lands'.
3. Hridai Ram Yadav, 'Management of Wastelands', Concept Publishing Company, New Delhi.
4. S.C. Kalwar, 'Wastelands and Planning for Development,' Concept Publishing Company **2008.**
5. C. Karthikeyan, K. Thangaraja, C. Cinthia Fernandez and K. Chandrakandon, 'Dryland Agriculture and Wasteland Management,' Atlantic Publishers, New Delhi, **2009.**

MRSPTU

IRRIGATION ENGINEERING

Subject Code: BAGE2-305 **L T P C** **Duration: 46 Hrs.**
3 1 0 4

Unit- I (10 Hrs.)

Source of irrigation water, measurement of irrigation water, infiltration, application of soil plant atmospheric continuum and principles of fluid mechanics to design of irrigation system, water balance equation and evaluation of different components; measurement of evaporation and evapo-transpiration.

Unit- II (12 Hrs.)

Water Resource Development and Utilization in India; Surface water resources, ground water resources, India's water budget, utilization of water resources, factors a fleeting water utilization, major river basins of India.

Unit- III (10 Hrs.)

History and development of Irrigation in India, Classification of irrigation projects, canal network, water distribution pattern, system of levying irrigation charges.

Unit- IV (14 Hrs.)

Estimation of irrigation water requirement and irrigation scheduling: efficiencies of irrigation systems, Hydraulics (in Brief).

Design and evaluation of surface, sub-surface, overhead and drip irrigation systems; design of water conveyance systems including control structures, design principles, characteristics curves, Selection of pumps and prime movers

Recommended Books:

1. A.M. Michael, 'Irrigation Theory and Practice', Vikas Publications, New Delhi.
2. S.K. Majumdar, 'Irrigation Engineering', Tata McGraw Hill Publishing Co. Ltd., New Delhi, **1983**.
3. Om Prakash, 'Irrigation and Water Management', Rama Publishing House, Meerut.
4. K.K. Schwab, 'Soil and Water Conservation Engineering'. John Wiley and Sons Inc. New York.
5. R. Lal 'Irrigation Hydraulics', Saroj Prakashan, Allahabad, **1978**.
6. N.N. Basak, 'Irrigation Engineering', McGraw Hill Education, **1999.**

AGRICULTURE FOR ENGINEERS LAB.

Subject Code: BAGE2-306 **L T P C**
0 0 2 1

MRSPTU

EXPERIMENTS

1. Study of Garden tools, implements and plant protection equipment.
2. Identification of rocks and minerals.
3. Study of manures and fertilizers.
4. Study of layout in different irrigation systems.
5. To study of Pruning and training of orchard trees.
6. Examination of soil profile in the field.
7. Determination of bulk density.
8. Identification of weeds.
9. Determination particle density and porosity of soil.
10. Study of different Cultivator.
11. Study of different weed control methods.
12. Determination of organic carbon of soil.
13. Fertilizer application methods.
14. Study of different orchard layout methods.
15. Identification of crops and their varieties seeds.

FARM MACHINERY LAB.

Subject Code: BAGE2-307 **L T P C**
0 0 2 1

EXPERIMENTS

1. Introduction to various farm machineries.
2. To study animal drawn and tractor drawn mould Board ploughs.
3. To study Indigenous or country plough.
4. To study the starting and stopping of Diesel Engine.
5. Introduction, construction and working of earth moving equipment.

6. To study four stroke cycle engine.
7. Construction and working of rotavator and other rotary tillers.
8. To study cultivators and its important functions.
9. Weeding equipment- their use and adjustment
10. Field operation of showing and planting equipment and their adjustments.
11. Field capacity and field efficiency measurement for at least two machines/implements.
12. Working of Paddy Transplanter and their calibration.
13. To Study the field capacity of sprayer and duster.
14. To study Air cooling system and its advantages.
15. Study on methods of repair, maintenance and off season storage of farm equipments.
16. Working of seed-cum-fertilizer drills and their calibration.

SURVEYING AND LEVELLING

Subject Code: BAGE2-401	**L T P C** **3 1 0 4**	**Duration: 48 Hrs.**

Unit – I (12 Hrs.)

Surveying - Principle and basic concepts of surveying, Plans and maps, Classification of surveying, basic measurements, Units of measurement, Types of Scales, Recording the measurement, Principal of chain surveying, Types of Chains, Types of Ranging Chaining Chain and tape errors & corrections, Selection of survey station and lines, Offset measurement, Cross Staff Optical Square- Prism Square, Obstacles in chaining and ranging.

Unit – II (12 Hrs.)

Surveying - Principle and basic concepts of surveying, Plans and maps, Classification of surveying, basic measurements, Units of measurement, Types of Scales, Recording the measurement, Principal of chain surveying, Types of Chains, Types of Ranging Chaining Chain and tape errors & corrections, Selection of survey station and lines, offset measurement, Cross Staff Optical Square- Prism Square, Obstacles in chaining and ranging.

MRSPTU

Unit – III (10 Hrs.)

Plane Tabling - Plane tabling instruments and accessories**,** Methods and principal**,** Two points problem**,** Three points problem**,** Errors in plane tabling, Planimeter, Sextant**,** Band level, Abney level**,** Clinometers, Pentameter, Computation of areas methods

Unit – IV (14 Hrs.)

Levelling - Definition, Basic principal of levelling**,** Benchmark**,** Types of levels optical**,** Principal causes telescopes sensitivity of bubble tubes**,** levelling staff**,** Temporary adjustment, Permanent adjustment of levels, Field book entries**,** Reduction of levels missing entries, Types of levelling**,** Simple and differential levelling, Check levelling & reciprocal levelling**,** Precise levelling**,** profile levelling

Theodolite - Theodolite traversing**,** Theodolite Surveying**,** Ranging by theodolite**,** Temporary and Permanent adjustment of theodolite

Recommended Books

1. T.P. Kanetkar & S.V. Kulkarni, ‘Surveying and Levelling Part-1’, Pune Vidyarthi Griha Prakashan.
2. B.C. Punamia, ‘Surveying and Levelling’, Vol-I & Vol-II, Laxmi Publications, **2005.**
3. S.K. Duggal, ‘Surveying’, Vol I & II, Tata McGraw Hill, **2006.**
4. R. Agor, ‘Surveying,’ Khanna Publishers.
5. S.S. Bhavikatti, ‘Surveying & Levelling’, Vol. I & II, **2009.**

THEORY OF MACHINES

Subject Code: BAGE2-402 **L T P C** **Duration: 46 Hrs.**
3 1 0 4

Unit – I (12 Hrs.)

Elements, links, pairs, kinematics chain, and mechanisms, classification of pairs and mechanisms, Lower and higher pairs, four bar chain, slider crank chain and their inversions, Degree of freedom, Determination of velocity and acceleration using graphical (relative velocity and acceleration) method. Instantaneous centres.

Unit – II (12 Hrs.)

Cam, Types of cam, Terminology used in cam-follower system, Cam profile, Gear train, Simple, compound, reverted, and epicyclical gear trains, Determination of velocity ratio and train value by tabular method

Unit – III (10 Hrs.)

Introduction to Belt drives, types of drives, belt materials, Length of belt, power transmitted, velocity ratio, belt size for flat and V belts. Effect of centrifugal tension, Creep and Slip on power transmission, Chain drives.

Unit – IV (12 Hrs.)

Introduction to Clutches, Types of clutches (Single disc, multiple disc, and cone clutches). Balancing of rotating masses in one and different planes, Partial primary balancing of reciprocating masses

Introduction to Governor, Types of governors, Constructional details and Analysis of Watt, Porter, Proell governor, Sensitiveness, stability, hunting, isochronisms, power and effect of a governor, Introduction to flywheel, Static and dynamic balancing.

MRSPTU

Recommended Books

1. R.S. Khurmi, 'Theory of Machine,' S. Chand Publication.
2. S.S. Rattan, 'Theory of Machine,' 4th Edn., McGraw Hill Education Publication.
3. Jagdish Lal, 'Theory of Mechanisms & Machines', Metropolitan Book Co.
4. V.P. Singh, 'Theory of Machines', Dhanpat Rai Pub.
5. Thomas Beven, 'Theory of Machines,' Longman's Green & Co., London.

ENGINEERING ECONOMICS

Subject Code: BAGE2-403 **L T P C** **Duration: 46 Hrs.**
4 0 0 4

Unit – I (12 Hrs.)

Economics; Definitions, Nature, Scope, Difference between Microeconomics & Macroeconomics Theory of Demand & Supply; meaning, determinants, law of demand, law of supply, equilibrium between demand & supply Elasticity, price elasticity, income elasticity, cross elasticity.

Unit – II (10 Hrs.)

Theory of production; production function, meaning, factors of production (meaning & characteristics of Land, Labour, capital & entrepreneur), Law of variable proportions & law of returns to scale Cost; meaning, short run & long run cost, fixed cost, variable cost, total cost, average cost, marginal cost, opportunity cost. Break even analysis; meaning, explanation, numerical

Unit – III (14 Hrs.)

Markets; meaning, types of markets & their characteristics (Perfect Competition, Monopoly, Monopolistic Completion, Oligopoly). National Income; meaning, stock and flow concept, NI at current price, NI at constant price, GNP, GDP, NNP, NDP, Personal income, disposal income.

Unemployment: meaning, types, causes, remedies Inflation; meaning, types, causes, measures to control. Money; meaning, functions, types, Monetary policy- meaning, objectives, tools, fiscal policy-meaning, objectives, tools.

Unit –IV (10 Hrs.)

Introduction to Production Management; definitions, objectives, functions, plant layout-types & factors affecting it, plant location- factors affecting it. Introduction to Human Resource Management; definitions, objectives of manpower planning, process, sources of recruitment, process of selection.

Recommended Books

1. R. Paneerselvam, 'Engineering Economics, 'PHI.
2. N. Gregory Mankiw, 'Principles of Economics', Cengage Learning.
3. L.M. Prasad, 'Principles and Practices of Management'.
4. Subba Reddy, 'Agricultural Economics,' Oxford, **2008.**
5. Tripathy and Redd, 'Principles of Management'.
6. K.K. Dewett & M.H. Navalur, 'Modern Economic Theory,' S. Chand Publications.

SOIL AND WATER CONSERVATION ENGINEERING

Subject Code: BAGE2-404 **L T P C** **Duration: 40 Hrs.**

3 0 0 3

MRSPTU

Unit – I (10 Hrs.)

Introduction- Soil erosion - causes, types and agents of soil erosion; water erosion – forms of water erosion, mechanics of erosion; gullies and their classification, stages of gully development; characteristics of contours and preparation of contour maps.

Unit – II (8 Hrs.)

Erosion Control Measures – Agronomical measures - contour cropping, strip cropping, mulching; mechanical measures - terraces – level and graded broad base terraces and their design, bench terraces & their design, layout procedure, terrace planning, bunds - contour bunds, graded bunds and their design; gully and ravine reclamation – principles of gully control - vegetative and temporary structures.

Unit – III (10 Hrs.)

Wind Erosion - Factors affecting wind erosion, mechanics of wind erosion, soil loss estimation, wind erosion control measures - vegetative, mechanical measures, wind breaks & shelter belts, sand dunes stabilization.

Unit – IV (12 Hrs.)

Soil Loss Estimation - Universal soil loss equation and modified soil loss equation, determination of their various parameters, Sedimentation - sedimentation in reservoirs and streams, estimation and measurement, sediment delivery ratio, trap efficiency.

Design Principle of Channel- Most Economical trapezoidal, Triangular channel and grassed water ways and their design; introduction to water harvesting techniques; introduction to stream water quality and pollution.

Recommended Books

1. Michael, 'Principles of Agricultural Engineering', Vol.-2,' Jain Brothers, **2013.**
2. R. Suresh, 'Soil & Water Conservation Engineering,' Standard Publishers Distributors.
3. Ghanshyam Das, 'Hydrology and Soil Conservation Engineering: Including Watershed Management,' 2nd Edn., PHI Publication.
4. V.V.N. Murthy, 'Land and Water Management Engineering.'

5. Bimal Chandra Mal, 'Introduction to Soil and Water Conservation Engineering,' Kalyani Publishers, **2011.**

FARM POWER

Subject Code: BAGE2-405 **L T P C** **Duration: 46 Hrs.**
3 1 0 4

Unit – I (10 Hrs.)

Sources of farm power -conventional & non-conventional energy sources and their utilization, classification of tractors and IC engines, Review of thermodynamic principles of IC (CI & SI) engines and deviation from ideal cycle.

Unit – II (12 Hrs.)

Engine & their components, their construction, operating principles and functions, valves & valve mechanism, Firing order and diagram, criteria for selection.

Study of constructional details, adjustments and operating principles of fuel and air supply, cooling, lubricating, ignition, governing and electrical systems.

Unit – IV (12 Hrs.)

IC engine fuels - their properties & combustion of fuels, gasoline tests and their significance, diesel fuel tests and their significance, detonation and knocking in IC engines, Properties of coolants, anti-freeze and anti-corrosion materials, lubricant types & study of their properties.

Unit –V (12 Hrs.)

Transmission systems of wheel and track type tractors: clutch, gear box, differential and final drive mechanism PTO system, type, standardization, belt and pulley on tractor and their standardization. Preventive maintenance of various systems

Recommended Books

1. Jagdishwar Sahay, 'Elements of Agricultural Engineering,' Standard Publishers Distributors.
2. John B. Lijiedahal, Paul K. Turn quist, 'Tractors and their Power Units,' CBS Publication.
3. S.C. Jain, 'Farm Tractor maintenance and repair,' Standard Publishers Distributors.
4. R. Suresh, 'Farm Power and Machinery Engineering', Standard Publishers Distributors.
5. Donnell Hunt, 'Farm Power and Machinery Management', Medtech, 10th Edn., **2013.**

THEORY OF MACHINES LAB.

Subject Code: BAGE2-407 **L T P C**
0 0 2 1

EXPERIMENTS

1. To study the various inversions of kinematic chains.
2. Conduct experiments on various types of governors.
3. Demonstration of static and dynamic balancing in the laboratory.
4. Determination of gyroscopic couple (graphical method).
5. Balancing of rotating masses (graphical method).
6. Cam profile analysis (graphical method)
7. Motion analysis of Epicyclical gear trains using tabular and formula methods.
8. Analysis of 4-bar mechanism slides crank mechanism and their inversions.
9. Draw graphs between height and equilibrium speed of a governor.
10. To draw circumferential and axial pressure profile in a full journal bearing.
11. To determine coefficient of friction for a belt-pulley material combination.
12. Determination of moment of inertia of flywheel.
13. To study the flywheel and governor action in laboratory.

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14. To study the static and dynamic balancing using rigid blocks.
15. To draw displacement, velocity & acceleration diagram of slider - crank and four bar mechanism.

SOIL & WATER CONSERVATION ENGINEERING LAB.

Subject Code: BAGE2-408 **L T P C**

0 0 2 1

EXPERIMENTS

1. Study of different types of conservation measures.
2. Design of drop spillway.
3. Design of drop inlet spillway.
4. Design of farm pond.
5. Demonstration of Bench Terrace in the farming.
6. Study of USLE/MUSLE parameter.
7. Study about the Contour farming.
8. To demonstrate the conservation of tillage.
9. Study of erosion checked by row cropping pattern.
10. Study of contour cropping effect on soil erosion.
11. Study of bund /graded/contour bund.
12. Design of grassed water ways.
13. Computation of soil erosion by USLE/MUSLE.
14. Design of Trapezoidal water ways.
15. Design of Triangular water ways.

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M. Tech. Civil Engg. (Construction Technology and Management)

Total Contact Hours = 24 **Total Marks = 600** **Total Credits = 22**

SEMESTER 1st		Contact Hrs			Marks			Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
MCIE6-101	Project Planning & Control	3	1	-	40	60	100	4
MCIE6-102	Construction Engineering & Management	3	1	-	40	60	100	4
MCIE6-103	Concrete Construction Technology	3	1	-	40	60	100	4
MCIE6-104	Software Lab – Project Planning	-	-	4	60	40	100	2
Departmental Elective – I (Select any one)		3	1	0	40	60	100	4
MCIE6-156	Computational Techniques							
MCIE6-157	Environment Engineering & Management							
Departmental Elective – II (Select any one)		3	1	0	40	60	100	4
MCIE6-158	Maintenance of Building Structures							
MCIE6-159	Composite Materials							
Total	**Theory = 5 Lab = 1**	15	5	4	260	340	600	22

MRSPTU

Total Contact Hours = 24 **Total Marks = 600** **Total Credits = 22**

SEMESTER 2nd		Contact Hrs			Marks			Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
MCIE6-205	Construction Laws & Contract Management	3	1	-	40	60	100	4
MCIE6-206	Building Cost & Quality Management	3	1	-	40	60	100	4
MCIE6-207	QA & QC Lab	-	-	4	60	40	100	2
Departmental Elective – III (Select any one)		3	1	0	40	60	100	4
MCIE6-260	Construction Costing & Financial Management							
MCIE6-261	Project Safety Management							
Departmental Elective – IV (Select any one)		3	1	0	40	60	100	4
MCIE6-262	Foundation Design & Construction							
MCIE6-263	Rural Construction Technology							
Open Elective – I (Select any one)		3	1	0	40	60	100	4
Total	**Theory = 4 Lab = 1**	**15**	**5**	**6**	**260**	**340**	**600**	**22**

Total Contact Hours = 12 **Total Marks = 500** **Total Credits = 26**

SEMESTER 3rd		**Contact Hrs**			**Marks**			**Credits**
Subject Code	**Subject Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
MCIE6-308	Professional Skills	3	1	-	40	60	100	4
MCIE6-309	Seminar	-	-	-	60	40	100	4
MCIE6-310	Project	-	-	-	60	40	100	10
Departmental Elective – V (Select any one)		3	1	0	40	60	100	4
MCIE6-364	Advanced Structural Design & Detailing							
MCIE6-365	Pavement Design, Construction & Maintenance							
Open Elective – II (Select any one)		3	1	0	40	60	100	4
Total	**Theory = 3 Lab = 0**	**9**	**3**	**0**	**240**	**260**	**500**	**26**

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Total Credits = 20

SEMESTER 4th		**Contact Hrs**			**Evaluation Criteria**	**Credits**
Subject Code	**Subject Name**	**L**	**T**	**P**	**Satisfactory/ Unsatisfactory**	
MCIE6- 411	**Thesis**	**0**	**0**	**0**		**20**

Overall

Semester	**Marks**	**Credits**
1st	600	22
2nd	600	22
3rd	500	26
4th	--	20
Total	**1700**	**90**

PROJECT PLANNING AND CONTROL

Subject Code –MCIE6-101	**L T P C** **3 1 0 4**	**Duration: 45 Hrs.**

UNIT-I (13 Hrs.)

Construction Planning: Need of construction planning, Constructional Resources, construction team, stages in construction, preparation of construction schedule, Job layout, inspection and quality control. Pre-tender planning; contract planning; planning and scheduling construction jobs by bar charts; Planning and scheduling construction jobs by critical path network techniques; allocation of resources, Planning and decision making Nature of planning, steps in planning, types of planning, levels of planning- planning process, decision making.

UNIT-II (11 Hrs.)

Work-study, work breakdown structure, Time estimates, Applications of CPM/PERT, statical concepts, Man-Material-Machinery-Money optimization, scheduling, monitoring, updating. Cost functions, cost control, time-cost trade off, resource planning-leveling and allocation. Resources - based networks, crashing, master networks, interface activities and dependencies, line of balancing techniques, application of digital computers, Material management purchases management and inventory control, Human Resource Management.

UNIT-III (11 Hrs.)

Quality control and safety in construction Quality and safety concerns, organizing for quality and safety, work and material specifications, total quality control, Safety: importance of safety, accident-prone situations at construction site i.e, safety measures for excavation, drilling/blasting, scaffolding/formwork, hoisting & erection demolition and hot bituminous work. Fire Safety: Safety record of construction industry, safety campaign.

UNIT-IV (10 Hrs.)

Supervision, Inspection and Quality Control: Supervisor's responsibilities; keeping records; control of field activities handling disputes and work stoppages; storage and protection of construction materials and equipment; testing and quality control. Purpose of inspection: Inspection of various components of construction; reports and records; statistical quality control.

Recommended Books

1. K.K. Chitkara, ‘Construction Project Management: Planning Scheduling and Control’, Tata McGraw Hill Publishing Company, New Delhi, **1998.**
2. M. Popescu Calin, Chotchal Charoenngam, ‘Project Planning, Scheduling and Control in Construction: An Encyclopedia of terms and Applications’, Wiley, New York, **1995.**
3. Chris Hendrickson and Tung Au, ‘Project Management for Construction – Fundamental Concepts for Owners, Engineers, Architects and Builders’, Prentice Hall Pittsburgh, **2000.**
4. J. Moder, C. Phillips and E. Davis, ‘Project Management with CPM, PERT and Precedence Diagramming’, Van Nostrand Reinhold Company, 3rd Edn., **1983.**
5. E.M. Willis, ‘Scheduling Construction Projects’, John Wiley & Sons, **1986**.

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6. D.W. Halpin, 'Financial and Cost Concepts for Construction Management', John Wiley & Sons. New York.

CONSTRUCTION ENGINEERING AND MANAGEMENT

Subject Code – MCIE3-102 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

UNIT-I (13 Hrs.)

General Management: Introduction and characteristics of management, Principle and function of management, Scientific management.

Introduction: Definition, functions and scope of construction management; scientific methods of management; construction team.

UNIT-II (12 Hrs.)

Materials Management: Scope, Objective and functions of material management, Procurement and store management, Materials handling management, Inventory control and management, Disposal of Surplus Materials

UNIT-III (10 Hrs.)

Time-cost Optimization: Direct cost, indirect cost, total cost; purpose, stages and methods of cost control techniques of time cost optimization; examples and case studies.

UNIT-IV (10 Hrs.)

Site Layout: Principles governing site lay out; factors effecting site lay out; preparation of site lay out. Feasibility study; project reports; progress reports; monitoring and controlling construction activities.

Recommended Books

1. Mahesh Verma, 'Construction Equipment and its Planning and Application'.
2. R.L. Peuripo, 'Construction Planning Equipment and Methods', Tata McGraw Hill.
3. Jagman Singh, 'Heavy Construction Planning Equipment and Methods', Oxford.

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CONCRETE CONSTRUCTION TECHNOLOGY

Subject Code: MCIE6-103 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

UNIT-I (10 Hrs.)

Introduction of Concrete materials, Admixtures, Fly Ash, Polymers, Early Age Properties, Strength, Permeability & Durability. Principles of Concrete mix design, Concrete Mix Design procedure by: IS/ACI/British Standards.

UNIT-II (10 Hrs.)

Concreting Operations-Practices and Equipment, batching; Mixing; Transporting; Placing and Compacting; curing. Properties and technique of construction for concrete, Fiber reinforced concrete, light weight concrete, Heavy weight concrete, Foam concrete, High performance Concrete.

UNIT-III (13 Hrs.)

Special concrete operations, shot Crete, grouting, Grunting, under water concreting, hot and cold weather concrete, pumpabale concrete. Construction techniques for reinforced concrete elements-materials, Principles and procedures for beams, slabs, columns, Foundations, walls and tanks, design and fabrication of form work for R.C.C. elements.

UNIT – IV (12 Hrs)

Pre-stressed concrete Construction-Principle, methods, materials, Tools and equipment for the construction of a pre-stressed bridge.

Inspection and Quality Control of Concrete Construction-Stages, Principles, Checklist, Statistical Controls, procedures.

Recommended Books

1. M.L. Gambhir, 'Concrete Technology', McGraw Hill Education.
2. Neville and Brooks, 'Concrete Technology', Prentice Hall.
3. M.S. Shetty, 'Concrete Technology', S. Chand.

SOFTWARE LAB –PROJECT PLANNING

Subject Code – MCIE6-104 **L T P C**
0 0 4 2

MRSPTU

List of Experiments

PRIMAVERA

1. Planning and Scheduling of Multi storied building
2. Planning and scheduling of Road Project
3. Prepare the resource sheet, assign and level the resource
4. Preparing different reports available in Primavera
5. Plot the variance graphs for the given Project

COMPUTATIONAL TECHNIQUES

Subject Code – MCIE6-156 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

UNIT-I (12 Hrs.)

Equations: Rotts of Algebraic, Transcendental equations, Solution of linear simultaneous Equations by different methods using - Elimination, Inversion, Gauss - Jordan methods. Homogeneous Problems and Eigen Value Problems. Nonlinear Equations, Interpolation.

UNIT-II (12 Hrs.)

Finite Difference Technique: Initial and Boundary Value Problems of Ordinary and Partial Differential equations, Solution of Various types of Plates.

UNIT-III (11 Hrs.)

New Marks Method: Solution of determinate and indeterminate Structures by using New Mark's Procedure. Newmark's Implicit and Explicit Solutions for Non Linear Problems and Convergence Criteria

UNIT-IV (10 Hrs.)

Statistical Methods: Method of Correlation and Regression Analysis. Initial Value Problems: Galerkin's Method of Least Square, Initial Value problem by Collocation points, Runga Kutta Method.

Recommended Books

1. M.K. Jain, S.R.K. Iyenger and R.K. Jain, 'Numerical Methods for Scientific and Engineering Computations', New age International Publication (P) Ltd.
2. S.S. Sastry, 'Introductory Numerical Methods', Prentice Hall India Ltd.
3. Erwin Kreyszig , 'Advanced Engineering Mathematics' , John Wiley & Sons, INC.

ENVIRONMENT ENGINEERING AND MANAGEMENT

Subject Code – MCIE6-157 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

UNIT-I (12 Hrs.)

Global Environmental Problems: Global warming, green-house effect, ozone depletion, acid rain, oil pollution, radiation hazard and control, global climate change. Main clauses and basic steps for Environmental Management System certification. Environmental Laws/Acts.

UNIT-II (10 Hrs.)

Cleaner Production Technologies Need and benefits, cleaner production techniques and options, zero impact manufacturing initiatives CDM and carbon credits/case studies.

UNIT-III (11 Hrs.)

Environment Impact Assessment: Definition and its importance for environment management, constituents of environment impact assessment, project data for EIA study, prediction of impacts, EIA methodologies, constraints in implementation of EIA, impact prediction on water resources projects and other relevant case studies. Environment pollution.

UNIT-IV (12 Hrs.)

Degradation of Land Resources: Deforestation: Forest land, deforestation and its effects on land use and Environmental quality, wetland and their importance in environment, causes and extent of wasteland, Soil degradation problems, erosion, salinization, water logging, land use management & planning.

Recommended Books

1. Peavy, Rowe, 'Techobanoglous, Environmental Engg.', Tata McGraw Hill.
2. Mackenzie L. Davis, 'Environmental Engg.', Tata McGraw Hill.
3. Baljeet S. Kapoor; 'Environmental Engg. An overview', Khanna Publishers.
4. Glbert H. Masters, 'Environmental Engineering and Science', Prentice Hall of India Pvt. Ltd.
5. G.N. Panday, G.C. Carney Environmental Engineering, Tata McGraw Hill.
6. P.D. Sharma, Ecology and Environment, Rastogi Publications.
7. P.A. Ray, Lcances, 'Environmental Impact Assessment', Hand National Environmental Protection Council, Manile.

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MAINTAINANCE OF BUILDING STRUCTURES

Subject Code – MCIE3-158 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

UNIT-I (12 Hrs.)

Importance of maintenance, deterioration and durability, factors affecting decision to carryout maintenance, maintenance and GNP, agencies causing deterioration, effect of deterioration agencies on materials. Factors to reduce maintenance at design stage, consideration of maintenance aspects in preparing tender document and specifications, sources of error in design which enhances maintenance, importance of working drawings and schedules, provision of access for maintenance and its importance at design stage. Economic consideration in maintenance: physical life, functional life, economic life of different types of buildings, discounting technique for assessment of economic life.

UNIT-II (8 Hrs.)

Maintenance Management: Definition, organization structure, work force for maintenance, communication needs, building inspections, maintenance budget and estimates, property inspections and reports, specification for maintenance jobs, health and safety in maintenance, quality in maintenance, maintenance manual and their importance. Materials for Maintenance: Compatibility of repair materials, durability and maintenance, types of materials, their specification and application, criteria for selection of material, use of commercial available materials in maintenance.

UNIT-III (12 Hrs.)

Investigation and Diagnosis for Repair of Structures: Basic approach to investigations, physical inspection, material tests, non-destructive testing for diagnosis, estimation of actual loads and environmental effects, study of design and construction practices used in original construction, retrospective analysis and repair steps. Maintenance Problems and Root Causes: Classification of defects, need for diagnosis, type of defects in building elements and building materials defect location, symptoms and causes.

UNIT-IV (13 Hrs.)

Remedial Measures for Building Defects: Preventive maintenance and special precautions - considerations, preventive maintenance for floors, joints, wet areas, water supply and sanitary systems, termite control, common repair techniques, common methods of crack repair.

- Repair of existing damp proofing systems in roofs, floors and wet areas.
- Protection, repair and maintenance of RCC elements.
- Repair, maintenance of foundations, basements and DPC
- Repair of finishes.
- Repair of building joints.
- Repair of water supply and sanitary systems, underground and overhead tanks.
- Common strengthening techniques
- Maintenance of Industrial Floors

Maintenance of Multi-storey Buildings: Specials features for maintenance of multi-storeyed buildings, including fire protection system, elevators booster pumps, generator sets.

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Recommended Books

1. A.C. Panchdari, ‘Maintenance of Buildings’, New Age International (P) Limited Publishers.
2. R. Chudley, ‘Building Finishes, Fittings and Domestic Services’, Longman Technical Services.
3. G. Szechy, D. SC; ‘Foundation Failures’, Concrete PublIcations Limited, 14 Dartmouth Street, London.
4. Whitney Clark Huntington Probert E. Mickadeit; Building Construction materials and types of construction Allan Hancock College H.J. Eidridge, Common Defects in Buildings, Her Majesty's Stationery Office, London.
5. W.H. Ransom, ‘Building Failures: Diagnosis and Avoidance’, New Age Publications (P) Ltd.
6. Housing Defects Reference Manual, The Building Research Establishment E. & F.N. SPON.

COMPOSITE MATERIALS

Subject Code – MCIE6-159 **L T P C** **Duration: 45 Hrs.**

3 1 0 4

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UNIT-I (13 Hrs.)

Fibre Reinforced Concrete: Properties of Constituent Materials, Mix Proportions, Mixing and Casting Procedures, Properties of Freshly mixed FRC, Mechanics and properties of Fibre reinforced concrete, Composite Material approach, Application of fibre reinforced concrete.

Fly Ash Concrete: Classification of Indian Flashes, Properties of Fly ash, Reaction Mechanism, Proportioning of Fly ash concretes, Properties of Fly ash concrete in fresh and hardened state, Durability of fly ash concrete.

UNIT-II (10 Hrs.)

Polymer Concrete: Terminology used in polymer concrete, Properties of constituent materials, Polymer impregnated concrete, Polymer modified concrete, Properties and applications of polymer concrete and polymer impregnated concrete.

Ferro Cement: Constituent materials and their properties, Mechanical properties of ferro cement, Construction techniques and application of ferro cement.

UNIT-III (10 Hrs.)

High Performance Concrete: Materials for high performance concrete, Supplementary cementing materials, Properties and durability of high performance concrete, Introduction to silica fume concrete, Properties and applications of silica fume concrete.

UNIT-IV (12 Hrs.)

Sulphur concrete and sulphur infiltrated concrete: Process technology, Mechanical properties, Durability and applications of sulphur concrete, Sulphur infiltrated concrete, Infiltration techniques, Mechanical properties, Durability and applications of sulphur infiltrated concrete.

Light Weight Concrete: Properties of light weight concretes, Pumice concrete, Aerated cement mortars, No fines concrete, Design and applications of light weight concrete.

Recommended Books

1. P.K. Mehta, and P.J.M. Monterio, 'Concrete, its Properties and Microstructure', McGraw-Hill Education.
2. B.K. Paul, and R.P. Pama, 'Ferrocement by International Ferrocement Information Center', Asian Institute of Technology.
3. Bentur and Mindess, 'Fibre Reinforced Concrete', CRC Press.
4. Malhotra and Ramezanianpour, 'Fly ash in Concrete', CANMET Natural Resources Canada.

CONSTRUCTION LAW AND CONTRACT MANAGEMENT

Subject Code – MCIE6-205 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

UNIT-I (12 Hrs.)

Indian Contracts Act, Elements of Contracts, Types of Contracts- features- suitability, Design of Contract Documents, International Contract Document, Standard Contract Document, Tort Law.

UNIT-II (10 Hrs.)

Prequalification, Bidding, Accepting, Evaluation of Tender from Technical, Contractual and Commercial points of view, Contract formation and interpretation, Potential Contractual Problems, World Bank Procedures and Guidelines.

UNIT-III (13 Hrs.)

Insurance and Bonding, Laws Governing sale- purchase and use of urban and rural land, Land Revenue Codes, Tax Laws, Income tax, Sales tax, Excise and Custom duties and their influence on construction costs, Legal requirements for planning, Property Laws agency law, Local Government Laws for Approval, Statutory Regulations

UNIT-IV (10 Hrs.)

Social Security, Welfare Regulations, Laws related to Wages, Bonus and Industrial disputes, Labour Administration, Insurance and safety regulations, Workmen's compensation Act, Indian Factory Act, Punjab Factory Act, Child Labour Act, other labour laws.

Recommended Books

1. G.T. Gajaria, 'Laws Relating to Building and Engineering Contacts of India'.
2. Jimmie Hinze, 'Construction Contracts', McGraw Hill, **2001.**

BUILDING COST & QUALITY MANAGEMENT

Subject Code – MCIE6-206 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

UNIT-I (13 Hrs.)

Estimation of Quantities for Excavation, Earthwork, D.P.C., R.C.C. work, flooring and roofing, plastering, pointing, wood work, white washing etc. for construction works-Buildings, Roads, Bridges etc.

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UNIT-II (12 Hrs.)

Estimation of Building Services – Plumbing - Water Supply, Electrification, Sanitary Fitting, Mechanical- HVAC etc., and their cost analysis.

UNIT-III (10 Hrs.)

Analysis of rates for various building works – Brick work in foundations and Superstructure, P.C.C, R.C. C., Plastering, Flooring, Timber work etc.

UNIT-IV (10 Hrs.)

Checking of Construction Quality – Bricks, Cement, Concrete, Aggregates, and Steel as per IS codes.

Recommended Books

1. B.N. Dutta, 'Estimating and Costing'.
2. G.S. Birdie, 'Estimating and Costing'.
3. Chakaraborty, 'Estimating and Costing'.

QA & QC LAB

Subject Code – MCIE6-206 **L T P C**
3 1 0 4

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List of Experiments

1. CEMENT
   a) Sampling procedures and sample collections
   b) Test for cement
2. AGGREGATE
   a) Sampling Procedures and Sample Collections
   b) Test for Fine Aggregate (Sand)
   c) Test for Coarse Aggregate
3. BRICKS
   a) Sampling Procedures and Sample Collections
   b) Test for Bricks IS: 1077- 1992
4. CONCRETE
   a) Sampling Procedures and Sample Collections
   b) Test of Cement Concrete
5. STEEL
   a) Sampling Procedures and Sample Collection
   b) Test of Steel for Reinforcement IS: 1786 – 2008
6. PIPES
   a) Sampling Procedures and Sample Collections
7. WATER FOR CONSTRUCTION PURPOSES
   a) Sampling of Water
8. BRICK BALLAST IS: 3068-1986 and IS: 3182-1986
9. CHECKS AND TESTS OF FINISHED WORKS

CONSTRUCTION COSTING & FINANCIAL MANAGEMENT

Subject Code – MCIE6-260 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

UNIT-I (13 Hrs.)

Costing of construction Works, different methods of costing, cost elements in a projects, analysis of rates, non-scheduled items of work, cost estimation for a small construction job, purpose, methods and stages of cost control, cost monitoring, cost forecasting methods, variations in individual items of work and their effect on total contract price, valuation of variations.

UNIT-II (12 Hrs.)

Determining the funds required for a construction job, preparing cash flow statements; cash inflow and outflow during contract period, Precautions in custody of cash, imprest account and temporary advance; maintenance of temporary advance; and advance account; different types of payment, first, running, advance and final payments.

UNIT-III (10 Hrs.)

Objectives and Scope of Material Management classification, Codification, ABC Analysis, Standardization and Substitution, introduction to inventory control, Stores Management, Organization and Lay out, Receipt, Inspection and Issue, Care and Safety, Store Records and Store Accounting.

UNIT – IV (10 Hrs.)

Meaning and Scope, Financial Statement Analysis, Funds Flow Analysis, Capital Budgeting, Cost- Benefit Analysis.

Recommended Books

1. F.W. Mueller, ‘Integrated cost and schedule control for construction projects’.
2. Gobourne, ‘Cost control in the construction industry’
3. Chris Hendrickson and Tung Au, ‘Project Management for Construction’.
4. Datta, ‘Material Management Procedures, Text and Cases’, Prentice Hall.
5. P. Gopalakrishnan, M. Sundaresan, ‘Material Management - An Integrated Approach’, Prentice Hall.

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PROJECT SAFETY MANAGEMENT

Subject Code – MCIE6-261 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

UNIT-I (12 Hrs.)

Safety in construction- Safety Concerns, Importance of Safety, Factors affecting safety: Psychological and Technological, Planning for safety provisions, Safety consideration during construction, demolition and during use of equipment.

UNIT-II (11 Hrs.)

Accidents and their causes, Human factors in construction safety, cost of construction injuries, occupational and safety hazard assessment, legal implications.

UNIT III (10 Hrs.)

Problems areas in construction safety, Elements of an effective safety programs, job site safety assessment, safety meetings, safety campaigns and safety incentives

UNIT IV (12 Hrs.)

Safety culture, safe workers, Safety and first line supervisors, safety and middle managers, top management practices, company activities and safety, safety personal, workers compensations, project coordination and safety procedures.

Recommended Books

1. Tim Howarth and Paul Watson, 'Construction Safety Management', John Wiley & Sons, **2008.**
2. Phil Hughes, Ed Ferrett, 'Introduction to Health and Safety in Construction: The Handbook for Construction Professionals and Students on Nebosh and Other Construction Courses', 3rd Edn, Routledge, **2008.**

FOUNDATION DESIGN AND CONSTRUCTION

Subject Code – MCIE6-262 **L T P C** **3 1 0 4** **Duration: 45 Hrs.**

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UNIT-I (12 Hrs.)

Shallow Foundation: Design of footing e.g. isolated footing in B.B.C. and steel grillage, combined footings of rectangular, Trapezoid cantilever types. Mat or raft foundation for dry and saturated soil, floating foundations

UNIT-II (8 Hrs.)

Deep Foundation: Design of Piles, Pile caps and pile foundations buildings, Design of retaining structures

UNIT-III (13 Hrs.)

Earth Retaining Structures: Design of retaining walls for dry and saturated back fills with surcharge loads. Retaining walls resting on piles, Design of bridge abutments, Design of sheet piles used for coffer dams, Design of sheeting bracing in excavation trenches, Special Structures

UNIT-IV (12 Hrs.)

Design of foundation for transmission, Design of basement walls, Bridges structures Analysis and Design: Design of walls foundation and caissons of different types, Design of bridge piers resting on piles.

Recommended Books

1. Pillai & Mennon, 'Advanced RCC Design', Tata McGraw Hill.
2. P.C. Varghese, 'Limit state Design of Reinforced Concrete', Prentice-Hall of India.
3. N. Krishna, 'Advanced Reinforced Concrete Design', CBS Publisher Publication, **2013.**

RURAL CONSTRUCTION TECHNOLOGY

Subject Code – MCIE6-263 **L T P C 3 1 0 4** **Duration: 45 Hrs.**

UNIT-I (8 Hrs.)

Rural Development Planning- Concept of Appropriate Technology, Scope, Development Plans; Various approaches to rural development planning Concept of Appropriate technology; Role of Civil Engineering in Rural Development; Organizational structures & management rural development programmes/projects.

UNIT-II (12 Hrs.)

Rural Housing: Low cost construction materials for housing low cost housing designs-architectural considerations for individual and group housing ; composite material-Ferro cement & flay ash, Autoclaved Calcium silicate bricks and soil-stabilized unburnt brick; Plinth protection of Mud Walls; Design Consideration and Construction of: Non-erodible Mud Plaster, water-proof and fire-retardant roof treatment for thatch roofs, Precast stone Masonry Block walling scheme; rat-trap bond for walls; Prefab Brick Panels for roof, Ferro cement flooring /roofing units, Precast R.C. Channel Unit for flooring/roofing scheme, Precast R.C. cored unit for flooring/roofing scheme, Precast R.C. Plank flooring/roofing scheme, L-Pan roofing scheme; Glued Plywood Web Beams and Roof Panels; manual & Power Scaffold hoist, lifting device for prefab components; solar passive building design; Building economics and management.

UNIT-III (13 Hrs)

Water Supply and Rural Sanitation: Epidemiology sources of water, BIS & WHO water standards. Quality, Storage and distribution for rural water supply works; Basic Design principles of treatment-Low Cost water treatment technologies; Hand pumps-types, installation operation, and maintenance of Mark-II hand pumps; Conservation of water; Rainwater, Harvesting; Drainage in rural areas, Design of low cost waste disposal systems; Design and constructions of low cost latrines: 2 pit pour flush water seal VIP latrines, septic tank etc.; Biogas technology: Low cost community & individual Garbage disposal systems, Recycling of organic/agricultural wastes: Development of village ponds; Ferro cement water storage tanks & latrines. Cattle shed management; Sewage farming-standards for disposal and use for irrigation.

UNIT-IV (12 Hrs.)

Low Cost Roads and Transport: Low cost pavement materials-testing suitability criteria processing materials; factors affecting pavement thickness & composition of various layers; CRRI Design for rural roads-Traffic Index, strength Index, CBR curve Intermediate Technology & Technology options for specify areas. Labour intensive techniques of road construction Mechanical stabilization; lime stabilization; water bound Macadam Construction; utilization of waste in rural construction one/two coat surface dressing; bitumen premix carpet; low cost improved transport system rural areas.

Recommended Books

1. A.G. Madhov Rao, D.S. Ramachandra Murthy, 'Apprority Technologies for Low Cost Housing', Oxford and IBH Pblishing Co. Pvt. Ltd.

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2. CBRI, ‘Roorkee Advances in building Materials Construction’.
3. C. Satyanarayan Murthy, ‘Design of Minor Irrigation and Canal Structures’, Wiley Eastern Ltd.
4. K. Park, ‘Preventive and Social Medicine’, Banarsi Bhnot.
5. Yash Pal Bedi, ‘A Hand Book of Preventive and Soc Medicine’, Atama Ram & Sons, Delhi.
6. Document on Rural Road Development in India Volume Central Road Research Institute, New Delhi.
7. S.B. Watt, ‘Ferrocement Water Tanks and their Construction’, Intermediate Technology Publications Ltd, London.
8. Ariane Van Bureu, ‘A Chinese Biogas Manual’, Publications, London.
9. K.C. Khandelwal and S.S. Mahdi, ‘Biogas Technology-A Practice Handbook’, Volume 1 & 2, Tata McGraw Hil Publishing Com Ltd. New Delhi.

ADVANCED STRUCTURAL DESIGN AND DETAILING

Subject Code – MCIE6-364 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

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UNIT-I (10 Hrs.)

Introduction to limit state method of design, provisions in the Indian standard codes for loading wind loads and seismic loads, design and detailing of concrete structures.

UNIT-II (11 Hrs.)

BIS Handbook for design, Examples of design using handbook.

Design of Structures as per I.S. 1893 for Earthquake Resistant Design Construction

UNIT-III (12 Hrs.)

Design and Detailing Requirements as per 4326-1993.

Design and Detailing of Earthen Buildings as per 13827-1993.

Design and Detailing of Masonry Structures as per I.S. 13828-1993

UNIT-IV (12 Hrs.)

Design and Ductile Detailing of R.C.C. Structures as per I.S. 13920-1993

Repair and Seismic Strengthening of Buildings as per I.S. 13935-1993.

Recommended Books

1. P. Dayaratnam, ‘Reinforced Concrete Structure’
2. A. K. Jain, ‘Reinforced Concrete, Limit State Method of Design’.
3. B.C. Punmia, ‘Reinforced Concrete Structures’, Vol II
4. Jain and Jai Krishna, ‘Plain and Reinforced Concrete’ Vol II.
5. P. Dayaratnam, ‘Design of Steel Structures’
6. S.K. Duggal, ‘Design of Steel Structures’
7. B.I.S. Codes 1893, 4326, 13827, 13828, 13920, 13935

PAVEMENT DESIGN, CONSTRUCTION AND MAINTENANCE

Subject Code – MCIE6-365 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

UNIT-I (13 Hrs.)

Types of pavement structure. Functions of pavement components, Factors affecting pavement design. Design wheel load, Strength characteristics of pavement materials. General design considerations, Methods for design of flexible pavements; Group Index method, California Bearing Ratio (CBR) method, California Resistance Value method, Triaxial Test method, Burmister method, McLeod's method.

UNIT-II (11 Hrs.)

General design considerations, Methods for design of rigid pavements; Westergard's method, F.A.A. method, IRC recommendations for design of concrete pavements, method, Types of joints and their design in cement concrete pavements. Thickness design for Airport pavement, LCN system of pavement design, design of airport pavement overlays.

UNIT-III (10 Hrs.)

Types of highway construction and their selection, materials for construction, construction procedure of different highways: Earth roads, Gravel roads, WBM roads, bituminous pavements, Cement concrete pavements, Low cost roads, Introduction to various equipment used for highway construction.

UNIT-IV (11 Hrs.)

Need for highway maintenance, Pavement failures their causes and remedial measures. Typical flexible and rigid pavement failures, Types of highway maintenance: Routine, periodic and special type, materials used for maintenance of different pavements, Strengthening of existing pavements, Maintenance management system.

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Recommended Books

1. E.J. Yoder, ‘Principals of Pavement Design’.
2. Khanna and Justo, ‘Highway Engineering’.
3. S.K. Sharma, ‘Principles, Practice and Design of Highway Engineering’.
4. M.G.L., ‘Handbook of Road Technology’.
5. Yang and Huang, ‘Pavement Analysis and Design’.
6. D. Croney and P. Croney, ‘The Design and Performance of Road Pavements’.
7. Horenjeff, ‘Planning and Design of Airports’.

M. Tech Civil Engg. (Geotechnical Engineering)

Total Contact Hours = 24 **Total Marks = 600** **Total Credits = 22**

SEMESTER 1st		Contact Hrs			Marks			Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
MCIE3-101	Engineering Behaviour of Soil	3	1	-	40	60	100	4
MCIE3-102	Site Investigation and Ground Improvement	3	1	-	40	60	100	4
MCIE3-103	Soil Dynamics	3	1	-	40	60	100	4
MCIE3-104	Soil Mechanics Lab	-	-	4	60	40	100	2
Departmental Elective – I (Select any one)		3	1	0	40	60	100	4
MCIE3-156	Rock Mechanics							
MCIE3-157	Clay Mineralogy							
Departmental Elective – II (Select any one)		3	1	0	40	60	100	4
MCIE3-158	Structural Design of Foundations							
MCIE3-159	Optimization Techniques							
Total	**Theory = 5 Lab = 1**	**15**	**5**	**4**	**260**	**340**	**600**	**22**

MRSPTU

Total Contact Hours = 24 **Total Marks = 600** **Total Credits = 22**

SEMESTER 2nd		Contact Hrs			Marks			Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
MCIE3-205	Advanced Soil Mechanics	3	1	-	40	60	100	4
MCIE3-206	Foundation Engineering	3	1	-	40	60	100	4
MCIE3-207	Foundation Engineering Lab	-	-	4	60	40	100	2
Departmental Elective – III (Select any one)		3	1	0	40	60	100	4
MCIE3-260	Pavement Design							
MCIE3-261	Earthen Dams							
Departmental Elective – IV (Select any one)		3	1	0	40	60	100	4
MCIE3-262	Geo-Environmental Engineering							
MCIE3-263	Computational Techniques							
Open Elective – I (Select any one)		3	1	0	40	60	100	4
Total	**Theory = 4 Lab = 1**	**15**	**5**	**4**	**260**	**340**	**600**	**22**

Total Contact Hours = 12 **Total Marks = 500** **Total Credits = 26**

SEMESTER 3rd		**Contact Hrs**			**Marks**			**Credits**
Subject Code	**Subject Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
MCIE3-308	Professional Skills	3	1	-	40	60	100	4
MCIE3-309	Seminar	-	-	-	60	40	100	4
MCIE3-310	Project	-	-	-	60	40	100	10
Departmental Elective – V (Select any one)		3	1	0	40	60	100	4
MCIE3-364	Retaining and Underground Structures							
MCIE3-365	Construction Planning & Scheduling							
Open Elective – II (Select any one)		3	1	0	40	60	100	4
Total	**Theory = 3 Lab = 0**	**9**	**3**	**0**	**240**	**260**	**500**	**26**

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Total Credits = 20

SEMESTER 4th		**Contact Hrs**			**Evaluation Criteria**	**Credits**
Subject Code	**Subject Name**	**L**	**T**	**P**	**Satisfactory/ Unsatisfactory**	
MCIE3- 411	Thesis	0	0	0		20

Overall

Semester	**Marks**	**Credits**
1st	600	22
2nd	600	22
3rd	500	26
4th	--	20
Total	**1700**	**90**

ENGINEERING BEHAVIOR OF SOIL

Subject Code –MCIE3-101 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

UNIT-I (10 Hrs.)

Introduction, formation of soil, clay mineralogy, structures of common clay minerals. Identification and classification of soil, soil weight volume relationship, index properties of soils, surface tension and capillary phenomenon. Measurement of capillary rise in soil, soil moisture, soil-water potential, measurement of soil-water potential.

UNIT-II (11 Hrs.)

Mechanism of swelling potential and pressure. Soil compaction, standard and modified Proctor compaction, theories of soil compaction; compaction control in field. Permeability, Darcys law, Theories of wells, flownets and their properties, seepage flownet in dams, flownet by relaxation method, seepage forces, uplift, piping phenomenon, problems.

UNIT-III (13 Hrs.)

Introduction. Consolidation of soils. Terzaghis theory of one dimensional consolidation, application to geotechnical problems. Two and three dimensional consolidation of soils, secondary consolidation. Shear strength of soils; unsaturated soil Skempton pore pressure theory, compressibility of unsaturated soil, Rowes stress dilatancy theory. Different shear parameters; special consolidation and shear tests, application to geotechnical problems.

UNIT-IV (11 Hrs.)

Elastic stresses in soil; Stress-strain behaviour of soils; Mohr Circle of Stress; Principal Stresses. Stress distribution in homogeneous, non-homogeneous, layered and anisotropic deposits. Effect of non-linearity. Review of classical earth pressure theories and trial wedge method for c-φ soils.

Recommended Books

1. J.H. Atkinson and P.L. Bransby, The Mechanics of Soils: An Introduction to Critical Soil Mechanics, McGraw Hill, **1978.**
2. J.H. Atkinson, An Introduction to the Mechanics of Soils and Foundation, McGraw- Hill Co., **1993.**
3. B.M. Das, Advanced Soil Mechanics, Taylor and Francis, 2nd Edn., **1997.**
4. D.M. Wood, Soil Behavior and Critical State Soil Mechanics, Cambridge University Press, **1990.**
5. R.F. Craig, Soil Mechanics, Van Nostrand Reinhold Co. Ltd., **1987.**
6. K. Terzaghi, and R.B. Peck, Soil Mechanics in Engineering Practice, John Wiley & Sons, **1967.**
7. T.W. Lambe and R.V. Whitman, Soil Mechanics, John Wiley & Sons, **1979.**

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SITE INVESTIGATION & GROUND IMPROVEMENTS

Subject Code – MCIE3-102	**L T P C** **3 1 0 4**	**Duration: 45 Hrs.**

UNIT-I (12 Hrs.)

Soil formation -Processes – Characteristics of major soil deposits of India. Necessity and Importance of soil exploration Method of sub surface exploration Test pits, Trenches, Caissons, Tunnels and drifts, Wash boring, Percussion drilling, Rotary drilling, Factors affecting the selection of a suitable method of boring. Extent of boring, Factors controlling spacing and depth of bore holes, Spacing and depth for various Civil engineering structures. Indirect method of exploration, Seismic method, Electrical resistivity, Resistivity sounding and profiling, Qualitative and quantitative interpretation of test results, Comparison of resistivity and seismic surveys, Shortcomings. Stabilization of bore holes, Different method of stabilisation of the bore holes, their relative merits and demerits.

UNIT-II (12 Hrs.)

Ground water Observation: Different method of ground water observation: Time lag in observation, Sampling of ground water. Sampling: Source of disturbance and their influence, Type of sampler, Principle of design of sampler, Representative and undisturbed sampling in various types of soils, Surface sampling, Amount of sampling, Boring and sampling record, Preservation and shipment of sample preparation of bore log. In situ Permeability. Pumping in test in a cased hole with open end, falling head packer test constant head packer test, Pump in out tests in a single test wall and open pit or unlined hole. Piezometer methods

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UNIT-III (11 Hrs.)

Fields Tests: Standard penetration test, Dynamic cone penetration tests with and without bentonite mud slurry. Static cone penetration test, Surface sampling. Cyclic plate load test, large shear box test, Vane shear test, Pile load, Block resonance test, wave propagation test. Small size penetrometers, Pressure meter test and Diltometer test. Various corrections in the test results and interpretation of test results for design of foundations. Correlation among various test results. Precautions to be exercised during the execution of these tests. Preparation of bore hole log.

UNIT-IV (10 Hrs.)

Introduction, Economic considerations, Consolidation by preloading and sand drains, Strengthening by granular columns and lime columns, Compaction by vibro - flotation, Blasting, Dynamic consolidation, Grouting techniques and principles grounds anchors, Reinforced earth construction Geo-Textiles Problems. Stabilization: Mechanical, Lime, Cement, Resins & Other Chemicals.

Recommended Books

1. P. Purushothama Raj, ‘Ground Improvement Techniques’, Tata McGraw Hill, New Delhi, **1995.**
2. B.C. Chattopadhyay and J. Maity, ‘Ground Control and Improvement Techniques’, PEEDOT, Howrah, **2011.**
3. Simon and Cayton, ‘Site Investigation, 2nd Edn., ‘Wiley-Blackwell’, **1995.**

4. B.M. Das, 'Principles of Foundation Engineering', Thomson Brooks/Cole.
5. N.P. Kurien, 'Design of Foundation Systems: Principles & Practices', Narosa, New Delhi, **1992.**
6. G. Ranjan and A.S.R. Rao, 'Basic and Applied Soil Mechanics', New Age International Publishers.

SOIL DYNAMICS

Subject Code – MCIE3-103 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

UNIT-I (10 Hrs.)

Introduction: Nature of dynamic loads, Stress conditions on soil, Elements under E.Q. loading (basic concepts only), Fundamentals of theory of vibrations-simple harmonic motion, Response of SDOF System-Vibration analysis procedure- Free and forced vibration with and without damping. Adverse effects of Seismic hazard and Site improvement methods for mitigation of earthquake hazards.

UNIT-II (09 Hrs.)

Dynamic Bearing Capacity: General, Failure Zones & Ultimate Bearing capacity criteria for satisfactory action of footing. Introduction to bearing capacity and settlement analysis under earthquake loading- Seismic design considerations, Codal provisions.

UNIT-III (14 Hrs,.)

Dynamic response of Retaining wall: Seismic design consideration of Retaining Walls during Earth Quakes, Modification of Coulomb's Theory, Indian standard code of Practice. Liquefaction of Soils: Soil liquefaction - Criterion and Factor Affecting Liquefaction, Susceptibility, initiation and effects of soil liquefaction, Laboratory and Field methods for estimation of liquefaction potential- CSR and CRR. Liquefaction behaviors of dense sand.

UNIT-IV (12 Hrs.)

M/C Foundations: Introduction, Design criteria for satisfactory M/C foundation as per IS codes, Methods of analysis- Linear elastic weightless spring and elastic half space theory approach. Design of Block Foundation for reciprocating engine and low speed machines. Vibration Isolation techniques & Screening of Waves.

Recommended Books

1. W. Day Robert, 'Geotechnical Earthquake Engineering Handbook', McGraw Hill, New York, **2007**.
2. S. Kramer, 'Geotechnical Earthquake Engineering', Pearson, New Delhi, **1995.**
3. K. Ishihara, 'Soil Behaviour in Earthquake Geotechnics', Oxford Science, NY, **1996**.
4. Lkuo Towhata, 'Geotechnical Earthquake Engineering', Springer, NY, **1995.**
5. Bharat Bhusan Prasad, 'Fundamental of Soil Dynamics and Earth Quake Engineering', PHI, **2005.**
6. S. Prakash and Puri, 'Foundations for Machines: Analysis and Design', Wiley, New York, **1988.**
7. Braja M. Das and G.V. Ramana, 'Principle of Soil Dynamics', Cengage Learning. **2010.**

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8. Swami Saran, 'Soil Dynamics and Machine Foundations', Galgotia Publishers, New Delhi, **1997.**
9. V.N.S. Murthy, 'Soil Mechanics and Foundation Engineering', CBS Publishers & Distributors, New Delhi, **2009.**

SOIL MECHANICS LAB

Subject Code – MCIE3-104 **L T P C**
0 0 4 2

List of Experiments

1. Preliminary Soil Tests
2. Relative Density of sand Test
3. Proctor Compaction Test
4. Consolidation Test
5. CBR Test
6. Permeability of Clay/ Sand Soils.
7. Free Swell, Swell Potential, Swell Pressure Test
8. Analysis of cuts and slopes
9. Shear Strength Tests

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ROCK MECHANICS

Subject Code – MCIE3-156 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

UNIT-I (12 Hrs.)

Superficial deposits. weathering and erosion processes, Mechanism involved, Detailed description of the resulting geomorphologic feat covering weather effects river actions, Sea action, Wind action and ice action, their origin, Mechanism involved and engineering significance. Detailed geologic and physiographic account of extra peninsular India and Indo gangetic Plains.

UNIT-II (14 Hrs.)

Study of important Rock: forming minerals, Quartz group, Mica, Feldspar group, Pyroxene group, Amphibole group and miscellaneous mine of common occurrence. Structures and texture of the main rock group geological and engineering characteristics of the important rock by: Microscopic study of important rock and minerals including preparation of thin sections. Geotectonics: North movement, Diastrophism, Oscstasy and central drafts, formation of major structural feature in rock folds. Faults, Joints and unconformities, their effects on cut crops mechanism involved, their engineering significance.

UNIT-III (11 Hrs.)

Rock as constructional materials: sand and gravel characteristics of aggregates, Stability of slopes and cutting, Landslides and Landoidence. Geological exploration of engineering sites. Geological investigation in the case of Dams and Reservoirs Canals. Building foundation and highways. Earthquakes: Mechanism involved; Geological consideration for construction; Reservoir related earthquakes.

UNIT-IV (8 Hrs.)

Groundwater: Ground water investigation in Civil engineering, Ground water provinces in India. Geological Mapping: Interpretation of geological mapping sections.

Recommended Books

1. M.T. Maruthesha Reddy, 'A Textbook of Applied Engineering Geology', New Age International (P) Limited, Publishers, **2007.**
2. D.P. Krynine, 'Principles of Engineering Geology and Geotechnics', CBS Publishers & Distributors-New Delhi.
3. D.S. Arora, 'Geology for Engineers', Mohindra Capital Publishers, Chandigarh.
4. J.M. Treteth, 'Geology of Engineers', Princeton, Von. Nostrand.

CLAY MINERALOGY

Subject Code – MCIE3-157 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

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UNIT-I (13 Hrs.)

Clay Minerals, Identification of Clay Minerals, Atomic bonds: Primary and Secondary types; Study of clay forming minerals; Base exchange capacity;

UNIT-II (14 Hrs.)

Specific Surface (Ss), Interaction of Water and Clay Minerals, Interaction of Clay Particles, Clay water electrolyte system; Gouy-Chapman diffuse double layer theory; Structure of clays; Principle of electro-osmosis;

UNIT-III (8 Hrs.)

Soil stabilization; Consolidation and strength characteristics of clay in light of clay mineralogy;

UNIT IV (10 Hrs.)

Clay mineral identification: Differential thermal analysis, X-ray diffraction technique and scanning electron microscopic studies.

Recommended Books

1. R.D. Holtz and W.D. Kovacs, 'An Introduction to Geotechnical Engineering', Prentice Hall, **1981**.
2. J.K. Mitchell, 'Fundamentals of Soil Behavior', 2nd Edn., John Wiley & Sons, **1993**.
3. J. Israelachvili, 'Intermolecular and Surface Forces', 2nd Edn., Academic Press, **1991**.
4. S.L. Kramer, 'Geotechnical Earthquake Engineering', Prentice Hall, **1996**.
5. T.W. Lambe and R.V. Whitman, 'Soil Mechanics', SI Version, John Wiley & Sons, **1979**.
6. J.C. Santamarina, K.A. Klein and M.A. Fam, 'Soils and Waves', John Wiley & Sons, **2001**.
7. H. Van Olphen, 'An Introduction to Clay Colloid Chemistry', Reprint Edn., Krieger Publishing Company, **1991.**
8. P.P. Xanthakos, 'Surry Walls as Structural Systems', 2nd Edn., McGraw-Hill, Inc, **1991**.

STRUCTURAL DESIGN OF FOUNDATION

Subject Code – MCIE3-158 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

UNIT-I (12 Hrs.)

Shallow Foundation: Design of footing e.g. isolated footing in B.B.C. and steel grillage, combined footings of rectangular, Trapezoid cantilever types. Mat or raft foundation for dry and saturated soil, floating foundations.

UNIT-II (8 Hrs.)

Deep Foundation: Design of Piles, Pile caps and pile foundations buildings, Design of retaining structures.

UNIT-III (13 Hrs.)

Earth Retaining Structures: Design of retaining walls for dry and saturated back fills with surcharge loads. Retaining walls resting on piles, Design of bridge abutments, Design of sheet piles used for coffer dams, Design of sheeting bracing in excavation trenches, Special Structures

UNIT-IV (12 Hrs.)

Design of foundation for transmission Design of basement walls, Bridges structures Analysis and Design: Design of walls foundation and caissons of different types, Design of bridge piers resting on piles.

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Recommended Books

1. Pillai & Menno, 'Advanced RCC Design', Tata McGraw Hill.
2. P.C. Varghese, 'Limit State Design of Reinforced Concrete', Prentice-Hall of India Pvt. Ltd'.
3. N. Krishna, 'Advanced Reinforced Concrete Design', CBS Publisher Publication, **2013.**

OPTIMIZATION TECHNIQUES

Subject Code – MCIE3-159 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

UNIT-I (13 Hrs.)

Optimisation Technique: Calculus of several variables, Implicit function theorem, Nature of singular points, Necessary and sufficient conditions for optimisation, Elements of calculus of variation, Constrained Optimisation, Lagrange multipliers, Gradient method, Dynamic programming.

UNIT-II (10 Hrs.)

Basics of engineering analysis and design, need for optimal design, formulation of optimal design problems, basic difficulties associated with solution of optimal problems.

UNIT-III (10 Hrs.)

Numerical methods for nonlinear unconstrained and constrained problems, sensitivity analysis, Linear post optimal analysis, sensitivity analysis of discrete and distributed systems.

UNIT-IV (12 Hrs.)

Introduction to variation methods of sensitivity analysis, shape sensitivity, Introduction to integer programming, dynamic programming, stochastic programming and geometric programming, Introduction to genetic algorithm and simulated annealing.

Recommended Books

1. S.S. Rao, 'Engineering Optimization – Theory and Practice', New Age International.
2. K. Deb, 'Optimization for Engineering Design – Algorithms and Examples', Prentice Hall.
3. U. Kirsch, 'Optimum Structural Design', McGraw Hill.
4. J.S. Arora, 'Introduction to Optimum Design', McGraw Hill.
5. S. Rajeev and C.S. Krishnamoorthy, 'Discrete Optimization of Structures using Genetic Algorithms', Journal of Structural Engineering, Vol. 118, No. 5, 1223- 1250, **1992.**
6. R.T. Hafta and Z. Gurdal, 'Elements of Structural Optimization', Kluwer Academic Publishers, 3rd revised and expanded Edn., **1996.**

ADVANCED SOIL MECHANICS

Subject Code: MCIE3-205 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

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UNIT-I (13 Hrs.)

Stability analysis of slope -effective vs. total stress analysis, Stability Analysis of Slope: Effective and total stress approach, shape of slip surface, methods of slices, graphic methods, location of critical slip circle, wedge analysis method, stability during critical conditions.

UNIT-II (11 Hrs.)

Sheet Pile Structures: Cantilever sheet piling, Anchored sheet piling: Free and fixed earth support methods of Analysis

UNIT-III (10 Hrs.)

Soil Anchors: Inclusions and Installation Techniques, Design of Soil Anchors, Application Criteria: Advantages and Limitations.

UNIT-IV (11 Hrs.)

Braced cuts, Arching action of soil and its application, coffer dams analysis and design.

Recommended Books

1. B.M. Das, 'Advanced Soil Mechanics', Taylor and Francis.
2. R.F. Scott, 'Principles of Soil Mechanics', Addison & Wesley.
3. R.O. Davis and A.P.S. Selvadurai, 'Elasticity and Geomechanics', Cambridge University Press, New York.
4. James K Mitchell, 'Fundamentals of Soil Behaviour', John Wiley and Sons.
5. D.M. Wood, 'Soil Behaviour and Critical State Soil Mechanics', University of Glasgow.

FOUNDATION ENGINEERING

Subject Code – MCIE3-206 **LT P C** **3 1 0 4** **Duration: 45 Hrs.**

UNIT-I (10 Hrs.)

Shallow Foundation: Bearing capacity factors. Effect of foundation shape, eccentricity and inclination of load, Influence of soil compressibility and water table

UNIT-II (11 Hrs.)

Deformation Modulus and Settlement: Tsytovich equivalent stratum, Settlement of footings on stratified deposits. Influence of adjacent footings. Allowable total and differential settlement of structures. Methods of proportioning, Raft foundations, semi-empirical methods. Foundations on swelling soils

UNIT-III (13 Hrs.)

Deep Foundations: Modes of failure. Bearing capacity and settlement of pile foundation. Types of piles. Allowable load, Pile Load test. Dynamic and static formulae. Bearing Capacity factors. Pile group bearing capacity and settlement. Interference, Behavior of piles under lateral loading. Winkler's assumption. Pile resistance and deflection under lateral loads, elastic method, Broms method.

UNIT-IV (11 Hrs.)

Well Foundations: Design and construction. Bearing capacity, settlement and lateral resistance. Tilts and shifts. CASSIONS: Types and design.

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Recommended Books

1. B. M Das, 'Principles of Foundation Engineering', Thomson Brooks/Cole.
2. J. E. Bowles, 'Foundation Analysis and Design', McGraw-Hill Book Company.
3. H.G. Poulos, and E.H. Davis, 'Pile Foundation Analysis and Design', John Wiley and Sons, New York.
4. N.P. Kurien, 'Design of Foundation Systems: Principles & Practices', Narosa, New Delhi **1992.**
5. H.F. Winterkorn and H.Y. Fang, 'Foundation Engineering Hand Book', Galgotia Book Source.

FOUNDATION ENGINEERING LAB

Subject Code – MCIE3-207 **LT P C** **0 0 4 2**

1. Field Investigation by Auger Boring
2. Pile Load Test
3. Plate load test
4. Standard Penetration Test
5. Static Cone Penetration test
6. Dynamic cone Penetration test
7. Soil test Repots
8. Field CBR test

PAVEMENT DESIGN

Subject Code – MCIE3-260 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

UNIT-I (13 Hrs.)

Types of pavement structure, Functions of pavement components, Factors affecting pavement design. Design wheel load, Strength characteristics of pavement materials. General design considerations, Methods for design of flexible pavements; Group Index method, California Bearing Ratio (CBR) method, California Resistance Value method, Triaxial Test method, Burmister method, McLeod's method.

UNIT-II (11 Hrs.)

General design considerations, Methods for design of rigid pavements; Westergard's method, F.A.A. method, IRC recommendations for design of concrete pavements, method, Types of joints and their design in cement concrete pavements. Thickness design for Airport pavement, LCN system of pavement design, design of airport pavement overlays.

UNIT-III (10 Hrs.)

Types of highway construction and their selection, materials for construction, construction procedure of different highways: Earth roads, Gravel roads, WBM roads, Bituminous pavements, Cement concrete pavements, Low cost roads, Introduction to various equipment used for highway construction.

UNIT-IV (11 Hrs.)

Need for highway maintenance, Pavement failures their causes and remedial measures. Typical flexible and rigid pavement failures, Types of highway maintenance: Routine, periodic and special type, materials used for maintenance of different pavements, Strengthening of existing pavements, Maintenance management system.

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Recommended Books

1. E.J. Yoder, ‘Principals of Pavement Design’.
2. Khanna and Justo, ‘Highway Engineering’.
3. S.K. Sharma, ‘Principles, Practice and Design of Highway Engineering’.
4. M.G. Lay, ‘Handbook of Road Technology’.
5. Yang and Huang, ‘Pavement Analysis and Design’.
6. D. Croney and P. Croney, ‘The Design and Performance of Road Pavements’.

EARTHEN DAMS

Subject Code – MCIE3-261 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

UNIT-I (12 Hrs.)

Historical Development, selection of dam site, types of embankment dams, choice of type of dam, components of a dam, free board, slope protection, cause of failure, criteria for safe design. Foundation Exploration and Materials for Embankments: Methods of investigations, properties of ground, field and laboratory tests, suitability criteria for materials. Seepage through Dam Section and its Control: Fundamentals of seepage flow, Laplacian equation and flow net. Determination of top flow line and discharge through dam, seepage force and its effects, critical conditions in earth dam; end of construction, steady seepage, rapid draw down. Drainage of Embankment: Horizontal drain, chimney drain, design of filter, use of impervious core in seepage control

UNIT-II (12 Hrs.)

Control of Seepage Trough Foundation: General consideration, treatment of foundation; trench cut off partial cutoff, grout cutoff, upstream impervious blanket, design of relief well, liquefaction of soil, mechanism of densification. Instrumentation in Earth Dam: Measurement of pore pressure, movement of dam and seepage, Instruments for measuring horizontal and vertical movement. Piezometers; types, choice for location, Instruments for measuring seepage.

UNIT-III (11 Hrs.)

Stability Analysis of Slope: Effective and total stress approach, shape of slip surface, methods of slices, graphic methods, location of critical slip circle, wedge analysis method, stability during critical conditions, stability during earth quake, Indian standard Code s of practice. Quality Control in Construction: Method of compactions, quality control of compaction in the field, borrow area control.

UNIT-IV (10 Hrs.)

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Rock fill Dams: Typical sections, Problems of design. Different types of membranes. Settlement of rock fill dams. Construction methods. Case Studies of Dam Failures: Failure of Panshet Dam, Nanak Sagar Dam, Sampana Dam.

Recommended Books

1. J.L. Sherard, R.J. Woodward, S.F. Gizienski, and W.A. Clevenger, ‘Earth and Earth – Rock Dams Engineering Problems of Design and Construction’, John Wiley and Sons, New York, **1963.**
2. R.F. Craig, ‘Soil Mechanics’, Chapman and Hall (ELBS).
3. C. Justin and Hinds, ‘Engineering for Dams’, Vol. 2 & 3.
4. S. Leliavsky, ‘Design of Dams for Percolation and Erosion’, Chapman and Hall.

GEO-ENVIRONMENTAL ENGINEERING

Subject Code – MCIE3-262	**L T P C** **3 1 0 4**	**Duration: 45 Hrs.**

UNIT-I (12 Hrs.)

Industrialization and Urbanization, Pollution, Control and remediation. Contamination: Surface contamination, Contamination transport, Soil-a Geotechnical trap, Effect of subsurface contamination, Detection of polluted zone, Monitoring and Effectiveness of designed facilities.

UNIT – II (12 Hrs.)

Contaminants of Solid Waste in Landfills: Waste contaminants, landfills, types, shape and size of landfills. Liner and liner system, Cover and cover system, Stability of landfills. Land fill construction & operation, sustainable waste management. Contaminants of Slurry wastes:

Slurry transported wastes, slurry ponds, operation, Embankment construction and raising, Design aspects, Environmental Impact and control.

UNIT – III (11 Hrs.)

Vertical Barriers for Contaminant: Contaminated sites, Types of barriers, Soil-Bentonite slurry trench walls, Cement-Bentonite slurry trench walls, construction material and design aspects.

UNIT – IV (10 Hrs.)

Geotechnical Reuse of Waste materials: Waste reduction, use in geotechnical construction, waste characteristics, transportation consideration, engineering properties of Wastes, Waste material in Embankment and Fills

Recommended Books

1. R.K. Rowe, 'Geotechnical and Geoenvironmental Engineering Handbook', Kluwer Academic Publications, London.
2. L.N. Reddi, and H.I. Inyang, 'Geoenvironmental Engineering Principles and Applications', Marcel Dekker, Inc., New York, **2000.**
3. M.D. LaGrega, P.L. Buckingham and J.C. Evans, 'Hazardous Waste Management', McGraw-Hill New York, **2001.**
4. H.D. Sharma and K.R. Reddy, 'Geoenvironmental Engineering: Site Remediation, Waste Containment, and Emerging Waste Management Technologies', John Wiley & Sons, Inc., USA, **2004.**

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COMPUTATIONAL TECHNIQUES

Subject Code – MCIE3-263 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

UNIT-I (12 Hrs.)

Equations: Rotts of Algebraic, Transcendental equations, Solution of linear simultaneous Equations by different methods using - Elimination, Inversion, Gauss - Jordan methods. Homogeneous Problems and Eigen Value Problems, Nonlinear Equations, Interpolation

UNIT-II (12 Hrs.)

Finite Difference Technique: Initial and Boundary Value Problems of Ordinary and Partial differential equations, Solution of Various types of Plates.

UNIT-III (11 Hrs.)

New Marks Method: Solution of determinate and indeterminate Structures by using NewMark's Procedure. Statistical Methods: Method of Correlation and Regression Analysis.

UNIT-IV (10 Hrs.)

Initial Value Problems: Galerkin's Method of Least Square, Initial Value problem by Collocation points, Runga Kutta Method. Newmark's Implicit and Explicit Solutions for Non Linear Problems and Convergence Criteria.

Recommended Books

1. M.K. Jain, S.R.K. Iyenger, R.K. Jain, 'Numerical Methods, Problems, and Solutions'.
2. G. Dahlquist and A. Bjorck, 'Numerical Methods'.

3. S.A. Tenkolsky, W.T. Vellerling, B.P. Flannery, 'Numerical Recipes in Fortran' W.H. Press.
4. Syal & Gupta, 'Computer Programming & Numerical Analysis'.

RETAINING AND UNDERGROUND STRUCTURES

Subject Code – MCIE3-364 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

UNIT – I (12 Hrs.)

Sheet Pile Walls: Retaining structure – Selection of soil parameters – Analysis and design of cantilever and anchored sheet pile walls. Deadman and continuous anchor. Diaphragm and bored pile walls – Design requirements.

UNIT – II (12 Hrs.)

Supported Excavations: Lateral pressure on sheeting in braced excavation, stability against piping and bottom heaving. Earth pressure around tunnel lining, shaft and silos

UNIT – III (11 Hrs.)

Design Of Reinforced Earth Retaining Wall: Reinforced earth retaining wall – principles, Concepts and mechanism of reinforced Earth – Design consideration of reinforced earth – Materials used in reinforced earth - Geotextile – Geogrids, Metal strips, facing elements.

UNIT – IV (10 Hrs.)

Drilled Shaft: Construction procedures, Design Considerations, Load Carrying Capacity and settlement analysis

Recommended Books

1. J.N. Mandal, 'Reinforced Soil and Geo-Textile' Proceedings FIGC- Oxford and IBH Publishing Company Private Ltd., New Delhi, **1988.**
2. J.L. Sherard, R.J. Woodward, S.F. Gizienski, and W.A. Clevenger, 'Earth and Earth – Rock Dams Engineering Problems of Design and Construction', John Wiley and Sons, New York, **1963.**
3. R.F. Craig, 'Soil Mechanics', Chapman and Hall (ELBS).
4. C. Justin and Hinds, 'Engineering for Dams', Vol. 2 & 3.
5. S. Leliavsky, 'Design of Dams for Percolation and Erosion', Chapman and Hall.

CONSTRUCTION PLANNING & SCHEDULING

Subject Code – MCIE-365 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

UNIT-I (13 Hrs.)

Construction Planning: Need of construction planning, Constructional Resources, construction team, stages in construction, preparation of construction schedule, Job layout, inspection and quality control. Planning and decision making Nature of planning, steps in planning, types of planning, levels of planning- planning process, decision making

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UNIT-II (11 Hrs.)

Pre-tender planning; contract planning; planning and scheduling construction jobs by bar charts, Work-study, work breakdown structure, Planning and scheduling construction jobs by critical path network techniques; allocation of resources. Time estimates, Applications of CPM/PERT, statical concepts, scheduling, monitoring, updating.

UNIT-III (11 Hrs.)

Resources - based networks, crashing, master networks, interface activities and dependencies, line of balancing techniques, application of digital computers, Material management purchases management and inventory control, Human Resource Management. Resource planning-leveling and allocation.

UNIT-IV (10 Hrs.)

Time-cost Optimization: Direct cost, indirect cost, total cost; purpose, stages and methods of cost control techniques of time cost optimization, Man-Material-Machinery-Money optimization. Cost functions, cost control, time-cost trade off.

Recommended Books

1. R.L. Peuripo, 'Construction Planning Equipment and Methods', Tata McGraw Hill.
2. K.K. Chitkara, 'Construction Project Management: Planning Scheduling and Control', Tata McGraw Hill Publishing Company, New Delhi, **1998.**
3. Calin M. Popesc, Chotchal Charoenngam, 'Project Planning, Scheduling and Control in Construction: An Encyclopedia of Terms and Applications', Wiley New York, **1995.**
4. Chris Hendrickson and Tung Au, 'Project Management for Construction – Fundamental Concepts for Owners, Engineers, Architects and Builders', Prentice Hall Pittsburgh, **2000.**
5. J. Moder, C. Phillips and E. Davis, 'Project Management with CPM, PERT and Precedence Diagramming', Van Nostrand Reinhold Company, **1983.**
6. E.M. Willis, 'Scheduling Construction Projects', John Wiley & Sons, **1986.**
7. D.W. Halpin, 'Financial and Cost Concepts for Construction Management', John Wiley & Sons, New York.

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M. TECH. CIVIL (STRUCTURAL & FOUNDATION ENGINEERING) 2016 ONWARDS

Total Contact Hours = 26 **Total Marks = 600** **Total Credits = 23**

SEMESTER 1st		Contact Hrs			Marks			Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
MCIE5-101	Matrix Structural Analysis	3	1	-	40	60	100	4
MCIE5-102	Advanced Foundation Engineering	3	1	-	40	60	100	4
MCIE5-103	Bridge Engineering	3	1	-	40	60	100	4
MCIE5-104	Non Destructive Testing Lab	-	-	6	60	40	100	3
Departmental Elective – I (Select any one)		3	1	0	40	60	100	4
MCIE5-156	Continuum Mechanics							
MCIE5-157	Advanced Numerical Analysis							
Departmental Elective – II (Select any one)		3	1	0	40	60	100	4
MCIE5-158	Pre Stressed Concrete Structures							
MCIE5-159	Behaviour & Design of Steel Structures							
Total	**Theory = 5 Lab = 1**	**15**	**5**	**6**	**260**	**340**	**600**	**23**

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Total Contact Hours = 25 **Total Marks = 600** **Total Credits = 22**

SEMESTER 2nd		Contact Hrs			Marks			Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
MCIE5-205	Direct Stiffness Method	3	1	-	40	60	100	4
MCIE5-206	Structural Dynamics	3	1	-	40	60	100	4
MCIE5-207	CAD Lab	-	-	6	60	40	100	3
Departmental Elective – III (Select any one)		3	1	0	40	60	100	4
MCIE5-260	Analysis and Design of Bridges							
MCIE5-261	Concrete Technology							
Departmental Elective – IV (Select any one)		3	1	0	40	60	100	4
MCIE5-262	Advanced Concrete Design							
MCIE5-263	Composite Materials							
Open Elective – I (Select any one)		3	0	0	40	60	100	3
Total	**Theory = 4 Lab = 1**	**15**	**5**	**6**	**260**	**340**	**600**	**22**

Total Contact Hours = 11 **Total Marks = 500** **Total Credits = 25**

SEMESTER 3rd		Contact Hrs			Marks			Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
MCIE5-308	Professional Skills	3	1	-	40	60	100	4
MCIE5-309	Seminar	-	-	-	60	40	100	4
MCIE5-310	Project	-	-	-	60	40	100	10
Departmental Elective – V (Select any one)		3	1	0	40	60	100	4
MCIE5-364	Analysis of Plates							
MCIE5-365	Finite Element Analysis							
Open Elective – II (Select any one)		3	0	0	40	60	100	3
Total	**Theory = 3 Lab = 0**	**9**	**2**	**0**	**240**	**260**	**500**	**25**

Total Credits = 20

SEMESTER 4th		Contact Hrs			Evaluation Criteria	Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Satisfactory/ Unsatisfactory**	
MCIE5- 411	**Thesis**	**0**	**0**	**0**		20

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Overall

Semester	**Marks**	**Credits**
1st	600	23
2nd	600	22
3rd	500	25
4th	--	20
Total	**1700**	**90**

MATRIX STRUCTURAL ANALYSIS

Subject Code- MCIE5-101 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

UNIT-I (10 Hrs.)

Basic Concepts of Structural Analysis: Static and Kinematic Indeterminacies of Beams, Rigid-Jointed Plane and Space Frames, Pin-Jointed Plane and Space Frames and Hybrid Structures, Actions and Displacements, Action and Displacement Equations, Generalized System of Coordinates, Slope-Deflection Equations in Generalized Coordinates, Relation Between Flexibility and Stiffness Matrices, Basic Definitions and Types Of Matrices, Matrix Operations, Matrix Inversion, Solution of Linear Simultaneous Equations, Matrix Partitioning.

Flexibility Matrix (Physical Approach): Development of Flexibility Matrices for Statically Determinate and Indeterminate Beams, Rigid-Jointed Plane Frames and Pin-Jointed Plane Frames Using Physical Approach.

Stiffness Matrix (Physical Approach): Development of Stiffness Matrices for Statically Determinate and Indeterminate Beams, Rigid-Jointed Plane Frames and Pin-Jointed Plane Frames Using Physical Approach, Reduced Stiffness Matrix, Total Stiffness Matrix, Translational or Lateral Stiffness Matrix.

UNIT-II (10 Hrs.)

Flexibility Matrix (Element Approach): Transformation of System Forces to Element Forces Through Force Transformation Matrix, Development of Flexibility Matrices for Statically Determinate and Indeterminate Beams, Rigid-Jointed Plane Frames and Pin-Jointed Plane Frames Using Element Approach.

Stiffness Matrix (Element Approach): Transformation of System Displacements to Element Displacements through Displacement Transformation Matrix, Development of Stiffness Matrices for Statically Determinate and Indeterminate Beams, Rigid-Jointed Plane Frames and Pin-Jointed Plane Frames Using Element Approach.

UNIT-III (12 Hrs.)

Flexibility Method of Analysis: Analysis of Continuous Beams, Rigid-Jointed Plane Frames and Pin-Jointed Plane Frames Using the Physical and Element Approaches, Effect of Support Settlements, Temperature Stresses and Lack of Fit.

UNIT-IV (12 Hrs.)

Stiffness Method of Analysis: Analysis of Continuous Beams, Rigid-Jointed Plane Frames and Pin-Jointed Plane Frames Using the Physical and Element Approaches, Effect of Support Settlements, Temperature Stresses and Lack of Fit, Comparison of Flexibility and Stiffness Methods of Analysis.

Recommended Books

1. William Weaver, Jr. James M. Gere, 'Matrix Analysis of Framed Structures'.
2. Madhu B. Kanchi, 'Matrix Methods of Structural Analysis', 2nd Edn., Wiley Eastern Ltd. **1993.**
3. K.I. Majeed, 'Non Linear Structure Analysis', Butterworth Ltd. London, **1973.**

MRSPTU

ADVANCED FOUNDATION ENGINEERING

Subject Code: MCIE5-102 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

UNIT-I (9 Hrs.)

Shallow foundations- Selection of Type and Depth of Foundations, Isolated Footings, Combined Footings, Mat Foundations Including Floating Raft, Settlement Calculations.

UNIT-II (16 Hrs.)

Pile Foundation- Introduction, Estimation of Pile Capacity by Static and Dynamic Formulae, Wave Equation Method of Analysis of Pile Resistance-Load-Transfer Method of Estimating Pile Capacity, Settlement of Single Pile, Elastic Methods. Laterally Loaded Pile- Modulus of Sub Grade Reaction Method, Ultimate Lateral Resistance of Piles. Pile Groups- Consideration Regarding Spacing, Efficiency of Pile Groups, Stresses on Underlying Soil Strata, Approximate Analysis of Pile Groups, Settlement of Pile Groups, Pilecaps, Pile Load Tests, Negative Skin Friction.

UNIT-III (10 Hrs.)

Deep foundations- Well Foundations, Pier Foundations, Caissons

UNIT-IV (10 Hrs.)

Earth Pressure Computation on Retaining Wall by Rankine and Coulomb's Wedge Theory, Cantilever and Anchored Sheet Pile, Coffer Dams

Recommended Books

1. Lambe and Whitman, 'Soil Mechanics', Wiley Eastern, **1976.**
2. B.M. Das, 'Advanced Soil Mechanics', Mc. Graw-Hill, NY, **1985**.
3. H.F. Winterkorn and H.Y. Fang Ed., 'Foundation Engineering Hand Book', Van-Nostrand Reinhold, **1975.**
4. J.E. Bowles, 'Foundation Analysis and Design', 4th Edn., Mc.Graw –Hill, NY, **1996.**
5. H.G. Poulose and E.H. Davis, 'Pile Foundation Analysis and Design', John-Wiley & Sons, NY, **1980.**
6. G. Leonards Ed., 'Foundation Engineering', Mc.Graw-Hill, NY, **1962.**
7. J.E. Bowles, 'Analytical and Computer Methods in Engineering', Mc.Graw-Hill, NY.
8. Sreenivasalu & Varadarajan, 'Handbook of Machine Foundations', Tata McGraw Hill.

BRIDGE ENGINEERING

Subject Code – MCIE5-103 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

UNIT-I (10 Hrs.)

Introduction - Definition and Components of Bridges. Layout and Planning of Bridges, Classification, Investigations for Bridges, Preliminary Data Collection, Choice of Type of the Bridges, Hydraulic Design of Bridges, Traffic Design of Bridges.

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UNIT-II (12 Hrs.)

Analysis and Design of Superstructure of Straight and Curved Bridge Decks-Loadings Details, Specification-Reinforced Concrete and Steel Decks. Decks of Various Types like Slab, Hollow and Voided Slab, Beam and Slam, Box Girder etc.

UNIT-III (11 Hrs.)

Design of Substructure - Piers and Abutments of Different Types. Analysis and Design of Foundations - Shallow Foundations (Open Foundations), Deep Foundations - Well Foundations and Caisson. Design and Constructional Aspects of Foundations.

UNIT-IV (12 Hrs.)

Modern Methods of Construction of Concrete and Steel Bridges- Their Impact on The Analysis and The Design. Introduction to Analysis and Design of Long Span Bridges like Suspension and Cable Stayed Bridges. Special Aspects in Analysis and Design, Based on Construction Methodology. Inspection and Maintenance and Rehabilitation of Bridges.

Recommended Books

1. Pama & Gusens, ‘Bridge Deck Analysis’.
2. Edward V. Hambly, ‘Bridge Deck Behaviour’.
3. D. Johnson Vector, ‘Essentials of Bridge Engineering’.

NON DESTRUCTIVE TESTING LAB

MRSPTU

Subject Code – MCIE5-104 **L T P C**
0 0 6 3

List of Experiments

1. Mix Design of concrete without admixtures as per IS Recommended Guidelines
2. Mix Design of concrete with admixtures as per IS Recommended Guidelines
3. Rebound Hammer Test
4. Ultrasonic Pulse Velocity Test
5. Bar Locator test
6. Split Tensile strength of Concrete.
7. Core Test

Recommended Books

1. M.L. Gambhir, ‘Concrete Manua’, Dhanpat Rai & Co.
2. P.S. Gahlot, Sanjay Sharma, ‘Building Repair and Maintenance Management’, CBS Publishers.
3. M.S. Shetty, ‘Concrete Technology’.

CONTINUUM MECHANICS

Subject Code – MCIE5-156 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

UNIT-I (10 Hrs.)

Vector and Tensors Algebra, Linearization and Directional Derivatives, Stress and Equilibrium, Analysis for Stresses, Translational and Rotational Equilibrium, Principal Stresses and Principal

Planes in 3D, Stress Invariants, Cauchy and Kirchhoff Stress Tensor, Deviatoric and Volumetric Components, Work Conjugancy, Octahedral and Von-Mises Stresses.

UNIT-II (10 Hrs.)

Kinematics, Linearized Kinematics, Strain Quadric of Cauchy, Principal Strains, Invariants, Equations of Compatibility, Finite Deformation, Material (Lagrangian) and Spatial (Eulerian) Descriptions, Deformation Gradient, Polar Decomposition, Volume Change, Distortional Component of Deformation Gradient, Area Change.

UNIT-III (12 Hrs.)

Equations of Elasticity, Hooke's Law, Generalized Hooke's Law, Anisotropic, Orthotropic and Isotropic Elasticity Tensor, Plane Stress and Strain Problems, Airy Stress Functions for Two-Dimensional Problems, Airy Stress Function in Polar Coordinates, Isotropic Hyper Elasticity, Three Dimensional Elasticity.

UNIT-IV (12 Hrs.)

Elasto-Plastic Behavior of Material, Elasto-Plastic Formulations, Material Yield Criteria- Von Mises, Tresca, Mohr-Coulomb, Ducker-Pager, Isotropic and Kinematic Hardening, Normality Principle, Plastic Flow Rule, Plastic Potential, Elasto-Plastic Stress-Strain Relations, Prandtl-Rauss Equations, Levy-Mises Relations, Hardening Modulus, Generalized Elasto-Plastic Stress-Strain Relations.

Recommended Books

1. David M. Potts and Lidija Zdravkovic, Thomas Telford, 'Finite Element Analysis in Geotechnical Engineering Theory', **1999.**
2. C.S. Desai, 'Mechanics of Materials and Interfaces: The Disturbed State Concept', CRC Press LLC, **2000.**
3. A.P.S. Selvadurai, M.J. Boulon, 'Mechanics of Geometrical Interfaces', Elsevier, **1995.**

MRSPTU

ADVANCED NUMERICAL ANALYSIS

Subject Code – MCIE5 -157 **L T P C** **Duration: 45 Hrs**
3 1 0 4

UNIT-I (10 Hrs.)

Introduction, roots of a non-linear equation and roots of a polynomial of nth degree [incremental search method, method of successive approximations, Newton's method, bisection method, secant method, Müller's method, synthetic division, Bairstow's method] and convergence study.

UNIT-II (10 Hrs.)

Solution of (Non-Homogeneous) Linear Algebraic Equations, Review of Matrix Algebra, Gauss Elimination Method, Cholesky's Decomposition Method, Householder Method, Gauss-Siedal Iterative Method.

Solution of Non-Linear Algebraic Equations, Method of Successive Approximation, Newton's Method, Modified Newton – Raphson Method, Secant Method.

UNIT-III (12 Hrs.)

Eigen Values and Eigen Vectors, Reduction of Generalized Eigen Value Problem to The Standard Eigen Value Problem, Methods for Obtaining Eigen Values and Eigen Vectors [Polynomial Method, Vector Iteration Method, Mises Power Method, Jacobi Method] 08 6. Time

Marching schemes for solution of problems in time domain, numerical integration (2 – D) [Newton – Cotes method, Gauss – Legendre method]

UNIT-IV (12 Hrs.)

Solution of Ordinary and Partial Differential Equations, Euler's Method, Runge – Kutta Method, Finite Difference Method, Applications to Problems of Beam and Plates on Elastic Foundation, Laplacian Equation, Consolidation Equation, Laterally Loaded Piles Etc.

Recommended Books

1. S.C. Chapra and R.P. Canale, 'Numerical Methods for Engineers', Tata McGraw Hill, **2003.**
2. B. Carnahan, H.A. Luther and J.O. Wilkes, 'Applied Numerical Methods', John Wiley, **1969.**
3. M.T. Heath, 'Scientific Computing: An Introductory Survey', McGraw Hill, **1997.**
4. J. Douglas Faires and Richard Burden, 'Numerical Methods', Thomson, **2003.**
5. S. Rajasekaran, 'Numerical Methods in Science and Engineering', S. Chand, **1999.**

PRE STRESSED CONCRETE STRUCTURES

Subject Code – MCIE5 -158 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

UNIT-I (10 Hrs.)

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Limit State Design of Statically Determinate Pre-Stressed Beams- Limit State of Collapse by Flexure, Shear, Torsion Limit State of Serviceability. Anchorage Zone Stresses for Posttensioned Members.

UNIT-II (12 Hrs.)

Statically Indeterminate Structures- Analysis and Design- Continuous Beams and Frames. Choice of Profile, Linear Transformation, Concordancy, Omically Viable Profile. Composite Beam with Precast Prestressed Beams and Cast in Situ RC Slab analysis and Design.

UNIT-III (12 Hrs.)

Time Dependant Effects such as Creep, Shrinkage etc. on Composite Construction Inclusive of Creep Relaxation and Relaxation Creep - Partial Prestressing Principles, Analysis and Design of Simple Beams, Crack and Crack Width Calculations.

UNIT-IV (11 Hrs.)

Analysis and Design of Prestressed Pipes, Tanks and Spatial Structures Slabs, Grids, Folded Plates and Shells.

Recommended Books

1. Lundy, 'Prestressed Concrete Structures'.
2. T.Y. Lin, 'Prestressed Concrete'.
3. N. Krishna Raju, 'Prestressed Concrete'.

BEHAVIOUR & DESIGN OF STEEL STRUCTURES

Subject Code – MCIE5-159 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

UNIT-I (09 Hrs.)

Concepts of Stability, Introduction to Buckling Behaviour of Columns, Stability of Beam-Columns and Frames. Lateral Instability of Beams.

UNIT-II (13 Hrs.)

Local Buckling and Post Buckling Behaviour of Plates, Behaviour and Design of Cold Formed Thin Walled Structures Subjected to Flexure and Compression.

UNIT-III (12 Hrs.)

Plastic Analysis and Design of Steel Structures, LRFD approach, Advanced Topics in Bolted and Welded Connections, Behaviour of Steel Concrete Composite Construction and Introduction to Brittle Fracture and Fatigue.

UNIT-IV (08 Hrs.)

Design of Steel Truss Bridges.

Recommended Books

1. S.P. Timoshenko and J.M. Gere, 'Theory of Elastic Stability', McGraw-Hill, **1963.**
2. A.S. Arya and J.L. Ajmani, 'Design of Steel Structures', Nem Chand & Bros. **2000.**
3. N. Subramanian, 'Design of Steel Structures', Oxford University Press, **2008.**
4. M.L. Gambhir, 'Stability Analysis and Design of Structures', Springer, **2005.**

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DIRECT STIFFNESS METHOD

Subject Code – MCIE5-205 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

UNIT-I (10 Hrs.)

Basic Concepts**:** Introduction, Identification of Members and Nodes, Global and Member Coordinates, Comparison with Classical Methods.

UNIT-II (10 Hrs.)

Element & Global Stiffness Matrices: Stiffness Matrix for Truss Element, Beam Element Stiffness Matrix, Rigid Frame Element Stiffness Matrix, Global Stiffness Matrix, Coordinate Transformation, Rotation Matrix: Displacement Transformation Matrix, Force Transformation Matrix.

UNIT-III (10 Hrs.)

Transformation of Stiffness Matrices: Construction of Structure or Global Stiffness Matrix, Load and Displacement Vectors, Load Vector of Loads Not Applied at Nodes.

UNIT-IV (15 Hrs.)

Analysis of Structures: Continuous Beams, Pin-Jointed Plane Frames and Rigid-Jointed Plane Frames Including Support Settlements using Direct Stiffness Matrix Method and Formalization of Direct Flexibility Matrix Method.

Application to Simple Grids & Trusses: Element Stiffness Matrix, Torsion Constant, Global and Element Forces.

Recommended Books

1. T.S. Thandavamoorthy, Weaver & Gere, 'Structural Analysis', Oxford Higher Education.
2. A.K. Jain, 'Advanced Structural Analysis'.
3. Menon, 'Advanced Structural Analysis'.

STRUCTURAL DYNAMICS

Subject Code – MCIE5-206 **L T P C** **Duration: 45 Hrs.**

3 1 0 4

UNIT-I (09 Hrs.)

Overview of Structural Dynamics, Single Degree of Freedom Systems – Analysis of Free Vibrations – undamped and damped systems, estimation of damping by logarithmic decrement method, Formulation of equation of motion for generalized SDOF dynamic problems using virtual work method, Response of SDOFS systems to Harmonic, Periodic, Impulse Loads.

UNIT-II (12 Hrs.)

Formulation of Equation of Motion for Two/Three DOF Systems. Finding Mode Shapes and Frequencies by Solving the Determinantal Equation and Iterative Techniques. Use of Sweeping Matrices for Obtaining Higher Modes. Proof of Convergence. Modal Superposition and Response Spectrum Methods.

UNIT-III (12 Hrs.)

Response of Single and Multiple DOFS Systems to Earthquake Loading using Time stepping Methods Based on Forward Cauchy Euler, Backward Cauchy Euler and Trapezoidal Rule. Accuracy, Stability and Algorithmic Damping in Step-By-Step Methods. Earthquake Response Analysis of Multi-DOF Systems Subjected to Earthquake Ground Motion. Concept of Modal Mass and Mode Participation Factors, etc.

UNIT-IV (09 Hrs.)

Newark & Hall's Linear and Inelastic Response Spectra for Earthquakes 6 6. Introduction to IS Code Provisions Regarding Earthquake.

Recommended Books

1. Ray W. Clough & Penzien, 'Dynamics of Structures', Mc Graw Hill, **1993.**
2. Anil Chopra, 'Dynamics of Structures', Mc Graw Hill, **2001.**

CAD LAB

Subject Code – MCIE5-207 **L T P C**

0 0 6 3

List of Experiments

1. Computer Aided Analysis & Design of Reinforced Concrete Elements Such as Beams, Slabs.
2. Computer Aided Analysis & Design of Steel Elements Such as Connections, Tension Members, Compression Members, Beams, Column Base, and Roof Trusses.
3. To Develop a Complete Self Reliance in Solving Analysis and Design Problems of Engineering with the use of Computers. The Effort Must Culminate with a CAD Program and a Project Report.

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4. To Develop a Complete Self Reliance of Software Used for the Structural Analysis & Design.

ANALYSIS AND DESIGN OF BRIDGES

Subject Code – MCIE5-260 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

UNIT-I (10 Hrs.)

Structural Forms and Design Loads for Bridges, Effective Width Concept and Load Distribution in Multi-Beam Bridges.

UNIT-II (10 Hrs.)

Grillage Analogy, Design of R.C. and Pre-Stressed Concrete Slab Bridges.

UNIT-III (12 Hrs.)

Design of R.C. and Pre-Stressed Concrete Girder Bridges, Behaviour of Box-Girder Bridges, Introduction to Arch Bridges, Suspension and Cable Stayed Bridges.

UNIT-IV (10 Hrs.)

Different Types of Bearings and Design of Elastomeric Bearings, Introduction to Secondary Effects, Temperature, Shrinkage, Creep. Construction Techniques and Effects of Construction Sequence on Design.

Recommended Books

1. N. Rajagopalan, ‘Bridge Superstructure’, Narosa Publishing House, **2010.**
2. D.J. Victor, ‘Essentials of Bridge Engineering’, Oxford & IBH Publishing, **2001.**
3. ‘Code of Practice for Concrete Road Bridges - IRC:112-2011’, Indian Road Congress. **2011.**
4. ‘Standard Specifications and code of Practice for Bridges, Section II- Loads and Stresses - IRC:6-2010’, Indian Road Congress, **2010.**
5. E.C. Hambly, ‘Bridge Deck Behaviour’, Chapman and Hall, London, **1976.**

MRSPTU

CONCRETE TECHNOLOGY

Subject Code – MCIE5-261 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

UNIT-I (10 Hrs.)

Ingredients of Concrete: Review of Cements including Blended Cements, Manufacture, Chemical Composition, Aggregates: Review of Types; Elementary Mineralogy and Petrology; Sampling and Testing; Effects on Properties of Concretes, Chemical and Physical Processes of Hydration. Mineral Admixtures: Pulverized Fly Ash, Ground Granulated Blast Furnace Slag and Silica Fume; Chemical Composition, Physical Characteristics, Chemical and Physical Processes of Hydration and Interaction, Effects on Properties of Concretes.

UNIT-II (11 Hrs.)

Admixtures: Review of Types and Classification, Chemical Composition, Effects on Properties of Concretes. Fresh-Concrete: Rheology of Mortars and Concretes; Workability, Segregation and Bleeding, Theory and Principles governing the correct transportation, Placing, Compaction and Curing of Concrete. Plastic Settlement and Plastic Shrinkage, Exothermic Characteristics: Early

Age Thermal Movements, Strength Development, Maturity, Accelerated Curing, Hot and Cold Weather Concreting.

UNIT-III (12 Hrs.)

Properties of Hardened Concrete: Strength, Deformation under Load, Elasticity, Creep, Drying Shrinkage and other volume Changes. Thermal Properties, Durability of Concrete and Concrete Construction: Durability Concept, Pore Structure and Transport Processes, Reinforcement Corrosion, Fire Resistance, Frost Damage, Sulfate Attack, Alkali Silica Reaction, Methods of Providing Durable Concrete.

UNIT-IV (12 Hrs.)

Concrete Mix Design: The process of Mix Selection, Factors governing the selection of Mix Proportions, Combining Aggregates to obtain Specified Grading, Different Methods of Mix Design, Concepts of Statistical Quality Control of Concrete Construction, Special Concretes: Lightweight Concrete, No-Fines Concrete, High Performance Concrete, High Density and Radiation-Shielding Concrete, Polymer Concrete, Fibre Reinforced Concrete, Self Compacting Concrete, Roller Compacted Concrete, High Volume Fly Ash Concrete, Ready Mixed Concrete.

Recommended Books

1. A.M. Neville and J.J. Brooks, 'Concrete Technology', 1st Edn., **2002.**
2. P.K. Mehta and Paulo J.M. Monteiro, 'Concrete: Microstructure, Properties and Materials', 3rd Edn., **2006.**

MRSPTU

ADVANCED CONCRETE DESIGN

Subject Code – MCIE5-262 **L T P C** **Duration: 45 Hrs.**

3 1 0 4

UNIT-I (08 Hrs.)

Plastic Section Theory for Reinforced Concrete Including Interaction of Flexure Shear-Axial Effects, Upper Bound and Lower Bound Plastic Theorems.

UNIT-II (13 Hrs.)

Application of Plastic Analysis to Frames – Instantaneous Centre of Rotations, Introduction to Pushover Analysis, Introduction to Strut-Tie Models, Strut-Tie Models for Deep Beams, Beam-Column Joints & Shear Walls.

UNIT-III (12 Hrs.)

Introduction to Yield Line Analysis and Application for Slabs, Raft Foundations etc, Introduction to Pre-Stressed Concrete and Behaviour for Simple Elements.

UNIT-IV (12 Hrs.)

Modelling of Creep/Shrinkage and Long Term Effects for RCC and Prestressed Concrete, Calculation of Crack Widths and Crack Control Designs.

Recommended Books

1. McGregor & White, 'Reinforced Concrete: Mechanics and Design', 6th Edn., **2011.**
2. Edward Nawy, 'Reinforced Concrete: A Fundamental Approach', 6th Edn., **2008**.
3. Arthur H. Nilson, 'Design of Prestressed Concrete', 2nd Edn., **1987.**
4. Darwin & Dolan, 'Design of Concrete Structures', 14th Edn., **2009.**
5. Edward Nawy, 'Prestressed Concrete: A Fundamental Approach', 5th Edn., **2005.**

6. J. Schlaich, K. Schaefer and M. Jennewin, ‘Toward a Consistent Design of Structural Concrete’, PCI Journal V. 32, No. 2, pp. 72-150, **1987.**
7. Kennedy & Goodchild, ‘Practical Yield Line Design’, The Concrete Centre, TCC/03/3, **2004.**

COMPOSITE MATERIALS

Subject Code – MCIE5-263 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

UNIT-I (10 Hrs.)

FIBRE REINFORCED CONCRETE: Properties of Constituent Materials, Mix Proportions, Mixing and Casting Procedures, Properties of Freshly Mixed Frc, Mechanics and Properties of Fibre Reinforced Concrete, Composite Material Approach, Application of Fibre Reinforced Concrete.

UNIT-II (12 Hrs.)

FLY ASH CONCRETE: Classification of Indian Fly ashes, Properties of Fly ash, Reaction Mechanism, Proportioning of Fly Ash Concretes, Properties of Fly Ash Concrete in Fresh and Hardened State, Durability of Fly Ash Concrete. Ferro Cement: Constituent Materials and Their Properties, Mechanical Properties of Ferro Cement, Construction Techniques and Application of Ferro Cement. Light Weight Concrete: Properties of Light Weight Concretes, Pumice Concrete, Aerated Cement Mortars, No Fines Concrete, Design and Applications of Light Weight Concrete.

UNIT-III (10 Hrs.)

POLYMER CONCRETE: Terminology used in polymer concrete, Properties of constituent materials, Polymer impregnated concrete, Polymer modified concrete, Properties and applications of polymer concrete and polymer impregnated concrete.

HIGH PERFORMANCE CONCRETE: Materials for high performance concrete, Supplementary cementing materials, Properties and durability of high performance concrete, Introduction to silica fume concrete, Properties and applications of silica fume concrete.

UNIT-IV (13 Hrs.)

SULPHUR CONCRETE AND SULPHUR INFILTRATED CONCRETE: Process Technology, Mechanical Properties, Durability and Applications of Sulphur Concrete, Sulphur Infiltrated Concrete, Infiltration Techniques, Mechanical Properties, Durability and Applications Of Sulphur Infiltrated Concrete.

Recommended Books

1. A.M. Nevillie, ‘Concrete Technology’.
2. M.L. Gambhir, ‘Concrete Technology’.
3. M.S. Shetty, ‘Concrete Technology’.

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SEMINAR

Subject Code – MCIE5-309 **L T P C**
0 0 0 4

This is an unstructured open-ended course where under the overall supervision of a faculty member of his discipline. Each student must submit a seminar report as a culmination of his Endeavour and investigation. The course will aim to evaluate student's actual ability to use the fundamentals of knowledge and to meet new unknown situations as demonstrated by the students' interaction with the teachers.

PROJECT

Subject code – MCIE5-310 **L T P C**
0 0 0 10

A student can work on the following types of Projects:

1. **Lab Oriented Projects:** These include Projects Involving Laboratory Investigation or Laboratory Development in The Students' Discipline or Interdisciplinary Areas. It Must Co-terminate with A Project Report.
2. **Study Oriented Projects:** These include Projects which are Oriented Towards Readings from Published Literature or Books About New Frontiers of Development or Analysis of Available Data Base. It must Co-terminate with A Project Report.
3. **Computer Oriented Projects:** These are Intended to Impart Practical Training to Students in The Areas of Computer Software and Hardware. The Projects would Be Student-Oriented, Individually Supervised by A Project Guide. It must Co-terminate with a Project Report.
4. **Projects on Organizational Aspects:** These Involve Projects Related to Thrust Areas Where Students re Expected to get Involved with Planning, Organization and Execution of New Ideas and Concepts. It Must co-terminate with a Project Report

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ANALYSIS OF PLATES

Subject code – MCIE5-364 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

UNIT-I (12 Hrs.)

Introduction to Theory of Elasticity: Introduction to The Elasticity Theory, Stress at a Point: Stress Tensor, Strains and Displacements, Constitutive Equations (Without Derivation), Equilibrium Equations (Without Derivation), Compatibility Equations (Without Derivation)
Rectangular Plates: Introduction, The Governing Equation for Deflection of Plates, bending of a Long, Uniformly Loaded Rectangular Plate (Simply Supported and Clamped Edges), Rectangular Plates Subjected to a Concentrated Load, Bending of Plates with Small Initial Curvature, Problems (Exact Analysis Using Charts/Tables and Approximate Analysis)

UNIT-II (10 Hrs.)

Pure Bending of Plates: Slope and Curvature, Pure Bending in Two Perpendicular Directions, Moment Curvature Relation, Anticlastic and Synclastic Surfaces, Thermal Stresses in Plates, Effect of Transverse Shear Deformation on Bending of Elastic Plates, Triangular Plates.

UNIT-III (12 Hrs.)

Circular Plates: Introduction, Plate Differential Equation, bending of a Circular Plate Subjected to a Lateral Pressure per unit area and a Centrally Placed Concentrated Load (Simply Supported and Clamped Edges), Bending of a Circular Plate Concentrically Loaded (Simply Supported and Clamped Edges), Deflection of a Symmetrically Loaded Circular Plate with a Circular Hole at the Centre, Problems.

UNIT-IV (11 Hrs.)

Orthotropic Plates: Introduction, Analysis by Orthotropic Plate Theory for Both Longitudinal as well as Transverse Structural Actions using the Design Charts Produced by Morice, Little and Rowe for Evaluating Bending Moment and Shear Forces, Problems.

Recommended Books

1. Timoshenko, 'Theory of Plates & Shells'.
2. Timoshenko, 'Theory of Elasticity'.
3. Dr. Sadhu Singh, 'Theory of Elasticity and Plasticity'.
4. N. Rajagopalan, 'Bridge Superstructure', Narosa Publishers.

FINITE ELEMENT ANALYSIS

Subject code –MCIE5-365 **L T P C** **Duration: 45 Hrs.**

3 1 0 4

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UNIT-I (11 Hrs.)

Basic Concepts, Discretization; Displacement, Force and Hybrid Models, Interpolation Functions for General Element Formulations: Compatibility and Completeness, Polynomial Forms: One Dimensional Elements, Geometric Isotropy, Triangular Elements, Rectangular Elements, Three Dimensional Elements, Isoperimetric Formulations, Axisymmetric Elements; Numerical Integration.

UNIT-II (11 Hrs.)

Applications in Solid Mechanics: Plane Stress/Strain: FE Formulation: CST, LST; Stiffness Matrix, Load Matrix Formation Rectangular Element Isoparametric Formulation: Plate Elements and Shell Elements, Three Dimensional Elements FE Formulation: Axisymmetric Stress Analysis, Torsion, Interface Elements, Infinite Elements.

UNIT-III (13 Hrs.)

Application in Structural Dynamics and Vibrations: Mass (Consistent and Diagonal) and Damping Matrices; Modal Analysis, Time History Analysis, Explicit Direct Integration/ Implicit Direct Integration and Mixed Methods. Introduction to Nonlinear Problems: Geometric and Material (Elasto-plastic), Solution Methods: Newton Ralphson Method, Modified Newton-Ralphson Method, Arc Method, A Problem of Geometric Nonlinearity**.**

UNIT-IV (10 Hrs.)

Stationary Principles, Rayleigh Ritz Method and Interpolation; Weighted Residual Methods and Variational Methods, Numerical Errors and Convergence

Recommended Books

1. David Hutton, 'Fundamentals of Finite Element Analysis', Tata McGraw Hill, **2005.**
2. R.D. Cook, Malkus and Plesha, 'Concepts and Applications of Finite Element Analysis', 3rd Edn., John Wiley. **1989.**
3. T. J. R. Hughes, 'The Finite Element Method: Linear Static and Dynamic Analysis', Prentice Hall, **1987.**
4. Klaus Juergen Bathe, 'Finite Element Procedures, Prentice Hall of India, **2003.**
5. O.C. Zienkiewicz., R.L. Taylor & J.Z. Zhu., 'The Finite Element Method its Basis & Fundamentals', Elsevier Publication, **2007.**

MRSPTU

M. TECH. MECHANICAL ENGINEERING (AUTOMATION & ROBOTICS)

Total Contact Hours = 24 **Total Marks = 600** **Total Credits = 22**

SEMESTER 1st		Contact Hrs			Marks			Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
MREM0-101	Research Methodology	4	0	0	40	60	100	4
MMEE3-102	Mechatronics	4	0	0	40	60	100	4
MMEE3-103	Robotics	4	0	0	40	60	100	4
MMEC0-104	Computer Aided Design	4	0	0	40	60	100	4
MMEE3-105	Lab -I	0	0	4	100	-	100	2
Departmental Elective – I (Select any one)		4	0	0	40	60	100	4
MMEE3-156	Management Information System							
MMEE3-157	Automatic Control System							
MMEE3-158	Industrial Automation							
Total	**Theory = 5 Lab = 1**	**20**	**0**	**4**	**300**	**300**	**600**	**22**

Total Contact Hours = 24 **Total Marks = 600** **Total Credits = 22**

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SEMESTER 2nd		Contact Hrs			Marks			Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
MMEE3-206	Computer Integrated Manufacturing Systems	4	0	0	40	60	100	4
MMEE3-207	Drives and Control System for Automation	4	0	0	40	60	100	4
MMEE3-208	Sensor Application in Manufacturing	4	0	0	40	60	100	4
MMEE3-209	Kinematics & Dynamics of Robots	4	0	0	40	60	100	4
MMEE3-210	Lab-II	-	-	4	60	40	100	2
Departmental Elective – II (Select any one)		4	0	0	40	60	100	4
MMEE3-259	Rapid Prototyping							
MMEE3-260	Computer Concept for Automation							
MMEE3-261	Microprocessors and Micro Controllers							
Total	**Theory = 5 Lab = 1**	**20**	**0**	**4**	**260**	**340**	**600**	**22**

Total Contact Hours = 20 **Total Marks = 500** **Total Credits = 26**

SEMESTER 3rd		Contact Hrs			Marks			Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
MMEE3-311	Artificial Intelligence	4	0	0	40	60	100	4
MMEE3-312	Robot Programming	4	0	0	40	60	100	4
MMEE3-313	Project & Seminar	0	0	4	40	60	100	4
MMEE3-314	Thesis Synopsis	0	0	4	-	100	100	10
Open Elective (Select any one)		4	0	0	40	60	100	4
Total	**Theory = 2 Lab = 2**	**12**	**0**	**8**	**160**	**340**	**500**	**26**

Total Credits = 20

SEMESTER 4th		Contact Hrs			Evaluation Criteria	Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Satisfactory/ Unsatisfactory**	
MMEE3- 415	Final Thesis	0	0	0		20

Overall

Semester	**Marks**	**Credits**
1st	600	22
2nd	600	22
3rd	500	26
4th	--	20
Total	**1700**	**90**

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RESEARCH METHODOLOGY

Subject Code – MREM0-101 **L T P C** **Duration – 45 Hours**
4 0 0 4

UNIT–I (11 Hrs.)

Introduction to Research: Meaning, Definition, Objective and Process

Research Design: Meaning, Types - Historical, Descriptive, Exploratory and Experimental

Research Problem: Necessity of Defined Problem, Problem Formulation, Understanding of Problem, Review of Literature

Design of Experiment: Basic Principal of Experimental Design, Randomized Block, Completely Randomized Block, Latin Square, Factorial Design.

Hypothesis: Types, Formulation of Hypothesis, Feasibility, Preparation and Presentation of Research Proposal

UNIT–II (10 Hrs.)

Sources of Data: Primary and Secondary, Validation of Data

Data Collection Methods: Questionnaire Designing, Construction

Sampling Design & Techniques – Probability Sampling and Non Probability Sampling

Scaling Techniques: Meaning & Types

Reliability: Test – Retest Reliability, Alternative Form Reliability, Internal Comparison Reliability and Scorer Reliability

Validity: Content Validity, Criterion Related Validity and Construct Validity

UNIT–III (13 Hrs.)

Data Process Operations: Editing, Sorting, Coding, Classification and Tabulation

Analysis of Data: Statistical Measure and Their Significance, Central Tendency, Dispersion, Correlation: Linear and Partial, Regression: Simple and Multiple Regression, Skewness, Time series Analysis, Index Number

Testing of Hypothesis: T-test, Z- test, Chi Square, F-test, ANOVA

UNIT – IV (11 Hrs.)

Multivariate Analysis: Factor Analysis, Discriminant Analysis, Cluster Analysis, Conjoint Analysis, Multi-Dimensional Scaling

Report Writing: Essentials of Report Writing, Report Format

Statistical Software: Application of Statistical Softwares like SPSS, MS Excel, Mini Tab or MATLAB Software in Data Analysis

**Each Student has to Prepare Mini Research Project on Topic/ Area of their Choice and Make Presentation. The Report Should Consists of Applications of Tests and Techniques Mentioned in The Above UNITs*

Recommended Books

1. R.I. Levin and D.S. Rubin, ‘Statistics for Management’, 7th Edn., Pearson Education, New Delhi.
2. N.K. Malhotra, ‘Marketing Research–An Applied Orientation’, 4th Edn., Pearson Education, New Delhi.
3. Donald Cooper, ‘Business Research Methods’, Tata McGraw Hill, New Delhi.
4. Sadhu Singh, ‘Research Methodology in Social Sciences’, Himalaya Publishers.

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5. Darren George & Paul Mallery, 'SPSS for Windows Step by Step', Pearson Education New Delhi.
6. C.R. Kothari, 'Research Methodology Methods & Techniques', 2nd Edn., New Age International Publishers.

MECHATRONICS

Subject Code: MMEE3-102 **L T P C** **Duration: 40 Hrs.**
4 0 0 4

UNIT-I (6 Hrs.)

Control Engineering: Open loop and closed loop control system, system components, hydraulic, thermal, pneumatic processes and their electrical analogies.

UNIT-II (15 Hrs.)

Process Control: Concept of measurement of electrical and non-electrical parameters, displacement, force, temperature, pressure etc. and related signal conditioning techniques. Valves, drives and actuators, PID controllers, multivariable and multi-loop processes, basic circuits using pneumatic and PLC's.

UNIT-III (6 Hrs.)

Sensors and Signal Conditioners: Transducers for Industrial processes, signal conditioning, output devices and displays.

UNIT-IV (13 Hrs.)

Microprocessors and Interfacing: Microprocessors/ Microcontroller architecture and programming memory, Input/output operations and interfacing, peripherals, typical applications of Microprocessors, system design concept through case studies.

Recommended Book

1. Koren, 'Computer Control of Manufacturing System', McGraw Hill.
2. Groover, 'Production Systems and CIM', PHI.
3. Maleki, 'Flexible Manufacturing Systems', Prentice Hall.
4. BC. Kuo, 'Feedback Control Systems', PHI.
5. EO. Doeblin, Measurement Systems, McGraw Hill.

ROBOTICS

Subject Code: MMEE3-103 **L T P C** **Duration: 43 Hrs.**
4 0 0 4

UNIT-I (8 Hrs.)

Introduction: Definitions, Types of Robots, Application of Robots, Representing Position and Orientation, Representing Pose in 2-Dimensions, Representing Pose in 3-Dimensions, Representing Orientation in 3-Dimensions, Combining Translation and Orientation.

UNIT-II (13 Hrs.)

Time and Motion: Trajectories, Smooth One-Dimensional Trajectories, Multi-Dimensional Case, Multi-Segment Trajectories, Interpolation of Orientation in 3D, Cartesian Motion, Time Varying Coordinate Frames, Rotating Coordinate Frame, Incremental Motion, Inertial Navigation Systems. Mobile Robot Vehicles, Mobility, Car-like Mobile Robots, moving to a

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Point, following a Line, Following a Path. Navigation: Reactive Navigation, Braitenberg Vehicles, Simple Automata, Map-Based Planning, Distance Transform, Voronoi Roadmap Method, Probabilistic Roadmap Method, Localization, Dead Reckoning, Modeling the Vehicle, Estimating Pose, using a Map, Creating a Map, Localization and Mapping, Monte-Carlo Localization.

UNIT-III (12 Hrs.)

Robot Arm Kinematics: Describing a Robot Arm, Forward Kinematics, a 2-Link Robot, A 6-Axis Robot, Inverse Kinematics, Closed-Form Solution, Numerical Solution, Under-Actuated Manipulator, Redundant Manipulator, Trajectories, Joint-Space Motion, Cartesian Motion, Motion through a Singularity.Installing ROS, Understanding the ROS File system level, Packages, Stacks, Messages, Services, Understanding the ROS Computation Graph level, Nodes, Topics, Services, Messages, Bags, Master, Parameter Server, creating workspace, Creating & Building an ROS package, Creating & Building the node, Visualization of images.

UNIT-I (10 Hrs.)

Robot Programming: Using Sensors and Actuators with ROS, SCORBOT structure, joint movements, work envelop, motors, encoders, micro switch, transmission, gripper, SCORBOT programming, IS-14533: 2005 Manipulating industrial robots -Performance criteria related test methods, Mobile Robot Programming, Industrial Robot Programming.

Recommended Books

1. Peter Corke Robotics, 'Vision and Control: Fundamental Algorithms in MATLAB', Springer Tracts in Advanced Robotics, Vol. 73, **2011**.
2. Aaron Martinez & Enrique Fernández, 'Learning ROS for Robotics Programming', Packt Publishing, **2013**.

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COMPUTER AIDED DESIGN

Subject Code: MMEE3-104 **L T P C** **Duration: 40 Hrs.**
4 0 0 4

UNIT-I (6 Hrs.)

Introduction

Design process in general and using computers, hardware and software in CAD applications

UNIT-II (12 Hrs.)

Two Dimensional Transformations

Two dimensional geometric transformations-basic transformations, concatenation, reflection, shear and transformations between coordinate systems. Two and Three Dimensional Object Representations Parametric representation of synthetic curves, spline representations, cubic spline interpolation methods, Bezier curves and surfaces, B spline curves and surfaces, conversion between spline representations

UNIT-III (10 Hrs.)

Representation of Solids

Half spaces, boundary representation (B-rep), sweep representation, constructive solid geometry (CGS), solid manipulations. Three Dimensional Geometric Transformations: Transformations-translation, rotation, scaling, reflections, shears, concatenation transformations.

UNIT-IV (12 Hrs.)

Basic concepts of visual realization, hidden line removal, hidden surface removal, shading surfaces and solids, CAD Standards, CAD and CAM integration, Introduction to reverse engineering and rapid prototyping**,** Practice on available CAD packages, computer programming for geometric modelling of curves, surfaces & solids, projects involving assembly and kinematics analysis of mechanisms, surface modeling in any available CAD package.

Recommended Books

1. Groover and Zimmer, 'CAD/CAM', Prentice Hall.
2. I. Zeid, 'CAD/CAM: Theory and Practice', McGraw Hill.
3. M.E. M, 'Geometric Modeling'.

LAB-I

Subject Code: MMEE3-105 **L T P C**
0 0 4 2

One lab /field/industrial oriented project /problem of one semester will be allocated to each student related to the subjects related to the subjects taught in 1st semester.

MANAGEMENT INFORMATION SYSTEM

Subject Code: MMEE3-156 **L T P C** **Duration: 45 Hrs.**
4 0 0 4

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UNIT-I (12 Hrs.)

INFORMATION SYSTEMS

Information Systems -Establishing the Framework -Business Models - Information System Architecture- Evolution of formation Systems, Modern Information System**,** Modern Information System -Systems Development-life Cycle, Structured Methodologies -Designing Computer Based methods, Procedures Control Designing Structured Programs.

UNIT-II (12 Hrs.)

INTEGRATED CONSTRUCTION MANAGEMENT

Integrated Construction Management- Information System- Project Management- Information System- Functional Areas finance, Marketing Production, Personnel –levels, DSS, EIS, ES- Comparison Concepts and Knowledge representation –Managing Inter- National Information System

UNIT-III (9 Hrs.)

CODING TECHNIQUES

Control -Testing Security- Coding Techniques- Defection of Error – Validating -Cost Benefit Analysis -Assessing the value and risk of Information System.

UNIT-IV (12 Hrs.)

SOFTWARE ENGINEERING

Software engineering qualities- Design-Production- Service, Software specification- Software Metrics, Software quality assurance –Systems Methodology –Objectives-Time and Logic, Knowledge and Human Dimension -Software life cycle models- Verification and Validation. 27 CEM-2013 SRM(E&T)

Recommended Books

1. O. Brian, ‘Introduction to Information System’, McGraw Hill.
2. O. Brian, ‘Management Information System’, TMH.
3. Alter, ‘Information Systems: A Management Perspective’, Addison Wesley.
4. Arora & Bhatia, ‘Information Systems for Managers’, Excel.
7. Murdick, ‘Information System for Modern Management’, PHI.
8. Alexis Leon, ‘Enterprise Resource Planning’, TMH.

AUTOMATIC CONTROL SYSTEMS

Subject Code: MMEE3-157 **L T P C** **Duration: 45 Hrs.**
4 0 0 4

UNIT-I (12 Hrs.)

Motivation for control. Review of differential equations, impulse response and Laplace transformations, Introduction to state equations and transfer functions. Interpretation of poles and zeros of transfer functions**.** Time domain response of second order system. Comm and tracking and system type. Rough/Hurwitz test.

UNIT-III (12 Hrs.)

Frequency Response and Frequency Domain Methods. Nyquist stability test. Bode plots. Phase and gain margins. Bode phase formula. Robustness. Uncertainty and performance weights. Robust stability test. Robust performance test. Loop shaping necessary and sufficient conditions. Bode integral formula.

UNIT-IV (10 Hrs.)

Applications of Root Locus, Sensitivity of roots of characteristics equation, Tool for design and analysis of control systems, Case studies using mat lab on Bode, Nyquist and Root locus.

UNIT-II (11 Hrs.)

State Variable Analysis and Design, Introduction, Concepts of state variables for linear discrete time systems, Diagonalization solutions of state equations, Concepts of controllability and observability, Pole placement by state feedback, Observer systems, problems.

Recommended Books

1. Franklin, Powell, and Enami-Naeini, ‘Feedback Control of Dynamical Systems’, 5th Edn., Addison-Wesley, **2006.**
2. I.J. Nagrath, M. Gopal, ‘Control Systems Engineering’, 5th Edn., New Age International (P) Ltd, Publishers.

INDUSTRIAL AUTOMATION

Subject Code: MMEE3-158 **L T P C** **Duration: 42 Hrs.**
4 0 0 4

UNIT-I (8 Hrs.)

Introduction: Automation in Production System, Principles and Strategies of Automation, Basic Elements of an Automated System, Advanced Automation Functions, Levels of Automations. Flow lines & Transfer Mechanisms, Fundamentals of Transfer Lines.

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UNIT-II (12 Hrs.)

Material handling and Identification Technologies: Overview of Material Handling Systems, Principles and Design Consideration, Material Transport Systems, Storage Systems, Overview of Automatic Identification Methods. Automated Manufacturing Systems: Components, Classification and Overview of Manufacturing Systems, Manufacturing Cells, GT and Cellular Manufacturing, FMS, FMS and its Planning and Implementation. Quality Control Systems: Traditional and Modern Quality Control Methods, SPC Tools,

UNIT-III (13 Hrs.)

Control Technologies in Automation: Industrial Control Systems, Process Industries Versus Discrete-Manufacturing Industries, Continuous Versus Discrete Control, Computer Process and its Forms. Computer Based Industrial Control**:** Introduction & Automatic Process Control, Building Blocks of Automation Systems: LAN, Analog & Digital I/O Modules, SCADA Systems & RTU. Distributed Control System: Functional Requirements, Configurations & some popular Distributed Control Systems.

UNIT-IV (9 Hrs.)

Modeling and Simulation for Plant Automation: Introduction, need for system Modeling, Building Mathematical Model of a Plant, Modern Tools & Future Perspective. Industrial Control Applications: Cement, Thermal Water Treatment & Steel Plants.

Recommended Books

M.P. Groover, 'Automation, Production Systems and Computer Integrated Manufacturing', 5th Edn., Pearson Education, **2009**.

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COMPUTER INTEGRATED MANUFACTURING SYSTEM

Subject Code: MMEE3-206 **L T P C** **Duration: 39 Hrs.**
4 0 0 4

UNIT-I (10 Hrs.)

Introduction: Introduction to Product life cycle management. Need of CAD/CAM integration through computers, Benefits of integration, Types of production systems and their automation, CAD/CAM integration. Concept of FMS and CIMS. DNC based factory management and control, Integrated CAD/CAM system and shared database.

UNIT-II (11 Hrs.)

Elements of a General CIM System: Types of CIM systems, CAD-CAM link for CIMS, Benefits of CAM, FMS and CIMS, Automated material handling systems, equipment and their functions. Integration of Robots in CIMS, automated guided vehicle navigation system, Automatic Storage and Retrieval Systems (AS/RS), Carousel storage system, design of automatic material handling system, KWO analysis, work-part transfer mechanisms.

UNIT-III (8 Hrs.)

Group Technology: Concept and terminology, Part family formation, Classification and coding systems for components, Group technology machine cells.

UNIT-IV (10 Hrs.)

Computer Aided Production Planning and Control: Computer aided shop floor control, Computer aided inspection & quality control, Shop floor data collection systems, Sensors used in Automation, Tool management system, Automatic identification systems, Barcode system.

CIM Database and Database Management Systems: Types, Management information system, manufacturing data preparation.

Recommended Books:

1. M.P. Groover and E.W. Zimmers, 'CAD/CAM', Dorling Kingsley, **2008**.
2. M.P. Groover, 'Automation, Production Systems and Computer Integrated Manufacturing', Pearson Education Asia, **2009**.
3. K.S. Vajpayee, 'Principles of Computer Integrated Manufacturing', Prentice Hall, **2006**.
4. P.N. Rao, N.K. Tewari and T.K. Kundra, 'Computer Integrated Manufacturing', McGraw Hill, **1998**.

DRIVES AND CONTROL SYSTEM FOR AUTOMATION

Subject Code: MMEE3-207 **L T P C** **Duration: 42 Hrs.**
4 0 0 4

UNIT-I (10 Hrs.)

Introduction: Working principle of synchronous, Asynchronous & stepper motors, Difference between Induction and servo motors, Torque v/s speed characteristics, Power v/s. Speed characteristics, Vector duty induction motors, Concepts of linear and frameless motors, Selection of feedback system, Duty cycle, V/F control, Flux Vector control.

UNIT-II (12 Hrs.)

Industrials Drives: DC and AC motors operation and selection, method of control and application of brushless DC motor, PMSM, stepper motor, A.C servomotor, selection criteria for servo motor and servo amplifier, universal motor, electric drive, types of industrial drives, the characteristics of drive, advantages of drives over other prime movers, motor rating, heating effects,

Motion laws for rotary and linear systems: converting rotary to linear system, concepts and principles of ball screws, rack and pinion, belt and pulley, chain drives, gear drives, Selection of converting systems, Dynamic response gearing, and control approaches of Robots, Control loops using Current amplifier.

UNIT-III (10 Hrs.)

Introduction to Programmable Logic Controllers: Definitions of PLC, basic structure of PLC, working principles, data storage methods, inputs / outputs flag processing's, types of variables, definition of firmware, software, programming software tool and interfacing with PC (RS232 & TCP-IP), methods of PLC programming (LD, ST, FBD & SFC), function blocks logical / mathematical operators & data types, array & data structure, PID, types of tasks and configuration, difference between relay logic and PLC, selection of PLC controller

UNIT-IV (10 Hrs.)

Logic, instructions & Application of PLC: What is logic, Conventional Ladder v/s PLC ladder, series and parallel function of OR, AND, NOT logic, Ex or logic, Analysis of rung. Timer and Counter Instructions; on delay and Off delay and retentive timer instructions, PLC counter up and down instructions, combining counters and timers, Comparison and data handling instructions, Sequencer instruction, Visualization Systems, Types of visualization system, PC based Controller, Applications of HMI's, and Interfacing of HMI with controllers.

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Recommended Books

1. Johnson Curties, 'Process Control Instrumentation Technology', 8th Edn., Prentice hall of India,
2. Andrew Parr, 'Industrial drives', Butterworth – Heineamann.
3. G.K. Dubey, 'Fundamentals of Electrical Drives'.
4. W. Bolton, 'Programmable Logic Controllers'.

SENSOR APPLICATION IN MANUFACTURING

Subject Code: MMEE3-208 **L T P C** **Duration: 41 Hrs.**
4 0 0 4

UNIT-I (09 Hrs.)

Fundamentals of Sensors and Transducers: Performance terminology, static and dynamic characteristics of transducers, classification of sensors and transducers, signal processing and signal conditioning. Operational amplifiers, filters, protection devices, analog to digital converter, digital to analog converter.

UNIT-II (12 Hrs.)

Sensors and their applications: Inductive, capacitive, magnetic, various types of photo sensors, detection methods, through-beam detection, reflex detection & proximity detection, ultrasonic and microwave sensors. Applications and understanding of the above sensors.

Advanced Sensor Technologies: Laser production, characteristics of lasers, types of laser sensors, bar code sensors, benefits of bar coding, transponder, RFID (Radio Frequency Identification), electro-magnetic identifier, optical encoders, color sensors, sensing principles, color theory, unit color measurement, colour comparator, color sensing algorithm, fuzzy logic color sensor. fuzzy logic for opt-electronic colour sensor in manufacturing.

UNIT-III (10 Hrs.)

Sensors in Flexible Manufacturing Systems: Vision sensors, image transformations, robot visual sensing tasks, detecting partially visible objects, sensors in flexible manufacturing system cell.

Sensors for Special Applications: A multi objective approach for selection of sensors in manufacturing**,** cryogenic manufacturing applications, semiconductor absorption sensors, semiconductor temperature detector using photoluminescence temperature detectors using point-contact, sensors in process manufacturing plants, measurement of high temperature, robot control through sensors, other sensors, collection and generation of process signals in decentralized manufacturing system.

UNIT-IV (10 Hrs.)

Networking: Networking of sensors, control of manufacturing process, tracking- the mean time between operations interventions, tracking the yield and mean process time, detection of machining faults, diagnostic systems, resonance vibration analyzer, sensing motor current for signature analysis, temperature sensing.

Recommended Books

1. Sabnesoloman, 'Sensors & Control Systems in Manufacturing', McGraw Hill Book Company Network, **1994**.

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2. W. Bolton, 'Mechatronics'.
3. Jon S. Wilson, 'Sensor Technology Handbook'.
4. N.L. Buck & T.G. Buckwith, 'Mechanical Measurement'.
5. Ian Sinclai, 'Sensors and Transducers'.

KINEMATICS & DYNAMICS OF ROBOTS

Subject Code: MMEE3-209 **L T P C** **Duration: 40 Hrs.**
4 0 0 4

UNIT-I (09 Hrs.)

INTRODUCTION

Introduction, position and orientation of objects, objects coordinate frame Rotation matrix, Euler angles Roll, pitch and yaw angles coordinate Transformations, Joint variables and position of end effector, Dot and cross products, coordinate frames, Rotations, Homogeneous coordinates.

UNIT-II (11 Hrs.)

DIRECT KINEMATICS

Link coordinates D-H Representation, The ARM equation. Direct kinematic analysis for Four axis, SCARA Robot and three, five and six axis Articulated Robots.

INVERSE KINEMATICS

The inverse kinematics problem, General properties of solutions. Tool configuration, Inverse kinematics of four axis SCARA robot and three and five axes, Articulated robot.

UNIT-III (10 Hrs.)

WORKSPACE ANALYSIS AND TRACJECTORY PLANNING

Workspace Analysis, work envelope of a Four axis SCARA robot and five axis articulated robot workspace fixtures, the pick and place operations, Joint space technique - continuous path motion, Interpolated motion, straight line motion and Cartesian space technique in trajectory planning.

UNIT-IV (10 Hrs.)

MANIPULATOR DYNAMICS

Introduction, Lagrange's equation kinetic and potential energy. Link inertiTensor, link Jacobian Manipulator inertia tensor. Gravity, Generalized forces Lagrange-Euler Dynamic model, Dynamic model of a Two-axis planar roboNewton Euler formulation, Lagrange – Euler formulation, problems.

Recommended Books

1. Robert J. Schilling, 'Fundamentals of Robotics Analysis and Control', PHI Learning, **2009**.
2. Richard D. Klafter, A. Thomas, Chri Elewski, Michael Negin, 'Robotics Engineering an Integrated Approach', PHI Learning, **2009**.
3. P.A. Janaki Raman, 'Robotics and Image Processing: An Introduction', Tata McGraw Hill Publishing Company Ltd., **1995**.
4. Francis N-Nagy Andras Siegler, 'Engineering foundation of Robotics', Prentice Hall Inc., **1987**.

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LAB-II

Subject Code: MMEE3-210 **L T P C**
0 0 2 1

One lab /field/industrial oriented project /problem will be allocated to each student related to the subjects related to the subjects taught in 2nd Semester.

RAPID PROTOTYPING

Subject Code: MMEE3-259 **L T P C** **Duration: 40 Hrs.**
4 0 0 4

UNIT-I (08 Hrs.)

Introduction: Need for the compression in product development, history of RP systems, Survey of applications, Growth of RP industry, and classification of RP systems

Stereo Lithography Systems: Principle, Process parameter, Process details, Data preparation, data files and machine details,

UNIT-II (11 Hrs.)

Selective Laser Sintering and Fusion Deposition Modeling: Type of machine, Principle of operation, process parameters, Data preparation for SLS, Applications, Principle of Fusion deposition modeling, Process parameter.

Solid Ground Curing: Principle of operation, Machine details, Applications.

UNIT-III (09 Hrs.)

Laminated Object Manufacturing: Principle of operation. Process details, application.

Concepts Modelers: Principle, Thermal jet printer, Sander's model market. Genisys Xs printer HP system 5, object Quadra systems.

UNIT-IV (12 Hrs.)

Rapid Tooling: Indirect Rapid tooling -Silicone rubber tooling –Aluminum filled epoxy Tooling Spray metal tooling, Cast kirksite, 3Q keltool, etc Direct Rapid Tooling., AIM, Quick cast process, Copper polyamide, Rapid Tool, DMILS, Prometal, Sand casting tooling, Laminate tooling.

RP Process Optimization: Factors influencing accuracy. Data preparation errors, Part building errors, Error in finishing.

Recommended Books

1. Paul F. Jacobs, 'Stereo Lithography and other RP & M Technologie', SME, NY, **1996**.
2. D.T. Flham & S.S. Dinjoy, 'Rapid Manufacturing', Verlog London, **2001**.
3. 'Rapid Automated- Lament Wood', 1st Edn., Indus Press, New York, **1993**.

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COMPUTER CONCEPT FOR AUTOMATION

Subject Code: MMEE3-260	**L T P C** **4 0 0 4**	**Duration: 39 Hrs.**

UNIT-I (09 Hrs.)

Introduction to Big Data:

Big Data and its Importance – Four V's of Big Data – Drivers for Big Data –Introduction to Big Data Analytics – Big Data Analytics applications. Hadoop's Parallel World – Data discovery – Open source technology for Big Data Analytics – cloud and Big Data –Predictive Analytics – Mobile Business Intelligence and Big Data – Crowd Sourcing Analytics – Inter- and Trans Firewall, Analytics - Information Management.

UNIT-II (09 Hrs.)

Processing Big Data:

Integrating disparate data stores - Mapping data to the programming framework Connecting and extracting data from storage - Transforming data for processing - Subdividing data in preparation for Hadoop Map Reduce.

UNIT-III (11 Hrs.)

Hadoopmapreduce:

Employing Hadoop Map Reduce - Creating the components of Hadoop Map Reduce Jobs Distributing data processing across server farms -Executing Hadoop Map Reduce jobs - Monitoring the progress of job flows - The Building Blocks of Hadoop Map Reduce - Distinguishing Hadoop daemons - Investigating the Hadoop Distributed File System Selecting appropriate execution modes: local, pseudo-distributed, fully distributed.

UNIT-IV (10 Hrs.)

Database Management System:

Comparison of File System, Database Management System, Characteristic Features of Database Management Systems, Relational Databases.

Data Base Models: DBMS Languages and Interfaces. Data Base Security and Authorization

Recommended Books

1. RamezElmasri and Navathe, 'Fundamentals of DBMS', Addison Wesley, 5th Edn., **2009**.
2. Michael Minelli, Michehe Chambers, 'Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Business', 1st Edn., Ambiga Dhiraj, Wiley CIO Series, **2013**.
3. Arvind Sathi, 'Big Data Analytics: Disruptive Technologies for Changing the Game',1st Edn., IBM Corporation, **2012**.
4. Bill Franks, 'Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics', 1st Edn., Wiley and SAS Business Series, **2012**.

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MICROPROCESSORS AND MICRO CONTROLLERS

Subject Code: MMEE3-261 **L T P C** **Duration: 42 Hrs.**
4 0 0 4

UNIT-I (10 Hrs.)

Introduction to Microprocessors: Introduction to Microprocessors, Microprocessor Based Computer Systems, Architecture of 8085, 8086 and Segmentation.

Microprocessors Assembly Language Programming: Addressing Modes of 8086, Data Movement Instructions. Instruction Encoding, Arithmetic and Logic Instructions. Programming Examples. Machine Control and Miscellaneous Instructions.

UNIT-II (11 Hrs.)

Hardware Feature of 8086: Pin Outs and Pin Functions. Clock Generator, Bus Buffering, Latching and Timing Diagrams.

Interrupt Systems, Memory and I/O Interfacing In Microprocessors: Introduction to Interrupts, Interrupt related Instructions, Interrupt Processing, Memory Devices, Address Decoding, 8/16-Bit Memory Interfacing, DRAM Memory Systems. Introduction to I/O Interfacing. Memory Mapped and I/O Mapped I/O; Application examples related to Stepper Motor.

UNIT UNIT-III (10 Hrs.)

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Introduction to Micro Controllers: Introduction, Comparing Microprocessors and Micro Controllers, Z-80, 8051, PIC Micro Controllers, PIC Development Tools. The Micro Controller Survey, 4Bit, 8Bit, 16Bit and 32 Bit Micro Controllers. Develop Systems for Micro Controllers.

Micro Controllers Architecture: 8051 Architecture, PIC Architecture, 8051 Micro Controller Hardware, Input/Output Pins, Ports and Circuits, External Memory, Counter and Timers, Serial Data Input/Output,

UNIT-IV (11 Hrs.)

Basic Assembly Language Programming Concepts in Micro Controllers: The Mechanics of Programming, The Assembly Language Programming Process, PAL Instructions, Programming Tools and Techniques. Addressing Modes, Data Exchanges, Code Memory Read-Only Data Moves, Push Pop Op Codes, Logical Operators, Arithmetic Operators, Jump and Call Instructions.

Micro Controller Applications: Introduction, Key Boards, Displays, Pulse Measurement, D/A and A/D Conversions, Multiple Interrupts.

Recommended Books

1. K. Udaya Kumar & B.S. Umashankar, ‘Advanced Microprocessors and IBM PC’, TMH, 1st Edn., **1996**.
2. John B. Peatman, ‘Design with PIC and Micro Controllers’, 1st Edn., Pearson Education, **2001**.

ARTIFICIAL INTELLIGENCE

Subject Code: MMEE3-311 **L T P C** **Duration: 42 Hrs.**
4 0 0 4

UNIT-I (09 Hrs.)

INTRODUCTION: History, Definition of AI, Emulation of human cognitive process, intelligent agents – The concept of rationality, the nature of environments, the structure of agents.

UNIT-II (12 Hrs.)

PROBLEM-SOLVING: Problem-Solving Agents, Example Problems, Searching for Solutions, Uninformed Search Strategies, Breadth-first search, Uniform-cost search, Depth-first search, Depth-limited search, Iterative deepening depth-first search, Bidirectional search. Informed (Heuristic) Search Strategies, Greedy best-first search, A* search, Heuristic Functions, The effect of heuristic accuracy on performance.

UNIT -III (11 Hrs.)

BEYOND CLASSICAL SEARCH: Local Search Algorithms and Optimization Problems, Hill climbing search, simulated annealing, Local beam search, Genetic algorithms, Local Search in Continuous Spaces, searching with Nondeterministic Actions, Searching with Partial Observations, Online Search Agents and Unknown Environments.

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UNIT-IV (10 Hrs.)

PROGRAMMING AND LOGICS IN ARTIFICIAL INTELLIGENCE: LISP and other programming languages – Introduction to LISP, Syntax and numerical function, LISP and PROLOG distinction, input, output and local variables, interaction and recursion, property list and arrays alternative languages, formalized symbolic logics – properties of WERS, non-deductive inference methods.

Recommended Books

1. Stuart Russell and Peter Nowig, 'Artificial Intelligence: A Modern Approach', 3rd Edn., PEARSON.
2. Donald A. Waterman, 'A Guide to Expert Systems', 2nd Edn., Addison Wesley, **1986**.
3. DAN.W. Patterson, 'Introduction to Artificial Intelligence and Expert Systems', 2nd Edn., PHI, **2009**.
4. George. F. Luger, 'Artificial Intelligence', 3rd Edn., Pearson Education, Asia, **2009**.
5. Robert J. Schalkeff, 'Artificial Intelligence: An Engineering Approach', 2nd Edn., PHI, **1990**.

ROBOT PROGRAMMING

Subject Code: MMEE3-312 **L T P C** **Duration: 41 Hrs.**
4 0 0 4

UNIT I (10 Hrs.)

BASICS OF ROBOT PROGRAMMING:

Robot Programming-Introduction-Types- Flex Pendant- Lead through programming, Coordinate systems of Robot, Robot controller- major components, Functions-Wrist Mechanism-Interpolation-Interlock Commands Operating mode of robot, Jogging-Types, Robot specifications- Motion commands, end effectors and sensors commands.

UNIT II (13 Hrs.)

VAL LANGUAGE:

Robot Languages-Classifications, Structures- VAL language commands-motion control, hand control, program control, pick and place applications, palletizing applications using VAL, Robot welding application using VAL program-WAIT, SIGNAL and DELAY command for communications using simple applications.

RAPID LANGUAGE:

RAPID language basic commands- Motion Instructions-Pick and place operation using Industrial robot- manual mode, automatic mode, subroutine command based programming. Movemaster command Language-Introduction, syntax, simple problems.

UNIT III (09 Hrs.)

PRACTICAL STUDY OF VIRTUAL ROBOT:

Robot cycle time Analysis-Multiple robot and machine Interference-Process Chart-Simple Problems-Virtual robotics, Robot studio online Software-Introduction, Jogging, components, work planning, program modules, input and output Signals-Singularities-Collision Detection-Repeatability measurement of Robot-Robot economics.

UNIT III (09 Hrs.)

VAL-II AND AML:

VAL-II programming-basic commands, applications- Simple problem using conditional Statements-Simple pick and place Applications-Production rate calculations using robot. AML Language-General description, elements and functions, Statements, constants and Variables-Program Control Statements-Operating systems, Motion, Sensor Commands-Data processing.

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Recommended Books

1. S.R. Deb, 'Robotics Technology and Flexible Automation', Tata McGraw Hill Publishing Company Limited, **1994.**
2. Mikell. P. Groover, 'Industrial Robotics Technology, Programming and Applications', McGraw Hill Co, **1995**.
3. R.D. Klafter, T.A. Chmielewski, Noggin's, 'Robot Engineering: An Integrated Approach', Prentice Hall of India Pvt. Ltd., **1994**.
4. K.S. Fu., R.C. Gonzalez & C.S.G. Lee, 'Robotics Control, Sensing, Vision and Intelligence', McGraw Hill Book Co., **1987.**
5. J.J. Craig, 'Introduction to Robotics mechanics and Control', Addison-Wesley, **1999**.

M. TECH. MECHANICAL ENGINEERING (CAD/CAM) (1st Year)

Total Contact Hours = 24 Total Marks = 600 Total Credits = 22

SEMESTER 1st		Contact Hrs			Marks			Credits
Subject Code	Subject Name	L	T	P	Int.	Ext.	Total	
MREM0-101	Research Methodology	4	0	0	40	60	100	4
MMEE1-102	Computer Aided Design	4	0	0	40	60	100	4
MMEE1-103	Robotics	4	0	0	40	60	100	4
MMEE1-104	Mechatronics	4	0	0	40	60	100	4
MMEE1-105	Lab -I	0	0	4	60	40	100	2
Departmental Elective – I (Select any one)		4	0	0	40	60	100	4
MMEE1-156	Management Information System							
MMEE1-157	Modern Control of Dynamic Systems							
MMEE1-158	Total Quality Management							
Total	**Theory = 5 Lab = 1**	**20**	**0**	**4**	**260**	**340**	**600**	**22**

Total Contact Hours = 24 Total Marks = 600 Total Credits = 22

SEMESTER 2nd		Contact Hrs			Marks			Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
MMEE1-206	Computer Integrated Manufacturing	4	0	0	40	60	100	4
MMEE1-207	3D - Printing	4	0	0	40	60	100	4
MMEE1-208	Finite Element Modelling (FEM)	4	0	0	40	60	100	4
MMEE1-209	Micro-Electro Mechanical Systems (MEMS)	4	0	0	40	60	100	4
MMEE1-210	Lab-II	-	-	4	60	40	100	2
Departmental Elective – II (Select any one)		4	0	0	40	60	100	4
MMEE1-259	Geometrical Modelling & Analysis							
MMEE1-260	Artificial Intelligence							
MMEE1-261	Welding Technology and Processes							
Total	**Theory = 5 Lab = 1**	**20**	**0**	**4**	**260**	**340**	**600**	**22**

Total Contact Hours = 20 Total Marks = 500 Total Credits = 26

SEMESTER 3rd		Contact Hrs			Marks			Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
MMEE1-311	Machine Automation	4	0	0	40	60	100	4
MMEE1-312	Computer Aided Process Planning (CAPP)	4	0	0	40	60	100	4
MMEE1-313	Project & Seminar	0	0	4	40	60	100	4
MMEE1-314	Thesis Synopsis	0	0	4	-	100	100	10
Open Elective (Select any one)		4	0	0	40	60	100	4
Total	**Theory = 3 Lab = 2**	**12**	**0**	**8**	**160**	**340**	**500**	**26**

Total Credits = 20

SEMESTER 4th		Contact Hrs			Evaluation Criteria	Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Satisfactory/ Unsatisfactory**	
MMEE1- 415	Final Thesis	0	0	0		20

Overall

Semester	Marks	Credits
1st	600	22
2nd	600	22
3rd	500	26
4th	--	20
Total	**1700**	**90**

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RESEARCH METHODOLOGY

Subject Code – MREM0-101 **L T P C** **Duration: 45 hrs.**
4 0 0 4

UNIT–I (11 Hrs.)

Introduction to Research: Meaning, Definition, Objective and Process

Research Design: Meaning, Types - Historical, Descriptive, Exploratory and Experimental

Research Problem: Necessity of Defined Problem, Problem Formulation, Understanding of Problem, Review of Literature

Design of Experiment: Basic Principal of Experimental Design, Randomized Block, Completely Randomized Block, Latin Square, Factorial Design.

Hypothesis: Types, Formulation of Hypothesis, Feasibility, Preparation and Presentation of Research Proposal

UNIT–II (10 Hrs.)

Sources of Data: Primary and Secondary, Validation of Data

Data Collection Methods: Questionnaire Designing, Construction

Sampling Design & Techniques – Probability Sampling and Non Probability Sampling

Scaling Techniques: Meaning & Types

Reliability: Test – Retest Reliability, Alternative Form Reliability, Internal Comparison Reliability and Scorer Reliability

Validity: Content Validity, Criterion Related Validity and Construct Validity

UNIT–III (13 Hrs.)

Data Process Operations: Editing, Sorting, Coding, Classification and Tabulation

Analysis of Data: Statistical Measure and Their Significance, Central Tendency, Dispersion, Correlation: Linear and Partial, Regression: Simple and Multiple Regression, Skewness, Time series Analysis, Index Number

Testing of Hypothesis: T-test, Z- test, Chi Square, F-test, ANOVA

UNIT – IV (11 Hrs.)

Multivariate Analysis: Factor Analysis, Discriminant Analysis, Cluster Analysis, Conjoint Analysis, Multi-Dimensional Scaling

Report Writing: Essentials of Report Writing, Report Format

Statistical Software: Application of Statistical Soft wares like SPSS, MS Excel, Mini Tab or MATLAB Software in Data Analysis

**Each Student has to Prepare Mini Research Project on Topic/ Area of their Choice and Make Presentation. The Report Should Consists of Applications of Tests and Techniques Mentioned in The Above UNITs*

Recommended Books

1. R.I. Levin and D.S. Rubin, 'Statistics for Management', 7th Edn., Pearson Education, New Delhi.
2. N.K. Malhotra, 'Marketing Research–An Applied Orientation', 4th Edn., Pearson Education, New Delhi.
3. Donald Cooper, 'Business Research Methods', Tata McGraw Hill, New Delhi.
4. Sadhu Singh, 'Research Methodology in Social Sciences', Himalaya Publishers.
5. Darren George & Paul Mallery, 'SPSS for Windows Step by Step', Pearson Education, New Delhi.

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6. C.R. Kothari, 'Research Methodology Methods & Techniques', 2nd Edn., New Age International Publishers.

COMPUTER AIDED DESIGN

Subject Code: MMEE1-102 **L T P C** **DURATION: 40 Hrs.**
4 0 0 4

UNIT-I (6 Hrs.)

Introduction

Design process in general and using computers, hardware and software in CAD applications

UNIT-II (12 Hrs.)

Two Dimensional Transformations

Two dimensional geometric transformations-basic transformations, concatenation, reflection, shear and transformations between coordinate systems. Two and Three Dimensional Object Representations Parametric representation of synthetic curves, spline representations, cubic spline interpolation methods, Bezier curves and surfaces, B spline curves and surfaces, conversion between spline representations

UNIT-III (10 Hrs.)

Representation of Solids:

Half spaces, boundary representation (B-rep), sweep representation, constructive solid geometry (CGS), solid manipulations. Three Dimensional Geometric Transformations: Transformations-translation, rotation, scaling, reflections, shears, concatenation transformations.

UNIT-IV (12 Hrs.)

Basic concepts of visual realization, hidden line removal, hidden surface removal, shading surfaces and solids, CAD Standards, CAD and CAM integration, Introduction to reverse engineering and rapid prototyping, Practice on available CAD packages, computer programming for geometric modelling of curves, surfaces & solids, projects involving assembly and kinematics analysis of mechanisms, surface modeling in any available CAD package.

Recommended Books

1. Groover and Zimmer, 'CAD/CAM', Prentice Hall.
2. I. Zeid, 'CAD/CAM: Theory and Practice', McGraw Hill.
3. M.E. M, 'Geometric Modeling'.

ROBOTICS

Subject Code: MMEE1-103 **L T P C** **DURATION: 40 Hrs.**
4 0 0 4

UNIT-I (5 Hrs.)

Introduction

A sense of history, a sense of design, manipulators and manipulations, robot analysis and control in a nutshell.

UNIT-II (12 Hrs.)

Kinematics I: **Geometry**

Mathematics preliminary, position and orientation of a rigid body, co-ordinate transformation, Euler angle, homogeneous transformations. Kinematics modeling of manipulator arms, open kinematic chains, the denairt-Hartenberg notation, kinematics equations. Inverse kinematics:

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introduction, solving the kinematic equation for the 5 RIP manipulators, solvability. Kinematics II: Differential Motion Kinematic modeling of instantaneous motions, differential relations, infinitesimal relations, computation of the manipulators, Jacobian, inverse instantaneous

UNIT-III (14 Hrs.)

Kinematics

Resolved motion rate, redundancy, optimal solutions. Static's Force and moment analysis, equivalent joint torques, duality, transformations of force and moments. Stiffness, introduction, endpoint compliance analysis, the principal transformation of compliance matrices.

Dynamics

Newton-Euler formulation of equation of motion, basic dynamic equation, closed form Dynamic equations, physical interpretation of the dynamic equation. Longrangian Formulation of the manipulator dynamics, LaGrange dynamics, the manipulators inertia tensor, deriving LaGrange motion equation, transformations of generalized co-ordinates. Inverse dynamics; introduction, recursive computation, moving co-ordinates, walker Paul's algorithm.

UNIT-IV (8 Hrs.)

Trajectory Control

Introduction, position control, load scheme work, trajectory control, sliding surfaces, Perfect tracking using switched control laws, continuous control law to approximate switched control. robust trajectory control for robot manipulators, practical evaluation of parametric uncertainties, the modeling/performance trade-off.

Recommended Books

1. J. Baillieul, D.P. Martin, R.W. Brockett, Bruce R. Donald, 'Robotics'.
2. Ben-Zion Sandler, 'Robotics: Designing the Mechanisms for Automated Machinery'.
3. Michael Jenkin, Gregory Dudek, 'Computational Principles of Mobile Robotics'.
4. R. Bruce, 'Error Detection and Recovery in Robotics', Donald – Technology.
5. Craig Sayers, 'Remote Control Robotics'.
6. Y. Shimon, 'Handbook of Industrial Robotics'.

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MECHATRONICS

Subject Code: MMEE1-157 **L T P C** **Duration: 50** Hrs.
4 0 0 4

UNIT-I (6 Hrs.)

Control Engineering: Open loop and closed loop control system, system components, hydraulic, thermal, pneumatic processes and their electrical analogies.

UNIT-II (15 Hrs.)

Process Control: Concept of measurement of electrical and non-electrical parameters, displacement, force, temperature, pressure etc. and related signal conditioning techniques. Valves, drives and actuators, PID controllers, multivariable and multi-loop processes, basic circuits using pneumatic and PLC's.

UNIT-III (6 Hrs.)

Sensors and Signal Conditioners: Transducers for Industrial processes, signal conditioning, output devices and displays.

UNIT-IV (13 Hrs.)

Microprocessors and Interfacing: Microprocessors/Microcontroller architecture and programming memory, Input/output operations and interfacing, peripherals, typical applications of Microprocessors, system design concept through case studies.

Recommended Books

1. Koren, ‘Computer Control of Manufacturing System’, McGraw Hill.
2. Groover, ‘Production Systems and CIM’, PHI.
3. Maleki, ‘Flexible Manufacturing Systems’, Prentice Hall.
4. B.C. Kuo, ‘Feedback Control Systems’, PHI.
5. E.O. Doeblin, ‘Measurement Systems’, McGraw Hill.

MANAGEMENT INFORMATION SYSTEM

Subject Code: MMEE1-156 **L T P C** **Duration: 45 Hrs.**
4 0 0 4

UNIT-I (12 Hrs.)

INFORMATION SYSTEMS

Information Systems -Establishing the Framework -Business Models - Information System Architecture- Evolution of formation Systems, Modern Information System**,** Modern Information System -Systems Development-life Cycle, Structured Methodologies -Designing Computer Based methods, Procedures Control Designing Structured Programs.

UNIT-II (12 Hrs.)

INTEGRATED CONSTRUCTION MANAGEMENT

Integrated Construction Management- Information System- Project Management- Information System- Functional Areas finance, Marketing Production, Personnel –levels, DSS, EIS, ES-Comparison Concepts and Knowledge representation –Managing International Information System

UNIT-III (9 Hrs.)

CODING TECHNIQUES

Control -Testing Security- Coding Techniques- Defection of Error – Validating -Cost Benefit Analysis -Assessing the value and risk of Information System.

UNIT-IV (12 Hrs.)

SOFTWARE ENGINEERING

Software engineering qualities- Design-Production- Service, Software specification- Software Metrics, Software quality assurance –Systems Methodology –Objectives-Time and Logic, Knowledge and Human Dimension -Software life cycle models- Verification and Validation. 27 CEM-2013 SRM(E&T)

Reference & Text Books

1. O. Brian, ‘Introduction to Information System’, McGraw Hill.
2. O. Brian, ‘Management Information System’, TMH.
3. Alter, ‘Information Systems: A Management Perspective’, Addison Wesley.
4. Arora & Bhatia, ‘Information Systems for Managers’, Excel.
5. Bansal, ‘Information System Analysis & Design’, TMH.
6. Jawadegar, ‘Management Information System’, TMH.
7. Murdick, ‘Information System for Modern Management’, PHI.
8. Alexis Leon, ‘Enterprise Resource Planning’, TMH.

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MODERN CONTROL OF DYNAMIC SYSTEMS

Subject Code: MMEE1-157 **L T P C** **Duration: 45 Hrs.**
4 0 0 4

UNIT-I (5 Hrs.)

Introduction: Introduction to control system, Feedback and feedforward systems, design of control systems, classification of control systems.

UNIT-II (13 Hrs.)

Classical Control: Poles and zeros, Singularity functions, Frequency response, Laplace transform, transfer functions, Performance specifications, Stability of linear systems, Necessary conditions for stability, Root locus techniques, Bode plots, Nyquist plots, Routh Stability criterion, Polar plots, Robustness, Closed-loop compensation for SISO systems.

UNIT-III (12 Hrs.)

State-Space Representation: State variables and state models, Linear transformation for state-space representation, State models for linear continuous time systems, System characteristics, Canonical forms, Solution of the LTI state equations, State transition matrix.

UNIT-IV (15 Hrs.)

Control System Design in State-Space: Controllability, Observability, State feedback regulators, Pole-placement regulator design, Pole-placement design of tracking systems, Full order observer design, Design of compensators. Linear Optimal Control Optimal control problem, Infinite-time linear optimal regulator design, Optimal control of tracking systems, Output weighted linear optimal control, Solution of the Matrix Riccati Equation.

Recommended Books

1. A. Tewari, 'Modern Control Design with Matlab and Simulink', John Wiley and Sons, **2002**.
2. K. Ogata, 'Modern Control Engineering', Prentice Hall of India Pvt. Ltd., **2010**.
3. I.J. Nagrath and M. Gopal, 'Control Systems Engineering', New Age International Publishers, **2006**.
4. B.C. Kuo, 'Digital Control Systems', Oxford University Press, **2006**.
5. C. Richard Dorf and H. Bishop Robert, 'Modern Control Systems', Pearson, **2011**.

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TOTAL QUALITY MANAGEMENT (TQM)

Subject Code: MMEE1-158 **L T P C** **Duration: 44 Hrs.**
4 0 0 4

UNIT-I (8 Hrs.)

Quality Concepts

Evolution of Quality control, concept change, TQM Modern concept, Quality concept in design, Review off design, Evolution of proto type. Control on Purchased Product Procurement of various products, evaluation of supplies, capacity verification, Development of sources, procurement procedure.

UNIT-II (12 Hrs.)

Manufacturing Quality

Methods and Techniques for manufacture, Inspection and control of product, Quality in sales and services, Guarantee, analysis of claims. Quality Management, Organization structure and design, Quality function, decentralization, Designing and fitting organization for different types products and company, Economics of quality value and contribution, Quality cost, optimizing quality cost, seduction programme.

UNIT-III (12 Hrs.)

Human Factor in Quality

Attitude of top management, co-operation, of groups, operator's attitude, responsibility, causes of operator's error and corrective methods. Control Charts Theory of control charts, measurement range, construction and analysis of R charts, process capability study, use of control charts.

Attributes of Control Charts

Defects, construction and analysis off-chart, improvement by control chart, variable sample size, construction and analysis of C-chart.

UNIT-IV (12 Hrs.)

Defects Diagnosis and Prevention

Defect study, identification and analysis of defects, corrective measure, factors affecting reliability, MTTF, calculation of reliability, Building reliability in the product, evaluation of reliability, interpretation of test results, reliability control, maintainability, zero defects, quality circle.

IS0-9000 and its concept of Quality Management:

ISO 9000 series, Taguchi method, JIT in some details

Recommended Books

1. H. LaI, 'Total Quality management', Wiley Eastern Limited, **1990**.
2. Greg Bounds, 'Beyond Total Quality Management', McGraw Hill, **1994**.
3. H.G. Menon, 'TQM in New Product Manufacturing', McGraw Hill.

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COMPUTER INTEGRATED MANUFACTURING

Subject Code: MMEE1-205 **L T P C** **Duration: 39 Hrs.**
4 0 0 4

UNIT-I (10 Hrs.)

Introduction: Introduction to Product life cycle management. Need of CAD/CAM integration through computers, Benefits of integration, Types of production systems and their automation, CAD/CAM integration. Concept of FMS and CIMS. DNC based factory management and control, Integrated CAD/CAM system and shared database.

UNIT-II (11 Hrs.)

Elements of a General CIM System: Types of CIM systems, CAD-CAM link for CIMS, Benefits of CAM, FMS and CIMS, Automated material handling systems, equipment and their functions. Integration of Robots in CIMS, automated guided vehicle navigation system, Automatic Storage and Retrieval Systems (AS/RS), Carousel storage system, design of automatic material handling system, KWO analysis, work-part transfer mechanisms.

UNIT-III (08 Hrs.)

Group Technology: Concept and terminology, Part family formation, Classification and coding systems for components, Group technology machine cells.

UNIT-IV (10 Hrs.)

Computer Aided Production Planning and Control: Computer aided shop floor control, Computer aided inspection & quality control, Shop floor data collection systems, Sensors used in Automation, Tool management system, Automatic identification systems, Barcode system.

CIM Database and Database Management Systems: Types, Management information system, Manufacturing data preparation.

Recommended Books

1. M.P. Groover and E.W. Zimmers, 'CAD/ CAM', Dorling Kingsley, **2008.**
2. M.P. Groover, 'Automation, Production Systems and Computer Integrated Manufacturing', Pearson Education Asia, **2009.**
3. K.S. Vajpayee, 'Principles of Computer Integrated Manufacturing', Prentice Hall, **2006.**
4. P.N. Rao, N.K. Tewari and T.K. Kundra, 'Computer Integrated Manufacturing', McGraw Hill, **1998.**

FINITE ELEMENT MODELLING

Subject Code: MMEE1-207 **L T P C** **Duration: 45 Hrs.**
4 0 0 4

UNIT-I (11 Hrs.)

Approximate Solution Methods: Finite Difference Method, Finite Element Methods, Ritz and Rayleigh Ritz methods, Method of weighed residuals, General concepts, Point collocation, Subdomain collocation, least squares, Galerkin method.

UNIT-II (12 Hrs.)

Introduction to Finite Element Method: Introduction to variational calculus, The differential of a function, Euler-Lagrange equation, Geometric & natural boundary conditions, Basic Concept of Finite Element Method, Principle of potential energy, 1D elements, Derivation of Stiffness and Mass matrices for a bar, A beam and A shaft, Comparison with Analytical results, Interpolation and shape functions,

UNIT-III (12 Hrs.)

Solution of static problems and case studies in stress analysis of mechanical components, FEA using 2D and 3D elements, Plain strain and plain stress problems, FE using plates / shell elements, analysis using Isoparametric Elements. Programming of the different concepts covered in lectures using C++/MATLAB language, demonstration of analysis software for finite element analysis.

UNIT-IV (10 Hrs.)

Students will be given different 2D /3D components for structural/thermal/ fluid flow FEM analysis to be done using C++/MATLAB programming. The components are to be analyzed using different linear / higher order elements i.e., triangular, axisymmetric, quadrilateral, tetrahedral and hexahedral elements.

Recommended Books

1. O.C. Zienkiewicz, 'The Finite Element Method', Butterworth Heinemann, **2002.**
2. K.H. Huebner, D.L. Dewhirst, D.E. Smith and T.G. Byrom, 'The Finite Element Methods for Engineers', John Wiley, **2000.**
3. J.N. Reddy, 'An Introduction to the Finite Element Method', McGraw Hill, **2001.**
4. K.J. Bathe, 'Finite Element Procedures', Prentice Hall of India, **2008.**
5. R.D. Cook, 'Concepts and Applications of Finite Element Analysis', John Wiley and Sons, **2001.**
6. G.R. Buchman, 'Finite Element Analysis', Schaum's Outlines, McGraw Hill, **1995.**

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MICRO-ELECTRO MECHANICAL SYSTEMS (MEMS)

Subject Code: MMEE1-208 **L T P C** **Duration: 44 Hrs.**
4 0 0 4

UNIT-I (10 Hrs.)

Overview of MEMS and microsystems, microelectronics, microfabrication, miniaturization, typical MEMS and microsystems products

UNIT-II (11 Hrs.)

Working Principles of Microsystems: microsensors, microactuation, MEMS with microactuators, microfluidics, microvalves, micropumps, micro-heatpipes.

Overview of materials for MEMS and microsystems: atomic structure of matter, ions and ionization, doping of semiconductors, diffusion process, electrochemistry.

UNIT-III (11 Hrs.)

Microsystem Fabrication: photolithography, ion implantation, diffusion, oxidation, chemical vapor deposition, physical vapor deposition, sputtering, etching.

Micromanufacturing: bulk micromanufacturing, surface micromanufacturing, LIGA process.

UNIT-IV (12 Hrs.)

Assembly, Packaging and Testing of Microsystems: overview of microassembly, microassembly processes, major technical problems of microassembly, microsystem packaging and its levels, essential packaging technologies, reliability and testing in MEMS packaging.

Recommended Books

1. Tai-Ran Hsu, 'MEMS and Microsystems: Design, Manufacture, and Nanoscale Engineering', John Wiley & Sons, Inc.
2. N.P. Mahalik, 'Micro manufacturing and Nanotechnology', Springer.
3. Nadim Maluf, Kirt Williams, 'An Introduction to Microelectromechanical Systems Engineering', Artech House, Inc.
4. Mark Ratner, Danier Ratner, 'Nanotechnology', Pearson Education Inc.
5. Charles P. Poole Jr. & Frank J. Owens, 'Introduction to Nanotechnology', John Wiley & Sons.

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LAB-II

Subject Code: MMEE1-209 **L T P C**
0 0 4 2

One lab /field/industrial oriented project /problem will be allocated to each student related to the subjects related to the subjects taught in 2nd Semester.

GEOMETRICAL MODELLING & ANALYSIS

Subject Code: MMEE1-259 **L T P C** **Duration: 46 Hrs.**
4 0 0 4

UNIT-I (12 Hrs.)

Geometric Modeling: Parametric sketching, Constrained model dimensioning, Material addition and removal for extruded, Revolved, Swept and blended features, References and construction features of points, Axis, Curves, Planes, Surfaces and customized analysis features, feature and sequence of feature editing. Cosmetic features, Chamfers, Rounds, Standard holes, File formats for data transfer.

UNIT-II (12 Hrs.)

Feature patterns, Duplication, Grouping, Suppression, Assembly modeling, Assembly analysis tools. Top-down vs. bottom-up design, Parametric relations and design optimization parameters creation, Mass property analysis, Automatic production drawing creation and detailing, Software automation and customization tools, Colors, Advanced features for non-parallel blend, Helical sweep, Swept blend, Variable section sweep, Draft, Ribs, Sketched holes, Mechanism design and assembly.

UNIT-III (11 Hrs.)

Mechanical Design Analysis and Optimization: Design analysis for mass properties, Stress, Thermal stress, using CAD/CAE packages, Optimum design of machine components using multivariable nonlinear optimization techniques using iterative CAD/CAE software tools.

UNIT-IV (11 Hrs.)

Research Assignments: Individual research assignments will be based on use of standard CAD and CAE packages for modeling of mechanical elements, Assembly and Automated Drawing. Project involving assembly, position, kinematic and dynamic analysis of a mechanism. Interference analysis in motion. Optimization of mechanical system design using CAD/CAE software tools, Project on mechanical systems design and analysis. Make a prototype for design validation.

Recommended Books

1. Kelley David S., ‘Pro/ENGINEER Wildfire 5.0 Instructor’, Tata McGraw Hill, **2011.**
2. Shih Randy H., ‘Introduction to Finite Element Analysis Using Creo Simulate 1.0’, SDC Publications, USA, **2011.**
3. Shih Randy H., ‘Parametric Modeling with Creo Parametric 1.0-An Introduction to Creo Parametric 1.0’, SDC Publications, USA, **2011.**
4. N. Sidheswar, P. Kannaiah and V.V.S. Sastry, ‘Machine Drawing’, McGraw Hill, **2001.**

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ARTIFICIAL INTELLIGENCE

Subject Code: MMEE1-260/ **L T P C** **Duration: 45 Hrs.**
4 0 0 4

UNIT-I (10 Hrs.)

Human and Machine Intelligence, Artificial Intelligence (AI), Programming in AI environment, Natural Language processing (NLP).

UNIT-II (12 Hrs.)

Architecture of an Expert System, Knowledge base, inference engine forward and backward chaining, use of probability and fuzzy logic. Selection of inference mechanism.

Introduction, to Rule Based System, Conflict Resolution, Advantages and Drawbacks of Rule Based Systems Clausal Form Logic; Rule Base Verification, Refinement and Validation.

UNIT-III (12 Hrs.)

Creating Knowledge Base, Knowledge Engineer and Domain Expert, Phases of Knowledge Engineering, Tools for Knowledge Engineering.

Neural network applications, artificial neural network models, NN applications in Cellular manufacturing and other areas of mechanical Engg.

UNIT-IV (11 Hrs.)

Fundamentals of OOP (Object oriented programming), creating structures and objects, object operations, invoking procedures, programming applications, object oriented expert systems.

Semantic nets, structure and objects, ruled systems for semantic nets, certainty factors, automated learning.

Recommended Books

1. T.R. Addis, 'Designing Knowledge Based System', Prentice Hall, **1985**.
2. D.W. Rolston, 'Principles of Artificial Intelligence and Expert Systems Development', McGraw Hill, **1988.**
3. R. Maus and J. Keyes, 'Handbook of Expert Systems in Manufacturing' McGraw Hill, **1991.**
4. Robert Levine, 'A Comprehensive Guide to Artificial Intelligence and Expert Systems',
5. Elain Rich, 'Artificial Intelligence'.

WELDING TECHNOLOGY AND PROCESSES

Subject Code: MMEE1-261 **L T P C** **Duration: 45 Hrs.**
4 0 0 4

UNIT-I (11 Hrs.)

Welding Metallurgy: Welding as compared with other fabrication processes, Classification of welding processes; Heat affected zone and its characteristics; Effects of alloying elements on weldability, Weldability of steels, stainless steel, cast iron, and aluminum and titanium alloys, Weld testing standards, Hydrogen embrittlement, Lamellar tearing, residual stresses and its measurement, heat transfer and solidification, Analysis of stresses in welded structures, Pre and post welding heat treatments, Metallurgical aspects of joining, Conditions of soldering, Brazing and welding of materials.

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UNIT-II (10 Hrs.)

Weld Design & Quality Control: Principles of sound weld design, welding joint design, welding defects; Testing of weldament, Material joining characteristics, Welding positions, Allowable strength of welds under steady loads, Weld throat thickness; Weld quality, Discontinuities in welds, their causes and remedies and quality conflicts.

UNIT-III (12 Hrs.)

Modern Trends in Welding: Friction welding, Explosive welding, Diffusion bonding, High frequency induction welding, Ultrasonic welding, Electron beam welding, Plasma arc welding, Laser welding. Mechanization in Welding: Mechanization of flat/circular joints, Thin/thick sheets (resistance/arc weld), Mechanization of I beams (arc weld), Longitudinal circumferential SA welding (roller blocks, column booms, flux supports), Circular/spherical welding joints (rotating tables positioners), Manufacture of welding longitudinal welded pipes by induction, TIG, Plasma and SA welding of spiral welded pipes.

UNIT-IV (12 Hrs.)

Robotics in Welding: Robot design and applications in welding, Programming of welding robots, tolerances for assemblies for robot welding, New generation of welding robots, Self-alignment by current arc variation, Robots for car body welding, Microelectronic welding and soldering, Efficiency of robotics in welding.

Microwelding Technologies: Introduction to Microwelding techniques.

Recommended Books

1. Nikodaco & Shansky, 'Advanced Welding Processes', MIR Publications.

2. V.M. Radhakrishnan, 'Welding Technology and Design', New Age International.
3. M.M. Schwariz, 'Source Book of Innovative Welding Processes', American Society of Metals (Ohio).
4. J. Cornu, 'Advanced Welding Systems', Vol. I, II, III, Jaico Publishers.
5. P.N. Rao, 'Manufacturing Technology (Foundry, Forming and Welding)', Tata McGraw Hill.

MACHINE AUTOMATION

Subject Code: MMEE1-310 **L T P C** **Duration: 44 Hrs.**
4 0 0 4

UNIT I (10 Hrs.)

Introduction: NC, DNC, CNC, Programmed Automations, Machine control unit, Part program, NC tooling.

NC machine tools: Nomenclature of NC machine axes, Types of NC machine tools, Machining centres, Automatic tool changes (ATC), Turning centres.

UNIT II (11 Hrs.)

Machine control unit & tooling: Functions of MCU, NC actuation systems, Part program to command signal, MCU organization, Computerized numerical control, Transducers for NC machine tools, Tooling for NC machining centres and NC turning machines, Tool presetting.

UNIT-III (11 Hrs.)

Manual part programming: Part program instruction formats, Information codes: Preparatory function, Miscellaneous functions, Tool code and tool length offset, Interpolations, Canned cycles. Manual part programming for milling operations, Turning operations, Parametric subroutines.

UNIT-IV (12 Hrs.)

Computer aided part programming: NC languages: APT, NELAPT, EXAPT, GNC, VNC, Preprocessor, Post processor.

APT programming: APT language structure, APT geometry: Definition of point, time, vector, circle, plane, patterns and matrices. APT motion commands: setup commands, point-to-point motion commands, continuous path motion commands. Post processor commands, complication control commands. Macro subroutines. Part programming preparation for typical examples.

Recommended Books:

1. Numerical Control and Computer Aided Manufacturing by T.K. Kundra, P.N. Rao and N.K. Tewari, Tata McGraw-Hill Company Limited, New Delhi.
2. Numerical Control of Machine Tools by Yoram Koren and Joseph Ben-Uri, Khanna Publishers, Delhi

COMPUTER AIDED PROCESS PLANNING

Subject Code: MMEE1-311 **L T P C** **Duration: 43 Hrs.**
4 0 0 4

UNIT I (10 Hrs.)

Introduction

The Place of Process Planning in the Manufacturing cycle, Process planning and production planning, Process planning and Concurrent Engineering, CAPP, Group Technology.

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UNIT-II (11 Hrs.)

Part Design Representation

Design, Drafting, Dimensioning, Conventional Toloerencing, Geometric Toloerencing, CAD – input/output devices, Topology, Geometric transformation, Perspective transformation, Data Structure Geometric modeling for process planning, GT coding, The OPITZ system, The MICLASS System.

UNIT-III (10 Hrs.)

Process Engineering and Process Planning

Experienced based planning, Decision table and Decision trees, Process capability analysis, Process planning, variant process planning, Generative approach, Forward and backward planning, Input format, A1

UNIT-IV (12 Hrs.)

Computer Aided Process Planning Systems

Logical Design of process planning, Implementation considerations, Manufacturing system components, Production Volume, No. of production families, CAM-I, CAPP, MIPLAN, APPAS, AUTOPLAN and PRO, CPPP.

An Integrated Process Planning Systems

Totally integrated process planning systems, An Overview Modulus structure, Data structure, Operation, Report Generation, Expert process planning.

Recommended Books

1. Gideon Halevi and Roland D. Weill, 'Principle of Process Planning, Alogical Approach', Chapman & Hall, **1995**.
2. Tien-Chien-Chang, Richard A. Wysk, 'An Introduction to Automated Process Planning Systems', Prentice Hall, **1985**.
3. T.C. Chang, 'An Expert Process Planning System', Prentice Hall, **1985**.
4. Nanua Singh, 'Systems Approach to Computer Integrated Design and Manufacturing', John Wiley & Sons, **1996**.
5. Rao, 'Computer Aided Manufacturing', Tata McGraw Hill Publishing Co., **2000**.

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M. TECH. MECHANICAL ENGINEERING (INDUSTRIAL & PRODUCTION)

Total Contact Hours = 24 **Total Marks = 600** **Total Credits = 22**

SEMESTER 1st		Contact Hrs			Marks			Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
MREM0-101	Research Methodology	4	0	0	40	60	100	4
MMEE5-102	Advanced Manufacturing Processes	4	0	0	40	60	100	4
MMEE5-103	Advanced Engineering Materials	4	0	0	40	60	100	4
MMEE5-104	Method Engineering & Ergonomics	4	0	0	40	60	100	4
MMEE5-105	Lab -I	0	0	4	60	40	100	2
Department Elective – I (Select any one)		4	0	0	40	60	100	4
MMEE5-156	Value Engineering							
MMEE5-157	Project Management							
MMEE5-158	Total Quality Management							
MMEE5-159	Jig Fixture & Die Design							
Total	**Theory = 5 Lab = 1**	**20**	**0**	**4**	**260**	**340**	**600**	**22**

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Total Contact Hours = 24 **Total Marks = 600** **Total Credits = 22**

SEMESTER 2nd		Contact Hrs			Marks			Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
MMEE5-206	Metrology & Industrial Inspection	4	0	0	40	60	100	4
MMEE5-207	Supply Chain Management	4	0	0	40	60	100	4
MMEE5-208	Tool & Cutter Design	4	0	0	40	60	100	4
MMEE5-209	Facility Planning	4	0	0	40	60	100	4
MMEE5-210	Lab-II	-	-	4	60	40	100	2
Departmental Elective – II (Select any one)		4	0	0	40	60	100	4
MMEE5-260	Operation Management							
MMEE5-261	Product Design & Development							
MMEE5-262	Enterprise Resource Planning (ERP)							
Total	**Theory = 5 Lab = 1**	**20**	**0**	**4**	**260**	**340**	**600**	**22**

Total Contact Hours = 20 **Total Marks = 500** **Total Credits = 26**

SEMESTER 3rd		Contact Hrs			Marks			Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
MMEE5-311	3D- Printing	4	0	0	40	60	100	4
MMEE5-312	Production Planning & Control	4	0	0	40	60	100	4
MMEE5-313	Project & Seminar	0	0	4	40	60	100	4
MMEE5-314	Thesis Synopsis	0	0	4	-	100	100	10
Open Elective (Select any one)		4	0	0	40	60	100	4
Total	**Theory = 3 Lab = 2**	**12**	**0**	**8**	**160**	**340**	**500**	**26**

Total Credits = 20

SEMESTER 4th		Contact Hrs			Evaluation Criteria	Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Satisfactory/ Unsatisfactory**	
MMEE5- 415	Final Thesis	0	0	0		20

Overall

Semester	**Marks**	**Credits**
1st	600	22
2nd	600	22
3rd	500	26
4th	--	20
Total	**1700**	**90**

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RESEARCH METHODOLOGY

Subject Code – MREM0-101 **L T P C** **Duration: 45 Hrs.**
4 0 0 4

UNIT–I (11 Hrs.)

Introduction to Research: Meaning, Definition, Objective and Process

Research Design: Meaning, Types - Historical, Descriptive, Exploratory and Experimental

Research Problem: Necessity of Defined Problem, Problem Formulation, Understanding of Problem, Review of Literature

Design of Experiment: Basic Principal of Experimental Design, Randomized Block, Completely Randomized Block, Latin Square, Factorial Design.

Hypothesis: Types, Formulation of Hypothesis, Feasibility, Preparation and Presentation of Research Proposal

UNIT–II (10 Hrs.)

Sources of Data: Primary and Secondary, Validation of Data

Data Collection Methods: Questionnaire Designing, Construction

Sampling Design & Techniques – Probability Sampling and Non Probability Sampling

Scaling Techniques: Meaning & Types

Reliability: Test – Retest Reliability, Alternative Form Reliability, Internal Comparison Reliability and Scorer Reliability

Validity: Content Validity, Criterion Related Validity and Construct Validity

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UNIT–III (13 Hrs.)

Data Process Operations: Editing, Sorting, Coding, Classification and Tabulation

Analysis of Data: Statistical Measure and Their Significance, Central Tendency, Dispersion, Correlation: Linear and Partial, Regression: Simple and Multiple Regression, Skewness, Time series Analysis, Index Number

Testing of Hypothesis: T-test, Z- test, Chi Square, F-test, ANOVA

UNIT – IV (11 Hrs.)

Multivariate Analysis: Factor Analysis, Discriminant Analysis, Cluster Analysis, Conjoint Analysis, Multi-Dimensional Scaling

Report Writing: Essentials of Report Writing, Report Format

Statistical Software: Application of Statistical Softwares like SPSS, MS Excel, Mini Tab or MATLAB Software in Data Analysis

**Each Student has to Prepare Mini Research Project on Topic/ Area of their Choice and Make Presentation. The Report Should Consists of Applications of Tests and Techniques Mentioned in The Above UNITs*

Recommended Books

1. R.I. Levin and D.S. Rubin, 'Statistics for Management', 7th Edn., Pearson Education, New Delhi.
2. N.K. Malhotra, 'Marketing Research–An Applied Orientation', 4th Edn., Pearson Education, New Delhi.
3. Donald Cooper, 'Business Research Methods', Tata McGraw Hill, New Delhi.
4. Sadhu Singh, 'Research Methodology in Social Sciences', Himalaya Publishers.
5. Darren George & Paul Mallery, 'SPSS for Windows Step by Step', Pearson Education, New Delhi.

6. C.R. Kothari, ‘Research Methodology Methods & Techniques’, 2nd Edn., New Age International Publishers.

ADVANCE MANUFACTURING PROCESSES

Subject Code: MMEE5-102 **L T P C** **Duration: 46 Hrs.**

4 0 0 4

UNIT-I (11 Hrs.)

Introduction: Overview of general trends in Manufacturing, concept and significance of important properties related to manufacturing processes; Machinability index, Formability, weldabilty, Fluidity, dimensional accuracy, surface integrity, residual stresses, limitations of conventional manufacturing processes need and evolution of advanced manufacturing, selection and economics of manufacturing processes.

UNIT-II (15 Hrs.)

Advanced Machining Processes: Classification, Review of conventional machining processes, Principles, process parameters, capabilities and mechanism of material removal of Electro discharge machining, Electrochemical Machining, Laser Beam Machining, and Abrasive Flow machining, concept and need of Hybrid Machining Processes. Advanced Welding Processes: Classification, Review of conventional welding processes, Principles, process parameters, capabilities and theoretical considerations for Ultrasonic Welding, friction Welding, Explosion Welding, Underwater Welding, Adhesive Bonding.

UNIT-III (10 Hrs.)

Advanced Forming Processes: Classification, Review of conventional Forming processes, concept of High Energy Rate Forming, Principles, process parameters, capabilities and theoretical considerations for Explosive Forming, Electro hydraulic Forming, Electromagnetic Forming, Super plastic forming.

UNIT-IV (10 Hrs.)

Advanced Casting processes: Classification, Review of conventional casting processes\, brief review regarding Casting of Ferrous and Nonferrous metals, Principles, process parameters, capabilities and theoretical considerations for Shell Mould Casting, Vacuum Casting, Lost Foam Casting, Investment Casting, Centrifugal Casting, concept of rapid solidification.

Recommended Books

1. Shan and Pandey, ‘Modern Machining Processes’, Tata Mc Hill N. Delhi.
2. ‘ASTME High Velocity Forming of Metals’, PHI, N. Delhi.
3. Kalpakjian Serope and R. Schmid Steven, ‘Manufacturing Processes for Engg. Materials’, Pearson Education.
4. G.F Benedict, ‘Non Traditional Manufacturing’, Marcel Dekker.
5. P.K. Mishra, ‘Non-Conventional Machining’, Narosa Publishing House, N. Delhi.

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ADVANCE ENGINEERING MATERIALS

Subject Code: MMEE5-103 **L T P C** **Duration: 38 Hrs.**
4 0 0 4

UNIT-I (8 Hrs.)

The Structures of Materials: Metals, Ceramics, Polymers and Composites; Properties: Chemical, Physical, Mechanical and Dimensional Properties;

UNIT-II (10 Hrs.)

Ferrous Alloys: Heat Treatments, Selective and Surface-Hardening, Specifications, Low Alloy and High Alloy Steels, Tool Steels, Stainless Steels, Cast irons;

UNIT-III (10 Hrs.)

Non-ferrous Alloys: Copper and its alloys, Aluminum and its alloys, Nickel, Zinc, Titanium, Magnesium and Refractory Metals;

UNIT-IV (10 Hrs.)

Shape Memory Phenomenon and Alloys; Ceramics, Cermets, Glass and Carbon Products; Engineering Plastics, Polymeric Coatings and Adhesives; Failure Prevention; and The Selection Process

Recommended Books

1. G.E. Dieter, 'Engineering Design: A Materials and Processing Approach', McGraw Hill, **1991.**
2. M.F. Ashby, 'Materials Selection in Mechanical Design', Pergamon Press, **1992.**
3. W.J., Patton, 'Plastics Technology, Theory, Design and Manufacture', Lenton Publishing Co.
4. 'Introduction to Engineering Materials & Manufacturing Processes', NIIT, Prentice Hall of India.
5. Kenneth G. Budinski, 'Engineering Materials Properties and Selection', Prentice Hall of India.
6. R.A. Higgins, 'Engineering Metallurgy', Part-1, Edward Arnold.
7. Gladius Lewis, 'Selection of Engineering Materials', Prentice-Hall, New Jersey, US.

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METHODS ENGINEERING AND ERGONOMICS

Subject Code: MMEE5-104 **L T P C** **Duration: 45 Hrs.**
4 0 0 4

UNIT-I (8 Hrs.)

Introduction to Industrial Engineering and productivity measurement of productivity, Introduction to work study, methods-study principles and motion economy, filming techniques and micro-motion analysis, Introduction to work measurement. Time study, performance allowances, work sampling, predetermined motion system, standard data system, job evaluation of merit rating. Wage incentive plans, MTM (Methods Time Measurement)

UNIT-II (12 Hrs.)

Design Approach: A new design, modification, of existing design, assessment of design. Limitation of man and machine with respect to each other, posture-standing at work, seated at work, work station heights and seat geometry. Human anthropometry and its use in work place layout, Analysis. Controls: Hand controls and foot controls, location of controls and work place envelope. Recommendation about hand and foot push buttons, rotary selector switches, hand wheels, crank levers etc. Instruments and displays.

UNIT-III (12 Hrs.)

Work Load: Static and dynamic muscular work. Human motor activity, metabolism, physical work load, measurement of physical work load, mental work load, measurement of mental work load, repetitive and inspection work, work duration and rest pauses, principles of motion economy, Analysis. Climates**:** Heat Humidity: Body heat balance, effective temperature scales, zones of discomfort, effect of heat on body and work performance**.**

UNIT-III (13 Hrs.)

Vibration: Terminology, Response of body to low frequency (LF) vibration, vibrations and discomfort, effect on health of worker, high frequency vibration, effect of H.F. vibrations, methods of reducing vibrations, analysis**.** Noise: Terminology, physiological effects of noise, annoyance of noise, speed interference, hearing loss, temporary and permanent thresh hold shift, effect of noise on performance, reduction of noise, personal noise protection. Analysis**.**

Recommended Books:

1. E.V. Krick, 'Methods Engineering Study'.
2. H.S. Shah, 'Work Study and Ergonomics', Dhanpat Rai & Sons, **1992.**
3. Bridger, Introduction of Ergonomics, Tata McGraw Hill, **1995**.
4. O.P. Khanna, 'Work Study', Dhanpat Rai & Sons, **1995**.

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. LAB-I

Subject Code: MMEE5-105 **L T P C**
0 0 4 2

One lab /field/industrial oriented project /problem will be allocated to each student related to the subjects taught in 1st semester.

VALUE ENGINEERING

Subject Code: MMEE5-156 **L T P C** **Duration: 34 Hrs.**
4 0 0 4

UNIT-I (8 Hrs.)

Introduction: Life cycle of a Product, Definition, objectives and methodology of value Engineering, Comparison with other cost reduction techniques, unnecessary cost.

UNIT-II (12 Hrs.)

Functions: definition, types and relationship between different functions in design of a Product, functional cost, functional worth, test for poor value, aim of value engineering. Systematic approach, Phases of value engineering Job plan: General phase, information phase, function phase creation/speculation phase, evaluation phase, investigation phase, recommendation and implementation phase.

UNIT-III (6 Hrs.)

Decision /evaluation Matrix: Quantitative comparison of alternatives, estimation of weight factors and efficiency.

UNIT-IV (8 Hrs.)

FAST diagramming: Critical path of function, How, why and when logic, supporting and all time functions, Ground rule for FAST diagram.

Recommended Books

1. A.E. Mudge, 'Value Engineering – A Systematic Approach'.
2. L.D. Miles, 'Techniques of Value Analysis and Value Engineering'.
3. H.S. Mittal, 'Value Engineering for Cost Reduction and Product Improvement'.

PROJECT MANAGEMENT

Subject Code: MMEE5-157 **L T P C** **Duration: 37 Hrs.**
4 0 0 4

UNIT-I (8 Hrs.)

Introduction & Overview: Definitions, Types of projects, Project life cycle (Project phases) and decisions.

UNIT-II (12 Hrs.)

Go/ No go decisions based on: a) Project Identification and Screening, b) Project Appraisal: Market, Technical, social, Ecological & Financial, c) Project Selection: Pragmatic, pair wise, MADM approach. Development of Project Network: Project description, Work break down structure, Nomenclature, Rules for drawing and representation, consistency and Redundancy in Project Networks, Matrix representation.

UNIT-III (10 Hrs.)

CPM & PERT: Activity times, Completion, Floats, Probability (ND usage), Examples, and Problems. Project Monitoring & Control: Project adjustments, Crashing: Direct & Indirect cost, Normal & Crash: duration & cost, Resource leveling: Types, usage, leveling, Problems, Managing Risk.

UNIT-III (7 Hrs.)

Role of Human Factors: Dealing with people Team Building and Leadership in Projects, commitment, work culture, motivation, coordination, attitude, innovation.

Recommended Books

1. Clifford Gray and Erik Larson, 'Project Management', Tata McGraw Hill Edition.
2. J.D. Wiest and F.K. Levy, 'Management Guide to PERT/ CPM', PHI.
3. Ravi Shankar, 'Industrial Engg. & Mgmt.', Galgotia Publications.

TOTAL QUALITY MANAGEMENT

Subject Code: MMEE5-158 **L T P C** **Duration: 44 Hrs.**
4 0 0 4

UNIT-I (8 Hrs.)

Quality Concepts

Evolution of Quality control, concept change, TQM Modern concept, Quality concept in design, Review off design, Evolution of proto type. Control on Purchase of various products, evaluation of supplies, capacity verification, Development of sources, procurement procedure.

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UNIT-II (12 Hrs.)

Manufacturing Quality

Methods and Techniques for manufacture, Inspection and control of product, Quality in sales and services, Guarantee, analysis of claims. Quality Management, Organization structure and design, Quality function, decentralization, Designing and fitting organization for different types products and company, Economics of quality value and contribution, Quality cost, optimizing quality cost, seduction programme.

UNIT-III (12 Hrs.)

Human Factor in Quality

Attitude of top management, co-operation, of groups, operator's attitude, responsibility, causes of operator's error and corrective methods. Control Charts Theory of control charts, measurement range, construction and analysis of R charts, process capability study, use of control charts.

Attributes of Control Charts

Defects, construction and analysis off-chart, improvement by control chart, variable sample size, construction and analysis of C-chart.

UNIT-IV (12 Hrs.)

Defects Diagnosis and Prevention

Defect study, identification and analysis of defects, corrective measure, factors affecting reliability, MTTF, calculation of reliability, Building reliability in the product, evaluation of reliability, interpretation of test results, reliability control, maintainability, zero defects, quality circle.

IS0-9000 and its concept of Quality Management:

ISO 9000 series, Taguchi method, JIT in some details

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Recommended Books

1. H. LaI, 'Total Quality management', Wiley Eastern Limited, **1990**.
2. Greg Bounds, 'Beyond Total Quality Management'. McGraw Hill, **1994.**
3. H.G., 'TQM in New Product manufacturing', McGraw Hill.

JIG, FIXTURE & DIE DESIGN

Subject Code: MMEE5-159 **L T P C** **Duration: 38 Hrs.**
4 0 0 4

UNIT-I (12 Hrs.)

Jigs and Fixtures: Elements of jigs and fixtures, costs calculations. Locating element, clamping elements, procedure in designing. Jig and fixtures: Fits and tolerances analysis.
Non-Standard clamping devices, centralizers, equalizers, actuators (Pneumatic, hydraulic electric and electronic.) Automatic loading and unloading devices.

UNIT-I (11 Hrs.)

Types of Frunions: Single, double and multi-axis and indexers**.** Transfer line jigs & fixtures for the operation of Multi-drilling, boring, milling and grinding. Assembly line fixtures.

UNIT-III (7 Hrs.)

Universal Jigs and Fixtures, Transfer-devices, transfer machine, modulation-design concept, in process gauging.

UNIT-IV (8 Hrs.)

Design of Dies: Elements of Dies and Punch. Types and design procedure, progressive dies, drawing die, bending die etc. Analysis.

Recommended Books

1. Franklin-D-Jones, Jigs and Fixtures Design.
2. F.H. Colovin and Massachusettes, 'Jigs and Fixtures', Institute of Technology.
3. H.W. Hardy, 'Jigs and Fixtures Design'.
4. P.S. Haughton, 'Jigs and Fixtures Design'.
5. Parson, 'Jigs and Fixtures'.

METEROLOGY & INDUSTRIAL INSPECTION

Subject Code: MMEE5-206 **L T P C** **Duration: 46 Hrs.**
4 0 0 4

UNIT-I (10 Hrs.)

Standards of Measurement: Line, End and Wavelength standards. Primary secondary and working standards. Limits, Fits & tolerances, Interchangeability, design & manufacture of gauges, use of slip gauges, dial indicators, sine bars, auto-collimators, taper gauges, optical projectors and microscopes, straightness, flatness and square ness testing.

UNIT-II (11 Hrs.)

Instruments for Measuring Surface finish & Roughness: Classes of instruments, the Taylor-Hobson telesurf, plastic replica techniques, numerical assessment of roundness. Calibration of Working Standards by Interferrometry: Application of interferometry, calibration of gauges by interference.

UNIT-III (12 Hrs.)

The Calibration of working standards by direct comparison in series: Different types of comparators such as the pneumatic, optical, electrical and electronic comparators principle of amplification- magnification, sensitivity and response, the calibrations of end gauges in sets, ruling and calibration of standard scales.

UNIT-IV (13 Hrs.)

Measurement of Gear and Screw Threads: Measuring methods for run out, pitch, profile, lead, backlash, tooth thickness, composite elements, inspection equipment quality control screw thread terminology, measurement over wires, one wire measurement, three wire measurement, standard specifications and formulas, tolerances. Management of Inspection and quality control: Communication of specifications, the nature of dimensions, selection of gauging equipment, kind of inspection, quality control Management

Recommended Books

1. Taher, 'Metrology and Measuring'.
2. Miller, 'Dimensional Metrology'.
3. Khare & Vajpayee, 'Dimensional Metrology'.
4. I.C. Gupta, 'Engineering Metrology'.

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SUPPLY CHAIN MANAGEMENT

Subject Code: MMEE5-207 **L T P C** **Duration: 42 Hrs.**
4 0 0 4

UNIT-I (10 Hrs.)

Introduction: Objectives of supply chain Management, key components of supply chain i.e. sourcing, distribution strategy, customer service strategy; supply chain Management as Integrated logistics, generic activities, architecture of supply chain, future potential of supply chain Management.

UNIT-II (11 Hrs.)

Quality Management: Inherent link to SCM: Suppliers development, distribution channel, re-engineering of supply chain, IT – enabled supply chain: Electronic data interchange, enterprise resource planning, implementation of IT, Scope of emerging distributed cooperative tele manufacturing over internet.

UNIT-III (11 Hrs.)

Organizational Issues: Application of knowledge Management for effectiveness SCM, social interactions and linking of functional units in a supply chain, Combined core competency of SC: Global sourcing, technology and tools – essential enablers, framework for managing a knowledge intensive supply chain.

UNIT-IV (10 Hrs.)

Recent Trends in SCM: Tierisation of supplies, Reverse logistics, JIT II, Milk Round System (MRS), bar coding, Hub and Spoke Concept and other latest concepts.

Recommended Books

1. Chopra, ‘Supply Chain Management’, Pearson Education Asia, New Delhi.
2. Christopher, ‘Logistics and Supply Chain Management’, 2nd Edn., Pearson Education Asia, New Delhi.
3. Taylor & Brunt, ‘Manufacturing Operations and Supply Chain Management (The Lean Approach)’, Business Press Thomson Learning New York
4. J. Arjan, Van Weele, ‘Purchasing and Supply Chain Management (Analysis Planning and Practice)’, 2nd Edn., Business Press, Thomson Learning, New York.
5. Donalad Bowersox, ‘Logistic Management - The Integrated Supply Chain Process’, McGraw Hill, New York.

TOOL & CUTTER DESIGN

Subject Code: MMEE5-208 **L T P C** **Duration: 40 Hrs.**
4 0 0 4

UNIT-I (11 Hrs.)

Fundamentals of Cutting tools design, cutting tools and their principal elements, Tool geometry, system of nomenclatures and their interrelations, setting for the grinding of various basic cutting tool (turning, drilling, milling), Tool materials, developments of various tool materials, their relative characteristics, modern trend in tool development, concept of tool life.

UNIT-II (12 Hrs.)

Single point tools; purpose and principle types and their characteristics, design procedure of single point tools, design of various high production tools, design of carbide tools. Drills;

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purpose and principal types and their construction and geometry, development in the shape of twist drills analysis.

UNIT-III (09 Hrs.)

Milling Cutters; Purpose and types and their construction procedure of profile sharpened and form relieved cutters, design of hobs, analysis.

UNIT-IV (08 Hrs.)

Broaches: Purpose and types, design features of various broaches. Introduction of numerically controlled tools and their applications

Recommended Books

1. Sen & Bhattacharya, 'Principles of Machine Tools', New Central Book Agency.
2. Arshinov & Alekreev, 'Metal Cutting Theory and Cutting Tool Design', Mir Publishers.
3. Shah, 'Principles of Metal Cutting', Oxford, IBH.

FACILITY PLANNING

Subject Code: MMEE5-209 **L T P C** **Duration: 40 Hrs.**
4 0 0 4

UNIT-I (09 Hrs.)

Importance of plant lay out in plant design, types of layout, factors affecting design of plant layout, principles of plant layout design, importance of facilities planning.

UNIT-II (10 Hrs.)

location factors & analysis, Systematic planning of industrial facilities, phases involved in SPIF, layout evaluation heuristics, heuristics for line balancing,

UNIT-III (10 Hrs.)

Qualitative & quantitative techniques for plant layout decision, Computerization layout planning, classification of computerized layout planning algorithms, description of various algorithms for layout planning,

UNIT-IV (11 Hrs.)

integrating plant layout and material handling systems, systems approach to material handling, selection of MH equipment, characteristic features of various MH systems, automated guided vehicle systems and automated storage & retrieval systems.

Recommended Books

1. Richard Muther, 'Practical Plant Layout', McGraw Hill Book Company, New York.
2. Vijay Sheth, 'Facilities Planning and Materials Handling', Marcel Decker, New York.
3. Tompkins, 'While Facilities Planning', John Wiley & Sons, New York.
4. J.M. Apple, 'Plant Layout & Material Handing', John Woley & Sons, New York.
5. Francis White, 'Facility Location & Layout', PHI, New Delhi.

LAB-II

Subject Code: MMEE5-210 **L T P C**
0 0 4 2

One lab /field/industrial oriented project /problem will be allocated to each student related to the subjects related to the subjects taught in 2nd Semester.

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OPERATION MANAGEMENT

Subject Code: MMEE5-260 **L T P C** **Duration: 45 Hrs.**
4 0 0 4

UNIT-I (11 Hrs.)

Introduction to Operation Management: Today's Global business condition, Operations strategy, forming operations strategy.

Forecasting: Demand forecasting, Qualitative forecasting methods and quantitative methods, Selection of forecasting methods.

UNIT-II (12 Hrs.)

Designing and Developing Products and Services: Process Planning and Design, Major Factors affecting Process Design Decision, Types of Process Designs, Interrelationships among Product Design, Process Design and Inventory Policy, Process Design in Services.

UNIT-III (11 Hrs.)

Facility Capacity and Location: Facility Planning Long-Range Capacity Planning, Facility Location, Facility Layout in Product & Service

Production Planning: Production – Planning Hierarchy, Aggregate Planning, Master Production Scheduling, Types of Production-Planning and control systems, Planning and control of Projects.

UNIT-IV (11 Hrs.)

Quality: Managing Quality and SQC and SPC, Quality assurance, acceptance plans.

Inventory Management: Purchase system and purchase principles, stores Management, Standardization, codification and variety, MRP, Supply Chain Management.

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Recommended Books

1. Chunawala & Patel, 'Production and Operation Management', Himalaya Publishers.
2. Bhagde, 'Production and Materials Management', S.D U.S.G Publishers, **1995.**
3. Plossl, 'Production and Inventory Control', Prentice Hall, **1967.**
4. Heizer and Render, 'Operations Management', Prentice Hall, **2001.**
5. Norman Gaither and Greg Fraizer, 'Operations Management'.

PRODUCT DESIGN & DEVELOPMENT

Subject Code: MMEE5-261 **L T P C** **Duration: 45 Hrs.**
4 0 0 4

UNIT-I (12 Hrs.)

Creative thinking and organizing for product innovation. The product design function. Locating ideas for new products, selecting the right product. Qualifications of the product design engineer. Creative thinking. Curiosity and imagination. Ideas generate ideas. Taking time to think. Using a systematic producer for product innovation. Setting responsibilities for new product development. Structural units for new product development, Functions of the new product development unit. Opportunities for the product design engineer.

UNIT-II (11 Hrs.)

Criteria for Product Success: Areas to be studied preparatory to design. The value of appearance Principles and laws of appearance Incorporating quality and reliability into the design. Man-machine consideration, Designing for case of maintenance

UNIT-III (10 Hrs.)

Cost and Product Development: Source of funds for development cost product costs. Estimating the product cost. Kinds of cost procedures, Cost reduction

UNIT-IV (12 Hrs.)

Integrated Approach to Product Development: Diffusion of innovation. Generation, screening and development of new product ideas. Product life cycle and new product development. Economic analysis-evaluation of new product ideas/concepts. Value analysis. Test marketing of new product launch.

Recommended Books

1. Chitale and Gupta, 'Product Design and Manufacturing', Prentice Hall.
2. Bagchi, 'Taguchi Methods Explained', Prentice Hall.
3. Nible & Drper, ' Product Design and Process Engineering', McGraw Hill.

ENTERPRISE RESOURCE PLANNING

Subject Code: MMEE5-262 **L T P C** **Duration: 40 Hrs.**
4 0 0 4

UNIT-I (10 Hrs.)

ERP: An Overview - Benefits of ERP - ERP and Related Technologies - Business Process Reengineering (BPR)

UNIT-II (12 Hrs.)

Data Warehousing - Data Mining - On-line Analytical Processing (OLAP) - Supply Chain Management

ERP Implementation - ERP Implementation Lifecycle - Implementation Methodology - Vendors, Consultants and Users - Contracts with Vendors, Consultants and Employees - Project Management and Monitoring

UNIT-III (09 Hrs.)

Business Modules in an ERP Package - ERP Market - ERP-Present and Future - Turbo Charge the ERP System.

UNIT-IV (09 Hrs.)

Enterprise Integration Applications (EIA) - ERP and E-Commerce - ERP and Internet - Future Directions in ERP.

Recommended Books

1. Alexis Leon, 'ERP Demystified', Tata McGraw–Hill, **2002.**
2. Brady, 'Enterprise Resource Planning', Thomson Learning, **2001.**
3. S. Sadagopan, 'ERP: A Managerial Perspective', Tata McGraw-Hill, **1999.**

3D PRINTING

Subject Code: MMEE5-311 **L T P C** **Duration: 49 Hrs.**
4 0 0 4

UNIT-I (12 Hrs.)

Introduction to 3D Printing: Students will understand how technology shifts throughout history have made 3D printing possible, interface and basic tools available in the CAD software, unique advantages of 3D printing to their designs, distinguish between various 3D printing technologies

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and materials and select appropriately for a given application, compare additive manufacturing to traditional technologies and choose the best technology for a given application.

UNIT-II (13 Hrs.)

Mesh: Define essential geometry terms and how they relate to a 3D mesh, create smooth and detailed 3D structures, repair a 3D mesh and prepare files for print, take advantage of model-sharing websites to accelerate learning and improve product designs, commands for moving from 2D to 3D in CAD, Use the CAM software to prepare files for 3D printing.

UNIT-III (11 Hrs.)

Basic Introduction to various types of engineering, dental and bio-materials, Introduction to fabrication techniques and methodologies for different types of composite materials, Simulation and Finite Element modelling techniques for characterization, advantages and limitations of 3D printing.

UNIT-IV (13 Hrs.)

Gear Systems: Build a gear system in CAD, Convert 2D gear drawings to 3D models, Design systems with 3D printing technology in mind, including minimum tolerance and material thickness, Dynamic Surfaces and Chains: Nest and orient 3D models on the build tray to conserve space and materials, Make more space- and cost-efficient use of 3D printing technology.

PROJECT WORK: Students will apply what they learn in this class to design and 3D print something that moves something. Distribute the final project description that lists the project requirements.

Recommended Books:

1. Norman Dowling, 'Mechanical Behavior of Materials (3E)', Pearson Publishers.
2. 'Mechanical Behavior of Materials', Bowman, John Wiley & Sons.

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PRODUCTION PLANNING & CONTROL

Subject Code: MMEE5-312 **L T P C** **Duration: 42 Hrs.**

4 0 0 4

UNIT-I (11 Hrs.)

Function of production, planning and control, its importance in an organization, Manufacturing systems, Product development and design, Product analysis, Product characteristics, break even analysis, Step-wise cost function, Learning cost-profit-volume charts, Economics of new design, Sales forecasting and estimating, Sales trend analysis and activity charts, Production order.

UNIT-II (10 Hrs.)

Quantity in batch production, Stock control, Minimum lot batch size, Production range, Maximum profit batch size, Maximum rate of return batch size.

UNIT-III (10 Hrs.)

Machine capacity, Machine operation, Multi machine supervision by one operator, Machine interface, Aschroft number, Balancing, Profit maximization.

UNIT-IV (11 Hrs.)

Scheduling, Different forms, Sequencing, Batch production, Scheduling-maximum profit for whole schedule, Maximum return to whole schedule.

Elements of control procedure, Dispatching, Expediting, Computer aided production control.

Recommended Books:

1. Samual Eilon, ‘Elements of Production, Planning and Control’.
2. S.K. Mukhopadhaya, ‘Production, Planning and Control’, Prentice Hall of India.
3. Buffa, ‘Modern Production Management’.

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M. TECH. MECHANICAL ENGINEERING (THERMAL SC. ENGG.) (1st Year)

Total Contact Hours = 24 **Total Marks = 600** **Total Credits = 22**

SEMESTER 1st		Contact Hrs			Marks			Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
MREM0-101	Research Methodology	4	0	0	40	60	100	4
MMET8-102	Advance Thermodynamics	4	0	0	40	60	100	4
MMET8-103	Advanced Fluid Mechanics	4	0	0	40	60	100	4
MMET8-104	Internal Combustion Engine	4	0	0	40	60	100	4
MMET8-105	Lab -I	0	0	4	100	-	100	2
Department Elective – I (Select any one)		4	0	0	40	60	100	4
MMET8-156	Finite Element Modelling (FEM)							
MMET8-157	Gas Dynamics							
MMET8-158	Power Plant Engineering & Industrial Utilities							
Total	**Theory = 5 Lab = 1**	**20**	**0**	**4**	**300**	**300**	**600**	**22**

Total Contact Hours = 24 **Total Marks = 600** **Total Credits = 22**

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SEMESTER 2nd		Contact Hrs			Marks			Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
MMEE8-206	Computational Fluid Dynamics	4	0	0	40	60	100	4
MMEE8-207	Fuels and Combustions	4	0	0	40	60	100	4
MMEE8-208	Welding Technology	4	0	0	40	60	100	4
MMEE8-209	Applied Solar Energy	4	0	0	40	60	100	4
MMEE8-210	Lab-II	-	-	4	100	-	100	2
Departmental Elective – II (Select any one)		4	0	0	40	60	100	4
MMEE8-259	Refrigeration & Air Conditioning							
MMEE8-260	Statistical Methods & Algorithms							
MMEE8-261	Boundary Layer Theory							
Total	**Theory = 5 Lab = 1**	**20**	**0**	**4**	**300**	**300**	**600**	**22**

Total Contact Hours = 20 **Total Marks = 500** **Total Credits = 26**

SEMESTER 3rd		Contact Hrs			Marks			Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
MMEE8-311	Total Quality Management	4	0	0	40	60	100	4
MMEE8-312	Maintenance & Reliability Engineering	4	0	0	40	60	100	4
MMEE8-313	Project	0	0	4	40	60	100	4
MMEE8-314	Thesis Synopsis	0	0	4	-	100	100	10
Open Elective (Select any one)		4	0	0	40	60	100	4
Total	**Theory = 3 Lab = 2**	**12**	**0**	**8**	**160**	**340**	**500**	**26**

Total Credits = 20

SEMESTER 4th		Contact Hrs			Evaluation Criteria	Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Satisfactory/ Unsatisfactory**	
MMEE8- 415	Final Thesis	0	0	0		20

Overall

Semester	**Marks**	**Credits**
1st	600	22
2nd	600	22
3rd	500	26
4th	--	20
Total	**1700**	**90**

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RESEARCH METHODOLOGY

Subject Code – MREM0-101	**L T P C** **4 0 0 4**	**Duration: 45 Hrs.**

UNIT–I (11 Hrs.)

Introduction to Research: Meaning, Definition, Objective and Process

Research Design: Meaning, Types - Historical, Descriptive, Exploratory and Experimental

Research Problem: Necessity of Defined Problem, Problem Formulation, Understanding of Problem, Review of Literature

Design of Experiment: Basic Principal of Experimental Design, Randomized Block, Completely Randomized Block, Latin Square, Factorial Design.

Hypothesis: Types, Formulation of Hypothesis, Feasibility, Preparation and Presentation of Research Proposal

UNIT–II (10 Hrs.)

Sources of Data: Primary and Secondary, Validation of Data

Data Collection Methods: Questionnaire Designing, Construction

Sampling Design & Techniques – Probability Sampling and Non Probability Sampling

Scaling Techniques: Meaning & Types

Reliability: Test – Retest Reliability, Alternative Form Reliability, Internal Comparison Reliability and Scorer Reliability

Validity: Content Validity, Criterion Related Validity and Construct Validity

UNIT–III (13 Hrs.)

Data Process Operations: Editing, Sorting, Coding, Classification and Tabulation

Analysis of Data: Statistical Measure and Their Significance, Central Tendency, Dispersion, Correlation: Linear and Partial, Regression: Simple and Multiple Regression, Skewness, Time series Analysis, Index Number

Testing of Hypothesis: T-test, Z- test, Chi Square, F-test, ANOVA

UNIT – IV (11 Hrs.)

Multivariate Analysis: Factor Analysis, Discriminant Analysis, Cluster Analysis, Conjoint Analysis, Multi-Dimensional Scaling

Report Writing: Essentials of Report Writing, Report Format

Statistical Software: Application of Statistical Softwares like SPSS, MS Excel, Mini Tab or MATLAB Software in Data Analysis

**Each Student has to Prepare Mini Research Project on Topic/ Area of their Choice and Make Presentation. The Report Should Consists of Applications of Tests and Techniques Mentioned in The Above UNITs*

Recommended Books

1. R.I. Levin and D.S. Rubin, 'Statistics for Management', 7th Edn., Pearson Education, New Delhi.
2. N.K. Malhotra, 'Marketing Research–An Applied Orientation', 4th Edn., Pearson Education, New Delhi.
3. Donald Cooper, 'Business Research Methods', Tata McGraw Hill, New Delhi.
4. Sadhu Singh, 'Research Methodology in Social Sciences', Himalaya Publishers.
5. Darren George & Paul Mallery, 'SPSS for Windows Step by Step', Pearson Education, New Delhi.

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6. C.R. Kothari, 'Research Methodology Methods & Techniques', 2nd Edn., New Age International Publishers.

ADVANCED THERMODYNAMICS

Subject Code: MMEE8-102 **L T P C** **Duration: 42 Hrs.**
4 0 0 4

UNIT-I (8 Hrs.)

Exergy Analysis: Concept of exergy, energy analysis for open and closed systems with fixed and moving boundaries, dead state and irreversibility, exergy loss due to mixing of fluids, second law efficiency, exergy analysis for power and refrigerating cycles.

UNIT-II (10 Hrs.)

Real Gases: Assumptions of real gases, equations of state for real gases, compressibility factor, compressibility chart, reduced pressure and temperature, pressure and energy equations using kinetic theory, RMS velocity, equi-partition of energy, mean free path, Maxwell distribution function.

UNIT-III (12 Hrs.)

Thermodynamic Property Relations: Maxwell relations, Clapeyron equation, Clapeyron Clausius equation, Mayer equation, thermodynamic potentials, residual property functions, Helmoholtz and Gibbs functions, Tds equations, Fugacity of gases, thermodynamic properties of homogeneous mixtures, partial molal properties.

UNIT-IV (12 Hrs.)

Reacting Systems and Chemical Equilibrium: Chemical systems, enthalpy of reaction, combustion and formation, 1st and 2nd law analysis of reacting systems, adiabatic flame temperature, fuel cells – types and applications, criteria for chemical equilibrium, Henry and Rault's law, Gibbs phase rule, Hess's law.

Recommended Books

1. A. Bejan, 'Advanced Engineering Thermodynamics', John Wiley and Sons, **2006**.
2. K. Wark, 'Advanced Thermodynamics for Engineers', McGraw Hill, **1994**.
3. O.J. Bevan, & B.J. Juliana, 'Chemical Thermodynamics: Principles and Applications', Elsevier, **2005**.
4. D. Winterbone, & A. Turan, 'Advanced Thermodynamics for Engineers', Butterworth Heinemann, **2015.**

INTERNAL COMBUSTION ENGINES

Subject Code: MMEE8-104 **L T P C** **Duration: 45 Hrs.**
4 0 0 4

UNIT-I (8 Hrs.)

Introduction: Preliminary analysis, cylinder number, size and arrangement, constructional details, thermodynamic properties of fuel-air mixture before and after combustion, deviations of actual cycle from ideal conditions, analysis using combustion charts, two stroke engine scavenging.

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UNIT-II (14 Hrs.)

Fuel Supply Systems: S. I. engines: carburetion multi-jet, Carter, Zenith, Solex carburetors, MPFI, combustion, Ignition systems Gasoline injection, EFI system, MPFI system, electronic control system, injection timing, C.I. engines: in-line injection, rotary injection, electronic diesel injection system and control. Alternate Fuels for IC Engines: Liquid alternative fuels, advantages, potential, problems associated with utilization, vegetable oils, bio-diesel, emulsified fuels, effect on lubricating oils, gaseous alternative fuels, hydrogen, compressed natural gas, liquefied petroleum gas, di-methyl ether, multi-fuel engines.

UNIT-III (12 Hrs.)

Recent Trends in I.C. Engines: Dual-fuel engines, multi-fuel engines, stratified charge engine, Sterling engine, variable compression ratio engine, bench marking, combustion chamber design in SI and CI engines, swirl &inlet ports design, DI models, combustion chambers in S.I. engines, Supercharging, turbo-charging & matching of turbo-charging, friction and lubrication, Performance.

UNIT-IV (11 Hrs.)

Engine Emissions & Control: Air pollution due to IC engines, norms, engine emissions, HC, CO, NOx particulates, other emissions, Emission control methods, exhaust gas recirculation, modern methods.

Simulation Technique: Application of simulation techniques for engine tuning, engine selection parameters,

Recommended Books

1. J.B. Heywood, Internal Combustion Engine Fundamentals, McGraw Hill, **1988**.
2. R. Stone, Introduction to Internal Combustion Engines, MacMillan, **1999**.
3. W. Pulkrabek, Engineering Fundamentals of the Internal Combustion Engine, Prentice Hall, **2007**.
4. R. Ferguson Colin and Allan T. Kirkpatrick, Internal Combustion Engines: Applied Thermal Sciences, John Wiley and Sons, NY, **2000**.
5. C.F. Taylor, The Internal Combustion Engine in Theory and Practice, The MIT Press, **1985**.
6. H. Heisler, Advance Engine Technology, Butter Worth Hienemann, USA, **2000**.

LAB-I

Subject Code: MMEE8-105 **L T P C**
0 0 4 2

One lab /field/industrial oriented project /problem of duration one semester will be allocated to each student related to the subjects taught in 1st semester

FINITE ELEMENT MODELLING

Subject Code: MMET5-156 **L T P C** **Duration: 45 Hrs.**
4 0 0 4

UNIT-I (5 Hrs.)

Introduction: Historical background, basic concept of the finite element method, comparison with finite difference method.

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UNIT-II (15 Hrs.)

Variation Methods: Calculus of variation, Rayleigh-Ritz and Galerkin methods; Finite Element Analysis of 1-D problems: Formulation by different approaches (direct, potential energy and Galerkin); Derivation of elemental equations and their assembly, solution and its post processing, Applications in heat transfer, fluid mechanics and solid mechanics: bending of beams analysis of truss and frame.

UNIT-III (15 Hrs.)

Finite Element Analysis of 2-D problems: Finite element modelling of single variable problems, triangular and rectangular elements; Applications in heat transfer, fluid mechanics and solid mechanics; **Axi-symmetric and 3D bodies**

UNIT-IV (5 Hrs.)

Numerical Considerations: numerical integration, error analysis, meshes refinement. Plane stress and plane strain problems; Bending of plates; Eigen value and time dependent problems.

Recommended Books

1. K. J. Bathe, Finite Element Procedures in Engineering Analysis, Prentice-Hall, Englewood Cliffs, NJ, **1982**.
2. J. N. Reddy, An introduction to the Finite Element Method, **McGraw-Hill, New York, 1993.**
3. C.S. Krishnamoorthy, Finite Element Analysis, Tata McGraw Hill.
4. Finite Element Methods by Chandupatla, Pearson Publications.

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GAS DYNAMICS

Subject Code: MMEE8-157 **L T P C** **Duration: 45 Hrs.**
4 0 0 4

UNIT-I (14 Hrs.)

Fundamental Aspects of Gas Dynamics: Introduction, Isentropic flow in a stream tube, speed of sound, Mach waves; One dimensional Isentropic Flow: Governing equations, stagnation conditions, critical conditions, maximum discharge velocity, isentropic relations, Normal Shock Waves: Shock waves, stationary normal shock waves, normal shock wave relations in terms of Mach number; Oblique Shock Waves: Oblique shock wave relations, reflection of oblique shock waves, interaction of oblique shock waves, conical shock waves;

UNIT-II (11 Hrs.)

Expansion Waves: Prandtl-Meyer flow, reflection and interaction of expansion waves, flow over bodies involving shock and expansion waves; Variable Area Flow**:** Equations for variable area flow, operating characteristics of nozzles, convergent-divergent supersonic diffusers;

UNIT-III (10 Hrs.)

Adiabatic Flow in a Duct with Friction: Flow in a constant area duct, friction factor variations, the Fanno line; Flow with Heat addition or removal: One-dimensional flow in a constant area duct neglecting viscosity, variable area flow with heat addition, one-dimensional constant area flow with both heat exchanger and friction;

UNIT-III (10 Hrs.)

Generalized Quasi One-Dimensional Flow: Governing equations and influence coefficients, solution procedure for generalized flow with and without sonic point; Two-Dimensional Compressible Flow: Governing equations, vorticity considerations, the velocity potential, linearized solutions, linearized subsonic flow, linearized supersonic flow, method of characteristics.

Recommended Books

1. L.D. Landau and E. M. Lifshitz, ‘Fluid Mechanics’.
2. H.W. Liepmann, and A. Roshko, Butter worth Heinemann, **1995**.
3. ‘Elements of Gas Dynamics’, Dover Pub, **2001.**

POWER PLANT ENGINEERING AND INDUSTRIAL UTILITY

Subject Code: MMEE8-158 **L T P C** **Duration: 45 Hrs.**
4 0 0 4

UNIT-I (9 Hrs.)

Introduction: energy sources for generation of electric power, types of power plant-their special features and applications, present status and future trends of energy resources, overview of utility systems, project implementation stages.

UNIT-II (12 Hrs.)

Coal Fired Thermal Power Plant: site selection, plant layout, steam generators, pulverizers and coal feeding, mill rejects, combustion in furnace, coal handling, ash handling, electrostatic precipitators and bag filters, water systems, condensers, cooling towers. Nuclear Power Plant**:** Nuclear fuels, Nuclear energy, main components of nuclear power plants, nuclear reactors-types and applications, radiation shielding, radio-active waste disposal, safety aspects.

UNIT-III (13 Hrs.)

Recent Advancement in Thermal Power Systems: Fluidized Bed Combustion, CFBC, Environmental benefits, IGCC. Energy Economics: Load curves, effect of load on power plant design, methods to meet variable load, load prediction, cost of energy, system optimization, depreciation, tariff methods. Hydroelectric Power Plant**:** Hydroelectric survey, precipitation, run-off, hydrograph, flow duration curve, mass curve, reservoirs and dams and their different types and constructions. Materials Handling: Belt, chain, metallic, pneumatic and slurry conveying, hoppers and silos, feeders.

UNIT-IV (11 Hrs.)

Turbo Machines: Compressors, pumps and fan systems used in power plants, design and selection of components and systems, operating and system characteristics of dynamic machines, conventional and high concentration slurry pumps. Piping, Valves, Control and Instrumentation: Various specifications in the industry, stresses in pipes and thickness calculation criteria, pipe supports, various types of valves and application purpose of each type of valve, fittings and other pipe mounted instruments, overview of control systems.

Recommended Books

1. P.K. Nag, ‘Power Plant Engineering’, McGraw-Hill, **2007**.
2. A.K. Raja, A.P. Srivastava & M. Dwivedi, ‘Power Plant Engineering’, New Age Int., **2006**.
3. C. Elanchezhian, L. Saravankumar, B.V. Ramnath, ‘Power Plant Engineering’, I-K Int., **2007**.
4. T.C. Elliot, K. Chen, R. Swanekamp, ‘Standard Handbook of Power Plant Engineering’, McGraw Hill Education, **1998**.

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COMPUTATIONAL FLUID DYNAMICS

Subject Code: MMEE8-206	**L T P C** **4 0 0 4**	**Duration: 40 Hrs.**

UNIT-I (5 Hrs.)

Introduction: History of CFD; Comparison of the three basic approaches in engineering problem solving – Analytical, Experimental and Computational Methods. Recent Advances in Computational Techniques.

UNIT-II (12 Hrs.)

Problem Formulation: The standard procedure for formulating a problem Physical and Mathematical classification of problems; Types of governing Differential equations and Boundary conditions. Methods of Discretization: Basics of Finite Difference Method; Finite Element Method, Finite volume Method and Spectral Method. Treatment of Boundary Condition.

UNIT-III (10 Hrs.)

Numerical Solution to Heat Conduction Problems: Steady-state Problems: (i) One-dimensional Heat Conduction Transfer through a Pin-fin (ii) Two-dimensional Conduction through a plate Unsteady-state Problem: One dimensional Transient Heat Conduction. Explicit and Implicit Methods, Stability of numerical Methods.

UNIT-IV (13 Hrs.)

Numerical Solution to Fluid Flow Problems Types of fluid flow and their governing equations: Viscous Incompressible Flows Calculation of flow field using the stream function-vorticity method; Calculation of boundary layer flow over a flat plate; Numerical algorithms for solving complete NavierStokes equations- MAC method; SIMPLE algorithm; Project problem.

Recommended Books:

1. Suhas V. Patankar, ‘Numerical Heat Transfer and Fluid Flow’, Taylor & Francis.
2. J. Anderson, ‘Computational Fluid Dynamics’.

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FUELS AND COMBUSTIONS

Subject Code: MMEE8-207	**L T P C** **4 0 0 4**	**Duration: 39 Hrs.**

UNIT-I (10 Hrs.)

Fuels: Introduction and Classification.

Solid Fuels: Coal and its classification, composition of coal, analysis and properties of coal, natural coke, oxidation and hydrogenation of coal, processing of solid fuels: coal preparation, coal storage, coal carbonization and gasification, briquetting, gasification and liquefaction of solid fuels.

UNIT-II (11 Hrs.)

Liquid Fuels: Petroleum-origin and production, composition and classification of petroleum, processing of petroleum, properties of various petroleum products, petroleum refining, liquid fuels from sources other than petroleum.

Gaseous Fuels: Natural Gas, methane from coal mines, producer gas, water gas, coal gas, blast furnace gas, refinery gases, LPG, cleaning and purification of gaseous fuels, biomass gasification.

UNIT-III (10 Hrs.)

Combustion: Principles of combustion, combustion of oil, coal and gas, combustion equations, stoichiometric fuel air ratio, exhaust and flue gas analysis, practical analysis of combustion products, dissociation, internal energy and enthalpy of reaction, enthalpy of formation, calorific value of fuels, air and fuel-vapour mixtures, heat balance sheet of a boiler, boiler draft, design of chimney.

UNIT-IV (08 Hrs.)

Combustion Related Pollution: Sources and effects - acid rain, smog, greenhouse gases and effect, air sampling and measurement, pollutants: classification, monitoring and control, control equipment viz. (mechanical collectors, wet scrubbers, and ESP)

Recommended Books:

1. S. Sarkar, 'Fuels and Combustion', Orient Longman, **1989**.
2. T.D. Eastop and A. McConkey, 'Applied Thermodynamics', Dorling Kingsley, **2008**.
3. I. Glassman, 'Combustion', Academic Press, **2008**.
4. L. Theodore, 'Air Pollution Control Equipment Calculations', John Wiley, **2008**.

WELDING TECHNOLOGY

Subject Code: MMEE8-208	**L T P C** **4 0 0 4**	**Duration: 40 Hrs.**

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UNIT-I (09 Hrs.)

Introduction: Basic classification of welding processes, weldability, weld thermal cycle, metallurgy of fusion welds, solidification mechanism and microstructural products in weld metal, epitaxial, cellular and dendritic solidification, metallurgical changes in weld metal, phase transformation during cooling of weld metal in carbon and low alloy steel, prediction of microstructures and properties of weld metal. Heat affected zone, re-crystallization and grain growth of HAZ, gas metal reaction, effects of alloying elements on welding of ferrous metals.

UNIT-II (10 Hrs.)

Welding Arc: Arc efficiency, temperature distribution in the arc; arc forces, arc blow, electrical characteristics of an arc, mechanism of arc initiation and maintenance, role of electrode polarity on arc behaviour and arc stability, analysis of the arc

Coated Electrodes: Electrode coatings, classification of coatings of electrodes for SMAW, SAW fluxes, role of flux ingradients and shielding gases, classification of solid and flux code wires,

UNIT-III (11 Hrs.)

Fusion Welding reviews: Critical reviews of manual metal arc welding (MMAW) GTAW, GMAW, FCAW and CO welding processes, plasma arc, submerged arc welding, electro gas and electro slag welding, analysis of the process.

Welding power sources: Arc welding power sources basic charters tics of power sources for various arc welding processes, duty cycles, AC, DC welding power source, DC rectifiers, thyristor controlled rectifiers, transistorized units, inverter systems. Arc length regulation in mechanized welding processes,

UNIT-IV (10 Hrs.)

Metal Transfer and Melting Rate: Mechanism and types of metal transfer, forces affecting metal transfer, modes of metal transfer, metal transfer in various welding processes, effective of polarity on metal transfer and melting rate.

Solid State Welding: Theory and mechanism of solid state welding. Techniques and scope of friction welding, diffusion welding, cold pressure welding and ultrasonic welding. High energy rate welding. Analysis of the Process.

Recommended Books:

1. R.S. Parmar, 'Welding Processes & Technology', Khanna Publishers.
2. R.S. Parmar, 'Welding Engineering & Technology', Khanna Publishers.
3. S.V. Nandkarni, 'Modern Arc Welding Technology', Oxford & IDH Publishing Co.

APPLIED SOLAR ENERGY

Subject Code: MMEE8-209 **L T P C** **Duration: 41 Hrs.**
4 0 0 4

UNIT-I (10 Hrs.)

Solar Radiation: Solar constant, solar angles and basic definitions, extraterrestrial and terrestrial solar radiation, solar time, local standard time, equation of time.

Solar Radiation Measurement and Estimation: Measurement of solar radiation using pyranometer and pyrheliometer, sunshine recorder, atmospheric attenuation of solar radiation, estimation of average solar radiation using empirical equations.

UNIT-II (11 Hrs.)

Radiation Transmission through Glazing: Reflection and absorption by glazing, optical properties of glass cover system, transmittance for diffuse radiation, transmittance-absorbance product, effects of surface layers on transmittance.

Flat Plate Collectors: Description of flat plate collectors, liquid heating collectors, air heating collectors, collector overall heat loss coefficient, collector efficiency factor, collector heat removal factor, flow factor, thermal and thermohydraulic performance of flat plate collector.

UNIT-III (10 Hrs.)

Concentrating Collectors: Types of concentrating collectors, geometry of concentrating collectors, concentration ratio, thermal performance of concentrating collectors.

Evacuated Tube Collector (ETC): Description and working principle of ETC systems. construction details of ETC, selection and installation of ETC systems, performance parameter tests of ETC systems.

UNIT-IV (10 Hrs.)

Solar Still: Basics of solar still and solar distillation, types of solar stills, single effect and multiple effect solar stills, design of solar still, heat and mass transfer analysis for basin type solar still.

Solar Energy Storage: Packed bed storage, phase change energy storage, chemical energy storage, solar ponds.

Recommended Books:

1. J.A. Duffie and W.A. Beckmann, 'Solar Engineering of Thermal Processes', John Wiley & Sons, **2006**.
2. D.Y. Goswami, F. Kreith and J. Kreider, 'Principles of Solar Energy', Taylor & Francis, **2003**.

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3. A.S. Kalogirou, 'Solar Energy Engineering: Processes and Systems', Academic Press Inc., **2014**.
4. S. Sukhatma and J. Nayak, 'Solar Energy Principle of Thermal Collection and Storage', McGraw-Hill, **2009**.
5. H.P. Garg and J. Prakash, 'Solar Energy: Fundamentals and Applications', Tata McGraw Hill, **2000**.

LAB-II

Subject Code: MMEE8-210 **L T P C**
0 0 2 1

One lab /field/industrial oriented project /problem will be allocated to each student related to the subjects related to the subjects taught in 2nd Semester.

REFRIGERATION & AIR CONDITIONING

Subject Code: MMEE8-259 **L T P C** **Duration: 42 Hrs.**
4 0 0 4

UNIT-I (10 Hrs.)

Refrigerants: Classification of refrigerants, refrigerant properties, secondary refrigerants, ozone depletion potential and global warming potential of CFC refrigerants, eco-friendly refrigerants, azeotropic and zeotropic refrigerants.

Vapour Compression System: Multiple evaporator and compressor systems, cascade systems, manufacture of solid carbon oxide (Dry Ice).

UNIT-II (11 Hrs.)

System Components and Accessories: Types of evaporators, compressors, condensers, expansion devices, driers/ filters, receiver, accumulator, functional aspects of the above components & accessories, System equilibrium and cycling controls, capacity control in compressors.

Vapor Absorption System: Aqua ammonia & Li-Br systems, temperature-concentration diagram and enthalpy-concentration diagram for binary mixtures, thermodynamic analysis of aqua ammonia & Li-Br systems using enthalpy-concentration charts.

UNIT-III (10 Hrs.)

Steam Jet Refrigeration System: Principle and working of steam jet refrigeration system, performance analysis of steam jet refrigeration system.

Air Conditioning: Applied psychrometry, psychometric processes using chart.

Ventilation and Infiltration: Requirement of ventilation air, various sources of infiltration air, ventilation and infiltration as a part of cooling load.

UNIT-IV (11 Hrs.)

Load Estimation: Inside and outside design conditions, study of various sources of the internal and external heat gains, heat losses, equivalent temperature difference method for heat load calculations, RSHF, GSHF, ESHF, etc.

Air Distribution: Fundamentals of air flow in ducts, pressure drop calculations, design of ducts by velocity reduction method, equal friction method and static regain method, duct materials and properties, insulating materials, types of grills, diffusers.

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Recommended Books:
1. R.J. Dossat, 'Principles of Refrigeration', Dorling Kingsley, **2008**.
2. W.F. Stoecker, 'Refrigeration and Air Conditioning', McGraw Hill, **1986**.
3. W.B. Goshnay, 'Principles and Refrigeration', 'Cambridge University Press', **1982.**
4. B.C. Langley, 'Solid State Electronic Controls for HVACR', Prentice Hall, **1989**.
5. S.C. Arora and S. Domkundwar, 'A Course in Refrigeration and Air Conditioning', **1997**.

STATISTICAL METHODS & ALGORITHMS

Subject Code: MMEE8-260 **L T P C** **Duration: 41 Hrs.**
4 0 0 4

UNIT-I (10 Hrs.)

Introduction: Nature and objectives of research, Study and formulation of research problem. Scope and formulation of hypothesis. Preparation and presentation of research proposal using statistical package.

Review of Probability: Appraisal of axiomatic approach of probability, Conditional probability, Baye's rule, Conditional distributions, and conditional expectations.

UNIT-II (11 Hrs.)

Markov Chains: Basics of markov chains, Finite state space, Markov chains, Transition and stationary markov chains. Continuous time markov process: continuous time branching processes, Kolmogorov, Forward and backward equations, Pure birth, Pure death, Birth and death process.

Analysis of Variance: One Way Classification: ANOVA for fixed effect model, ANOVA for Random Effect Model, Two-way Classification (one observation per cell): ANOVA for fixed effect model, ANOVA for Random Effect Model.

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UNIT-III (11 Hrs.)

Design of Experiments: Completely Randomized Design, Randomized Block Design, Latin Square Design, their statistical analysis and variance of estimates, Analysis of Covariance.

Multivariate Data Analysis: Introduction, multivariate normal distributions, Mean vector, Variance-covariance matrix, Correlation matrix and their estimation for multivariate data., Step wise regression, Selection of best set of variables, Classification and discrimination problems. Factor analysis and principal component analysis. Illustrative examples and Multivariate data analysis using statistical package.

UNIT-IV (09 Hrs.)

Time Series and Forecasting: Components of time series, Analysis of time series, Measurement of trend, Measurement of seasonal variations, Measurement of cyclic variations, Auto-Regression Analysis, Auto-correlation, Random component in time series

Recommended Books:
1. J. Medhi, 'Stochastic Processes', New Age International, **2005**.
2. Montgomery, 'Introduction to Statistical Quality Control', John Wiley and Sons.

BOUNDARY LAYER THEORY

Subject Code: MMEE8-261 **L T P C** **Duration: 39 Hrs.**
4 0 0 4

UNIT-I (10 Hrs.)

BASIC CONCEPTS OF VISCOUS FLOWS: Viscous flow characteristics, introduction to hydrodynamic and thermal boundary layer theory, governing equations with effect of viscosity, flow over the flat plate at zero incidences, boundary layer thickness, displacement thickness, momentum thickness, energy thickness, boundary layer equation and their general properties.

UNIT-II (11 Hrs.)

THERMAL BOUNDARY LAYERS: Heat transfer from heated surface. Heat transfer from cold surface, thermal boundary layer growth over the hot and cold surface, flow over the flat plate with different flow conditions with heat transfer, exact and approximate solutions to thermal boundary layer flows, relation between thermal and hydrodynamic boundary layer theories, Reynolds analogy and Colburn analogy, non-dimensional numbers governing boundary layer flows,

UNIT-III (09 Hrs.)

TRANSITION: Pipe flow and flow over a flat plate, critical Reynolds number, turbulent spots, principles of theory of stability of Laminar flows, Summerfield equation, factors effecting transition, Laminar aero foils.

UNIT-IV (09 Hrs.)

BOUNDARY LAYER CONTROL: Need of boundary layer control, causes of boundary layer separation, flow over the cylinder and aerofoil for different flow conditions leads separation

Recommended Books:

1. Bansal, ‘Fluid Mechanics’.
2. R.K. Rajput, ‘Heat Transfer’.
3. Deward Shaughnessy, ‘Introduction to Fluid Mechanics’.
4. H. Schlichting, ‘Boundary Layer Theory’.

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TOTAL QUALITY MANAGEMENT

Subject Code: MMEE8-311 **L T P C** **Duration: 44 Hrs.**
4 0 0 4

UNIT-I (8 Hrs.)

Quality Concepts

Evolution of Quality control, concept change, TQM Modern concept, Quality concept in design, Review off design, Evolution of proto type. Control on Purchased Product Procurement of various products, evaluation of supplies, capacity verification, Development of sources, procurement procedure.

UNIT-II (12 Hrs.)

Manufacturing Quality

Methods and Techniques for manufacture, Inspection and control of product, Quality in sales and services, Guarantee, analysis of claims. Quality Management, Organization structure and design, Quality function, decentralization, Designing and fitting organization for different types products and company, Economics of quality value and contribution, Quality cost, optimizing quality cost, seduction programme.

UNIT-III (12 Hrs.)

Human Factor in Quality

Attitude of top management, co-operation, of groups, operator's attitude, responsibility, causes of operator's error and corrective methods. Control Charts Theory of control charts, measurement range, construction and analysis of R charts, process capability study, use of control charts.

Attributes of Control Charts

Defects, construction and analysis off-chart, improvement by control chart, variable sample size, construction and analysis of C-chart.

UNIT-IV (12 Hrs.)

Defects Diagnosis and Prevention

Defect study, identification and analysis of defects, corrective measure, factors affecting reliability, MTTF, calculation of reliability, Building reliability in the product, evaluation of reliability, interpretation of test results, reliability control, maintainability, zero defects, quality circle.

IS0-9000 and its concept of Quality Management:

ISO 9000 series, Taguchi method, JIT in some details

Recommended Books:

1. H. LaI, 'Total Quality Management', Wiley Eastern Ltd., **1990**.
2. Greg Bounds, 'Beyond Total Quality Management'. McGraw Hill, **1994**.
3. H.G, 'TQM in New Product Manufacturing', McGraw Hill.

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MAINTENANCE & RELIABILITY ENGINEERING

Subject Code: MMEE8-312 **L T P C** **Duration: 41 Hrs.**
4 0 0 4

UNIT I (10 Hrs.)

Evolution of maintenance, objective of maintenance, maintenance policies and philosophies, maintenance concept, maintenance management & terotechnology, relationship with functional areas, importance of maintenance, elements of good maintenance, Economics of maintenance, training and safety aspects in maintenance.

UNIT II (08 Hrs.)

Classification of maintenance programs, corrective preventive and predictive maintenance, comparison of maintenance programs, preventive maintenance- concepts, functions, benefits, limitations.

UNIT III (11 Hrs.)

Spare and Inventory planning, Manpower planning, Maintenance performance and Maintenance Auditing. Reliability centered maintenance (RCM) RCM logic, benefits of RCM, introduction to Total productive maintenance (TPM), Objectives, key supporting elements of TPM, methodology, evaluation and benefits.

UNIT IV (12 Hrs.)

Introduction to Reliability systems - series, parallel and hybrid systems, Techniques for improvement of operational reliability, Reliability calculations, and availability of machines and production systems, maintainability criteria, checklist to assess the maintainability of a system, maintainability programs, objectives, key issues in availability improvements program, fault diagnosis, Pareto principle Ishikawa diagram, Failure Distribution-Constant failure rate, Weiball analysis etc.

Recommended Books:

1. S.O. Duffuaa and A. Raouf, 'Planning and Control of Maintenance Systems: Modeling and Analysis', John Wiley Inc.,**1999**.
2. L.R. Higgin, 'Maintenance Planning and Control', McGraw- Hill Book Co., **1990**.
3. Kelly Anthony, 'Maintenance Planning and Control', East West Press Private Ltd., New Delhi, **1991**.
4. B.S. Blanchard and E.E. Lowey, 'Maintainability Principle and Practices', McGraw Hill Book.
5. Niebel Benjamin W. 'Engineering Maintenance Management', Marcel Dekker, **1994**.

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M.TECH. INFORMATION TECHNOLOGY

Total Contact Hours = 24 **Total Marks = 600** **Total Credits = 22**

SEMESTER 1st		Contact Hrs			Marks			Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
MITE2-101	Information Security	3	1	0	40	60	100	4
MITE2-102	Advance Database Systems	3	1	0	40	60	100	4
MITE2-103	Network Security	3	1	0	40	60	100	4
MITE2-104	Research Lab. - I	0	0	4	60	40	100	2
Departmental Elective – I (Select any one)		3	1	0	40	60	100	4
MITE2-156	Mobile Computing							
MITE2-157	Mobile Application Development							
MITE2-158	Real Time & Embedded Systems							
Departmental Elective – II (Select any one)		3	1	0	40	60	100	4
MITE2-159	Advance Software Engineering							
MITE2-160	Object Oriented Analysis & Design							
MITE2-161	Advanced Internet & Web Technologies							
Total	**Theory = 5 Lab = 1**	**15**	**5**	**4**	**260**	**340**	**600**	**22**

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Total Contact Hours = 24 **Total Marks = 600** **Total Credits = 22**

SEMESTER 2nd		Contact Hrs			Marks			Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
MITE2-205	Advanced Operating System	3	1	0	40	60	100	4
MITE2-206	Distributed System	3	1	0	40	60	100	4
MITE2-207	Advanced Operating System Lab.	0	0	4	60	40	100	2
Departmental Elective – III (Select any one)		3	1	0	40	60	100	4
MITE2- 262	Big Data							
MITE2-263	Cloud Computing							
MITE2-264	Virtualization and Cloud Security							
Departmental Elective – IV (Select any one)		3	1	0	40	60	100	4
MITE2-265	Data warehousing & Data Mining							
MITE2-266	Adhoc & Sensor Networks							
MITE2-267	Enterprise Response Planning							
Open Elective-I		3	1	0	40	60	100	4
Total	**Theory = 5 Lab = 1**	**15**	**5**	**4**	**260**	**340**	**600**	**22**

Total Contact Hours = 15 **Total Marks = 500** **Total Credits = 26**

SEMESTER 3rd		**Contact Hrs**			**Marks**			**Credits**
Subject Code	**Subject Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
MITE2-308	Professional Skills - I	3	1	0	40	60	100	4
MITE2-309	Project	0	0	0	60	40	100	10
MITE2-310	Seminar	0	0	2	60	40	100	4
Departmental Elective –V (Select any one)		3	1	0	40	60	100	4
MITE2-368	Soft Computing							
MITE2-369	Digital Image Processing							
MITE2-370	Parallel Computing							
Open Elective – II		3	1	0	40	60	100	4
Total	**Theory = 3**	**9**	**3**	**2**	**240**	**260**	**500**	**26**

Total Credits = 20

SEMESTER 4th		**Contact Hrs**			**Evaluation Criteria**	**Credits**
Subject Code	**Subject Name**	**L**	**T**	**P**	**Satisfactory/ Unsatisfactory**	
MITE2-411	Thesis	0	0	0		20

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Overall

Semester	**Marks**	**Credits**
1st	600	22
2nd	600	22
3rd	500	26
4th	---	20
Total	**1700**	**90**

INFORMATION SECURITY

Subject Code – MITE2- 101 **L T P C** **Duration – 45 Hrs.**
3 1 0 4

UNIT-I (12 Hrs.)

Topics in Elementary Number Theory: O and Ω notations – Time Estimates for Doing Arithmetic – Divisibility and The Euclidean Algorithm – Congruence: Definitions and Properties – Linear congruence, Residue Classes, Euler's Phi Function – Fermat's Little Theorem – Chinese Remainder Theorem – Applications to Factoring – Finite Fields – Quadratic Residues and Reciprocity: Quadratic residues – Legendre Symbol – Jacobi symbol.

UNIT-II (11 Hrs.)

Simple Cryptosystems: Enciphering Matrices – Encryption Schemes – Symmetric and Asymmetric Cryptosystems – Cryptanalysis – Block ciphers –Use of Block Ciphers – Multiple Encryption – Stream Ciphers –Affine cipher – Vigenere, Hill and Permutation Cipher – Secure Cryptosystem

UNIT-III (10 Hrs.)

Public Key Cryptosystems: The Idea of Public Key Cryptography – The Diffie–Hellman Key Agreement Protocol - RSA Cryptosystem – Bit security of RSA – ElGamal Encryption - Discrete Logarithm – Knapsack problem – Zero-Knowledge Protocols – From Cryptography to Communication Security - Oblivious Transfer.

UNIT-IV (12 Hrs.)

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Primality and Factoring: Pseudo primes – The Rho (Γ) Method – Format Factorization and Factor Bases – The Continued Fraction Method – The Quadratic Seieve Method. Number Theory and Algebraic Geometry: Elliptic Curves – Basic Facts – Elliptic Curve Cryptosystems – Elliptic Curve Primality Test – Elliptic Curve Factorization. Note: Theorem Proofs are excluded for Examination but The Statements of the Theorems and Solving Problems Are Included.

Recommended Books

1. Neal Koblitz, 'A Course in Number Theory and Cryptography', 2nd Edn., Springer, **2002.**
2. Johannes A. Buchman, 'Introduction to Cryptography', 2nd Edn., Springer, **2004.**
3. Serge Vaudenay, 'Classical Introduction to Cryptography – Applications for Communication Security', Springer, **2006.**
4. Victor Shoup, 'A Computational Introduction to Number Theory and Algebra', Cambridge University Press, **2005.**
5. A. Manezes, P. Van Oorschot and S. Vanstone, 'Hand Book of Applied Cryptography', CRC Press, **1996.**
6. S.C. Coutinho, 'The Mathematics of Ciphers – Number Theory and RSA Cryptography', A.K. Peters, Natick, Massachusetts, **1998.**

ADVANCED DATABASE SYSTEM

Subject Code – MITE2-102 **L T P C** **Duration - 45 Hrs.**
3 1 0 4

UNIT-I (12 Hrs.)

Parallel Databases: Database System Architectures: Centralized and Client-Server Architectures – Server System Architectures – Parallel Systems- Distributed Systems – Parallel Databases: I/O Parallelism – Inter and Intra Query Parallelism – Inter and Intra Operation Parallelism – Case Studies.

UNIT-II (13 Hrs.)

Object Oriented Database: Object Oriented Databases – Introduction – Weakness of RDBMS – Object Oriented Concepts Storing Objects in Relational Databases – Next Generation Database Systems – Object Oriented Data models – OODBMS Perspectives – Persistence – Issues in OODBMS – Object Oriented Database Management System Manifesto – Advantages and Disadvantages of OODBMS – Object Oriented Database Design – OODBMS Standards and Systems – Object Management Group – Object Database Standard ODMG – Object Relational DBMS –Postgres - Comparison of ORDBMS and OODBMS.

UNIT-III (11 Hrs.)

Web Database: Web Technology and DBMS – Introduction – The Web – The Web as a Database Application Platform – Scripting languages – Common Gateway Interface – HTTP Cookies – Extending the Web Server – Java – Microsoft's Web Solution Platform– Oracle Internet Platform – Semi structured Data and XML – XML Related Technologies – XML Query Languages.

UNIT-IV (10 Hrs.)

Intelligent Database: Enhanced Data Models for Advanced Applications – Active Database Concepts and Triggers – Temporal Database Concepts – Deductive databases – Knowledge Databases. **Current Trends:** Mobile Database – Geographic Information Systems – Genome Data Management – Multimedia Database – Parallel Database – Spatial Databases - Database administration – Data Warehousing and Data Mining.

Recommended Books

1. Thomas M. Connolly, Carolyn E. Begg, 'Database Systems - A Practical Approach to Design, Implementation, and Management', 3rd Edn., Pearson Education, **2003.**
2. Ramez Elmasri & Shamkant B. Navathe, 'Fundamentals of Database Systems', 4th Edn., Pearson Education, **2004.**
3. Tamer Ozsu M., Patrick Ualduriel, 'Principles of Distributed Database Systems', 2nd Edn., Pearson Education, **2003.**
4. C.S.R. Prabhu, 'Object Oriented Database Systems', PHI, **2003.**
5. Peter Rob and Corlos Coronel, 'Database Systems – Design, Implementation and Management'.

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NETWORK SECURITY

Subject Code – MITE2 - 103 **L T P C** **Duration – 45 Hrs.**
3 1 0 4

UNIT-I (12 Hrs.)

Overview of Computer Networks, Seven-Layer Architecture, TCP/IP Suite of Protocols, Etc. MAC Protocols for High-Speed LANS, MANS and Wireless Lans, Introduction to Security in Networks, Intrusion Kinds of Security Breaches, Points of Vulnerability, Methods of Defense, Control Measures, Effectiveness of Controls.

UNIT-II (12 Hrs.)

Basics of Encryption and Decryption, Encryption Techniques, Characteristics of Good Encryption Systems, Secret Key Cryptography, Data Encryption Standard, International Data Encryption Algorithm, Advanced Encryption Standard, Hash and MAC Algorithms.

UNIT-III (10 Hrs.)

Public Key Encryptions, Introduction to Number Theory, RSA Algorithm, Diffie-Hellman, Digital Signature Standard, Elliptic Curve Cryptography, Digital Signatures and Authentication, Trusted Intermediaries, Security Handshake Pitfalls.

UNIT-IV (11 Hrs.)

Secure Sockets, Ipsec Overview, IP Security Architecture, Ipsec-Internet Key Exchanging (IKE), IKE Phases, Encoding, Internet Security, Threats to Privacy, Packet Sniffing, Spoofing, Web Security Requirements, Real Time Communication Security, Security Standards, Kerberos, X.509 Authentication Service. Security Protocols - Transport Layer Protocols, SSL, Electronic Mail Security, PEM and S/MIME Security Protocol, Pretty Good Privacy. Web Security, Firewalls Design Principles, Trusted Systems, Electronic Payment Protocols, Intrusion Detection, Password Management, Viruses and Related Threats, Virus Counter Measures, Virtual Private Networks.

Recommended Books

1. William Stallings, ‘Cryptography and Network Security: Principles and Standards’, 3rd Edn., Prentice Hall India, **2003.**
2. Charlie Kaufman, Radia Perlman and Mike Speciner, ‘Network Security: Private Communication in a public world’, 2nd Edn., Prentice Hall India, **2002.**
3. Charles P. Pleeger, ‘Security in Computing’, 5th Edn., Pearson Education Asia, **2001**.
4. William Stallings, ‘Network Security Essentials: Applications and standards’, Pearson Education Asia, **2000.**

MOBILE COMPUTING

Subject Code – MITE2 - 156 **L T P C** **Duration - 45 Hrs.**
3 1 0 4

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UNIT-I (10 Hrs.)

Introduction: Mobile Communications, Mobile Computing – Paradigm, Promises/Novel Applications and Impediments and Architecture; Mobile and Handheld Devices, Limitations of Mobile and Handheld Devices. GSM – Services, System Architecture, Radio Interfaces, Protocols, Localization, Calling, Handover, Security, New Data Services, GPRS, CSHSD, DECT.

UNIT-II (12 Hrs.)

(Wireless) Medium Access Control (MAC): Motivation for a specialized MAC (Hidden and exposed terminals, Near and far terminals), SDMA, FDMA, TDMA, CDMA, Wireless LAN/(IEEE 802.11) **Mobile Network Layer:** IP and Mobile IP Network Layers, Packet Delivery and Handover Management, Location Management, Registration, Tunnelling and Encapsulation, Route Optimization, DHCP.

UNIT-III (10 Hrs.)

Mobile Transport Layer: Conventional TCP/IP Protocols, Indirect TCP, Snooping TCP, Mobile TCP, Other Transport Layer Protocols for Mobile Networks. **Database Issues:** Database Hoarding & Caching Techniques, Client- Server Computing & Adaptation, Transactional Models, Query processing, Data Recovery Process & QoS Issues.

UNIT-IV (13 Hrs.)

Data Dissemination and Synchronization: Communications Asymmetry, Classification of Data Delivery Mechanisms, Data Dissemination, Broadcast Models, Selective Tuning and Indexing Methods, Data Synchronization – Introduction, Software, and Protocols **Mobile Ad hoc Networks (MANETs):** Introduction, Applications & Challenges of a MANET, Routing, Classification of Routing Algorithms, Algorithms such as DSR, AODV, DSDV, Mobile Agents, Service Discovery. **Protocols and Platforms for Mobile Computing:** WAP, Bluetooth, XML, J2ME, Java Card, Palm OS, Windows CE, Symbian OS, Linux for Mobile Devices, Android.

Recommended Books

1. Jochen Schiller, ‘Mobile Communications’, 2nd Edn., Addison Wesely, Pearson Education.
2. Raj Kamal, ‘Mobile Computing’, Oxford University Press, **2007.**
3. Mazliza Othman, ‘Principles of Mobile Computing and Communications:’, Auerbach Publications.
4. William Stallings, ‘Wireless Communications and Networks', Prentice Hall, **2005.**
5. M. Richharia, ‘Mobile Satellite Communication: Principles and Trends', Pearson Education.

MOBILE APPLICATION DEVELOPMENT

Subject Code – MITE2-157
L T P C
3 1 0 4
Duration - 45 Hrs.

UNIT-I (10 Hrs.)

Introduction: Mobile Development Importance, Survey of mobile based application development, Mobile myths, third party frameworks, Mobile Web Presence and Applications, creating consumable web services for mobile, JSON, Debugging Web Services, Mobile Web Sites, Starting with Android mobile Applications.

UNIT-II (13 Hrs.)

Mobile Web: Introduction, WAP1, WAP2, Fragmentation Display, Input Methods, Browsers and Web Platforms, Tools for Mobile Web Development. **Application Architectures and Designs:** Mobile Strategy, Navigation, Design and User Experience, WML, XHTML Mobile Basics, Mobile HTML5, CSS for Mobile, WCSS extensions, CSS3, CSS for mobile browsers, HTML5 Compatibility levels, Basics of Mobile **HTML5:** Document Head, Document Body, HTML5 Mobile Boilerplate, the Content, HTML5 Forms: Design, Elements, Attributes, Validation.

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UNIT-III (10 Hrs.)

Devices, Images, Multi-Media: Device Detection, Client-side Detection, Server-side Detection, Device Interaction, Images, Video, Audio, Debugging and Performance, Content Delivery, Native and Installed Web Apps.

UNIT-IV (12 Hrs.)

Advanced Tools & Techniques: J2ME programming basics, HTML5 Script Extensions, Code Execution, Cloud based browsers, JS Debugging and profiling, Background Execution, Supported Technologies and API, Standard JavaScript Behaviour, Java Libraries, Mobile Libraries, UI Frameworks: Sencha Touch, JQuery Mobile, Enyo, Montage, iUI, jQTouch, JavaScript Mobile UI Pattern **Advanced Applications:** Geolocation and Maps app, Online Apps, Storage, and Networks, Distribution and Social Web 2.0

Recommended Books

1. Jeff McWherter, Scott Gowell, ‘Professional Mobile Application Development’, John Wiley & Sons.
2. Maximiliano Firtman, ‘Programming the mobile Web’, 2nd Edn., Oreilly, **2013.**
3. ‘Digital Content’: http://en.wikibooks.org/wiki/Category: J2ME Programming.
4. ‘Android Studio Development Essentials’, Ref: http://www.techotopia.com/.

REAL TIME & EMBEDDED SYSTEMS

Subject Code – MITE2-158 **L T P C** **Duration - 45 Hrs.**
3 1 0 4

UNIT-I (12 Hrs.)

Introduction to Embedded Systems: Definition of Embedded System, Embedded Systems Vs General Computing Systems, History of Embedded Systems, Classification, Major Application Areas, Purpose of Embedded Systems, Characteristics and Quality Attributes of Embedded Systems, Design cycle in the development phase for an embedded system, Use of software tools for development of an ES.

UNIT-II (12 Hrs.)

Typical Embedded System: Core of the Embedded System: General Purpose and Domain Specific Processors, ASICs, PLDs, Commercial Off-The-Shelf Components (COTS), Memory: ROM, RAM, Memory according to the type of Interface, Memory Shadowing, Memory selection for Embedded Systems, Sensors and Actuators, Communication Interface: On board and External Communication Interfaces.

UNIT-III (11 Hrs.)

Embedded Firmware: Reset Circuit, Brown-out Protection Circuit, Oscillator Unit, Real Time Clock, Watchdog Timer, Embedded Firmware Design Approaches and Development Languages. **RTOS Based Embedded System Design:** Operating System Basics, Types of Operating Systems, Tasks, Process and Threads, Multiprocessing and Multitasking, Task Scheduling.

UNIT-IV (10 Hrs.)

Task Communication: Shared Memory, Message Passing, Remote Procedure Call and Sockets, Task Synchronization: Task Communication/Synchronization Issues, Task Synchronization Techniques, Device Drivers, how to Choose an RTOS.

Recommended Books

1. K.V. Shibu, 'Introduction to Embedded Systems', McGraw Hill Publications.
2. Raj Kamal, 'Embedded Systems', Tata McGraw Hill.
3. Frank Vahid, Tony Givargis, 'Embedded System Design', John Wiley.
4. Lyla, 'Embedded Systems', Pearson Education, **2013.**
5. David E. Simon, 'An Embedded Software Primer', Pearson Education.

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ADVANCED SOFTWARE ENGINEERING

Subject Code – MITE2-159 **L T P C** **Duration - 45 Hrs.**
3 1 0 4

UNIT-I (12 Hrs.)

Principles and Motivations: History, Definitions; Engineering Approaches to Software Development: Software Development Process Models from The Points of View of Technical Development and Project Management: Waterfall, Rapid Prototyping, Incremental Development, Spiral Models, Agile Software Development, Emphasis on Computer-Assisted Environments. Selection of Appropriate Development Process.

Software Development Methods: Formal, Semi-Formal and Informal Methods; Requirements elicitation, requirements specification; Data, Function and Event Based Modelling; Some of the popular methodologies such as Your dons SAD, SSADM etc; CASE Tools-Classification, Features, Strengths and Weaknesses; ICASE; CASE standards.

UNIT-II (11 Hrs.)

Software Project Management: Principles of Software Projects Management; Organizational and Team Structure; Project Planning; Project Initiation and Project Termination, Technical, Quality, and Management Plans; Project Control; Cost Estimation Methods: Function Points and COCOMO.

UNIT-III (11 Hrs.)

Software Quality Management: Quality Control, Quality Assurance and Quality Standards with Emphasis on ISO 9000; Functions of Software QA Organization in A Project; Interactions with Developers; Quality Plans, Quality Assurance Towards Quality Improvement; Role of Independent Verification & Validation; Total Quality Management; SEI Maturity Model; Software Metrics.

UNIT-IV (11 Hrs.)

Configuration Management: Need for Configuration Management; Configuration Management Functions and Activities; Configuration Management Techniques; Examples and Case Studies. **Software Testing Fundamentals**: Basic Terminology, Testing Techniques and Strategies. Brief Introduction to Various Standards Related to Software Engineering.

Recommended Book

1. Roger Pressman, ‘Software Engineering - A Practitioners Approach’, McGraw Hill.
2. Ian Sommerville, ‘Software Engineering’, Addison-Wesley Publishing Company.
3. James F. Peter, Software Engineering - An Engineering Approach, John Wiley.
4. Pankaj Jalote, ‘An integrated Approach to Software Engineering’, Narosa.

OBJECT ORIENTED ANALYSIS AND DESIGN

Subject Code: MITE2-160	**L T P C** **3 1 0 4**	**Duration: 45 Hrs.**

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Learning Objectives

To give students the detailed knowledge about Objects, Classes, types of modelling and detailed system design students will also come across the comparison of different methodologies.

Learning Outcomes

CO1 Understanding Objects and classes and concept of generalization and inheritance
CO2 Learning Dynamic modelling and various functional models
CO3 Understanding system design and Object design
CO4 Comparing various methodologies and their implementation

UNIT-I (11 Hrs.)

Introduction to Object: Object Orientation, Development, Modelling, Object Modelling technique. Objects and classes, Links and Association, Generalization and inheritance, Grouping constructs, Aggregation, Abstract Classes, Generalization as extension and restriction, multiple inheritance, Meta data, Candidate keys, Constraints.

UNIT-II (12 Hrs.)

Dynamic Modelling: Events and states, Nesting, Concurrency, Advanced Dynamic Modelling concepts, Functional modelling: Functional Models, Data flow diagrams, Specifying operations, Constraints, Relation of Functional model to Object and Dynamic Models.

Design Methodology, Analysis: Object modelling, Dynamic modelling, Functional modelling, adding operations, Iterating Analysis.

UNIT-III (11 Hrs.)

System design: Subsystems Concurrency, Allocation to processor and tasks, Management of data stores, Handling Global Resources, Handling boundary Conditions, Setting Trade-off priorities.

Object Design: Overview, Combining the three models, Designing Algorithms, Design Optimization, Implementation of Control, Adjustment of Inheritance, Design of Associations, Object Representation, Physical Packaging, and Document Design Decision.

UNIT-IV (11 Hrs.)

Comparison of Methodologies: Structured Analysis/Structured Design, Jackson Structured **Development. Implementation**: Using Programming Language, Database System, outside Computer.

Programming Style: Object Oriented Style, Reusability, Extensibility, Robustness, and Programming-in-the-large.

Recommended Books

1. Rambough, 'Object Oriented Modelling and Design', Pearson Education.
2. BOOCH, 'Object Oriented Analysis and Design', Addison Wesley.
3. Rebecca Wirfs-Brock, 'Design Object Oriented Software', PHI.

ADVANCED INTERNET & WEB TECHNOLOGIES

Subject Code – MITE2-161 **L T P C** **Duration - 45 Hrs.**
3 1 0 4

UNIT-I (10 Hrs.)

Introduction: Internet Protocol Model, Internet Addresses, IP Routing Concepts, Table Driven and Next Hop Routing, Other Routing Related Protocols, Internet Access Through PPP, SLIP, WWW, Web Servers, Browsers.

UNIT-II (12 Hrs.)

Name Services and Configuration: DNS, DHCP, X500 Directory Services, LDAP, Internet Security, Authentication and Encryption, Watermarks, Firewall, SSL, Digital Signatures. **Web Services:** Web Services, Evolution and Differences with Distributed Computing, XML, WSDL, SOAP, UDDI, Transactions, Business Process Execution Language for Web Services, WS-Security and The Web Services Security Specifications, WS-Reliable Messaging, WS-Policy, WS-Attachments. Web 2.0 Technologies: Introduction to Ajax, Ajax Design Basics, Java script, Blogs, Wikis, RSS Feeds.

UNIT-III (11 Hrs.)

Content Delivery and Preparation: Introduction to WWW, TCP/IP, HTTP, FTP, UDP, N-Tier, Markup Languages VRML–HTML, DHTML, DNS, URL, Browsers, Platform for Web Services Development, MVC Design Pattern, .NET, J2EE Architecture, J2EE Components & Containers, Specification, Application Servers, Struts.

UNIT-IV (12 Hrs.)

Dynamic Web Programming: Java Applets, Java Script, JSP, JSTL, ASP, PHP, Servlets, Servlet Life Cycle, C#, Component Technologies, Java Beans, CORBA, Introduction to Ejbs, JDBC, Secure Electronic Transactions Over Web.

Introduction to Cloud Computing: Cloud Computing- History of Cloud Computing, Cloud Architecture, Cloud Storage, Why Cloud Computing Matters, Pros and Cons Of Cloud Computing, Companies in The Cloud Today, Cloud Services.

Recommended Books

1. E. Balagurusamy, 'Programming with Java', 4th Edn., Tata McGraw-Hill Education, **2009.**
2. E. Ladd and J. O'Donnell, 'Platinum Edition Using Xhtml, Xml and Java 2', 4th Edn., Que Publishing, **2001**
3. P.J. Deitel, H. Deitel and A. Deitel, 'Internet and World Wide Web How to Program', 5th Edn., India: Pearson Education Limited, **2011.**
4. M. August Miller, 'Cloud Computing: Web-Based Applications That Change the Way

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You Work and Collaborate Online', Que Publishing, **2008.**

ADVANCED OPERATING SYSTEM

Subject Code: MITE2-205 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

UNIT-I (11 Hrs.)

Processes and Scheduling: Process States and System Call Interface; Life Cycle of a Process: Process Dynamics; Scheduler: working and implementation; Linux Process States and System Calls; Process Groups, Sessions, Foreground and Background Processes.

UNIT-II (11 Hrs.)

Interprocess Communication and Synchronisation: Signals, Pipes and Named Pipes (FIFOs); Threads and pthread library; Mutexes and Condition Variables; Semaphores; Producer-Consumer Problem and Solutions using mutexes, condition variables and semaphores.

UNIT-III (12 Hrs.)

Files and File Systems: File and File Meta-data; File Naming Systems; File System Operations; File System Implementation; File System Structures; Booting an OS; File System Optimisation. Devices and Device Drivers: Devices and Types of Devices; Terminal, Disk, SCSI, Tape and CD devices; Unification of Files and Devices; Device Drivers: Concepts and Implementation Details

UNIT-IV (11 Hrs.)

Resource Management and Security: Resource Management Issues; Types of Resources; Integrated Resource Scheduling; Queuing Models of Scheduling; Protection of Resources – hardware, software, and attacks; Security Policies.

Recommended Books

1. Charles Crowley, 'Operating Systems: A Design-Oriented Approach', Tata McGraw-Hill.
2. Richard Stevens, Stephen Rago, 'Advanced Programming in the Unix Environment', Addison-Wesley.
3. M. Maekawa and Arthur E. Oldehoeft and R. R. Oldehoeft, 'Operating Systems: Advanced Concepts', Benjamin Cummings.

DISTRUBUTED SYSTEMS

Subject Code: MITE2-206 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

1. Characterization of Distributed Systems: Introduction, system models –Architectural and fundamental models
2. Interprocess communication: API for internet protocol, Marshalling. Client server communication, group communication case study: unix
3. Distributed objects and remote invocation: communication between Distributed objects, RPC, events and notification case study: Java RMI
4. Operating System Support: Operating System layer. Protection, processes and threads, operating system architecture

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5. Distributed File System: File service architecture, network file system, Sun network file system, Andrew file system Case Study: unix
6. Name services: Name services and domain name system. directory and discovery services Case Study: Global Name service
7. Transaction and concurrency control: transactions, nested transactions, Locks, optimistic concurrency control, time stamp ordering, Comparison of methods for concurrency control
8. Distributed transaction: Flat and nested distributed transactions. Atomic Commit protocol, Distributed dead locks
9. Distributed Multimedia systems; characteristics of multimedia, multimedia data. Quality of service management, resource management, stream adaptation. Case study; Tiger video file server.
10. Distributed shared memory: design and implementation issues, sequential consistency and Ivy and Release Consistency an Munin Case Study of distributed systems: CORBA.

Recommended Books

1. G. Coulouis, et al, 'Distributed Systems: Concepts and Design', Pearson Education Asia, **2004.**
2. A.S. Tanenbaum, 'Modern operating Systems', Prentice Hall.

ADVANCED OPERATING SYSTEM LAB.

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Subject Code: MITE2-207 **L T P C**
0 0 4 2

List of Experiments

1. Write programs using the following system calls of UNIX operating system: Fork, exec, getpid, exit, wait, close, stat, opendir, readdir.
2. Write programs using the I/O system calls of UNIX operating system (open, read, write, etc.).
3. Write C programs to simulate UNIX commands like ls, grep, etc.
4. Given the list of processes, their CPU burst times and arrival times, display/print the Gantt chart for FCFS and SJF. For each of the scheduling policies, compute and print the average waiting time and average turnaround time.
5. Given the list of processes, their CPU burst times and arrival times, display/print the Gantt chart for Priority and Round robin. For each of the scheduling policies, compute and print the average waiting time and average turnaround time.
6. Developing Application using Inter Process Communication (using shared memory, pipes or message queues).
7. Implement the Producer – Consumer problem using semaphores (using UNIX system calls).
8. Implement some memory management schemes – I
9. Implement some memory management schemes – II
10. Implement any file allocation technique (Linked, Indexed or Contiguous).

BIG DATA

Subject Code: MITE2-262 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

UNIT-I (11 Hrs.)

Introduction to Big Data: Introduction – distributed file system – Big Data and its importance, Four Vs, Drivers for Big data, Big data analytics, Big data applications. Algorithms using map reduce, Matrix-Vector Multiplication by Map Reduce.

UNIT-II (10 Hrs.)

Introduction to Hadoop: Big Data – Apache Hadoop & Hadoop EcoSystem – Moving Data in and out of Hadoop – Understanding inputs and outputs of MapReduce - Data Serialization.

UNIT-III (11 Hrs)

Hadoop Architecture: Hadoop Architecture, Hadoop Storage: HDFS, Common Hadoop Shell commands, Anatomy of File Write and Read., NameNode, Secondary NameNode, and DataNode, Hadoop MapReduce paradigm, Map and Reduce tasks, Job, Task trackers - Cluster Setup – SSH & Hadoop Configuration – HDFS Administering –Monitoring & Maintenance.

UNIT-IV (13 Hrs.)

Hadoop Ecosystem and Yarn: Hadoop ecosystem components - Schedulers - Fair and Capacity, Hadoop 2.0 New FeaturesNameNode High Availability, HDFS Federation, MRv2, YARN, Running MRv1 in YARN.

Hive and HiveQL, HBase: Hive Architecture and Installation, Comparison with Traditional Database, HiveQL - Querying Data - Sorting and Aggregating, Map Reduce Scripts, Joins & Subqueries, HBase conceptsAdvanced Usage, Schema Design, Advance Indexing - PIG, Zookeeper - how it helps in monitoring a cluster, HBase uses Zookeeper and how to Build Applications with Zookeeper. Practical: (45 hours)

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Recommended Books

1. Boris lublinsky, Kevin T. Smith, Alexey Yakubovich, 'Professional Hadoop Solutions', Wiley.
2. Chris Eaton, Dirk deroos et al, 'Understanding Big Data', McGraw Hill.
3. Vignesh Prajapati, 'Big Data Analytics with R and Haoop', Packet Publishing.
4. Tom Plunkett, Brian Macdonald et al, 'Oracle Big Data Handbook', Oracle Press.
5. Jy Liebowitz, 'Big Data and Business Analytics', CRC Press.

CLOUD COMPUTING

Subject Code: MITE2-263 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

UNIT-I (11 Hrs.)

Introduction to Cloud Computing: Definition, Characteristics, Components, Cloud provider, SAAS, PAAS, IAAS and Others, Organizational scenarios of clouds, Administering &Monitoring cloud services, benefits and limitations, Deploy application over cloud, Comparison among SAAS, PAAS, IAAS, Cloud computing platforms: Infrastructure as service: Amazon EC2, Platform as Service: Google App Engine, Microsoft Azure.

UNIT-II (11 Hrs.)

Introduction to Cloud Technologies: Study of Hypervisors, SOAP, REST, Compare SOAP and REST, Web services, AJAX and mashups-Web services, Mashups: user interface services, Virtual machine technology, virtualization applications in enterprises, Pitfalls of virtualization, Multi-entity support, Multi-schema approach, Multi-tenance using cloud data stores, Data access control for enterprise applications.

UNIT-III (11 Hrs.)

Data in the Cloud: Relational databases, Cloud file systems: GFS and HDFS, Big Table, HBase and Dynamo, Map-Reduce and extensions: Parallel computing, the map-Reduce model, Parallel efficiency of Map-Reduce, Relational operations using Map-Reduce, Introduction to cloud development, Monitoring in Cloud, A grid of clouds, Mobile Cloud Computing, Sky computing, Utility Computing, Elastic Computing.

UNIT-IV (12 Hrs.)

Cloud Security: Fundamentals, Vulnerability assessment tool for cloud, Privacy and Security in cloud, Cloud computing security architecture, Cloud computing security challenges, Issues in cloud computing, implementing real time application over cloud platform, Issues in Inter-cloud environments, QoS Issues in Cloud, Dependability, data migration, streaming in Cloud. Quality of Service (QoS) monitoring in a Cloud computing environment, Inter Cloud issues, load balancing, resource optimization.

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Recommended Books

1. Antohy T. Velte, et.al, 'Cloud Computing: A Practical Approach', McGraw Hill.
2. Judith Hurwitz, R. Bloor, M. Kanfman, F. Halper, 'Cloud Computing for Dummies', India Edn., Wiley.
3. S. Kumaraswammy, S. Latif, Tim Malhar, 'Cloud Security & Privacy', SPD,O'Reilly.
4. Barrie Sosinsky, 'Cloud Computing Bible', Wiley India.
5. George Reese, 'Cloud Applications', O'Reilly Publication.
6. Ronald Krutz and Russell Dean Vines, 'Cloud Security', Wiley-India.

VIRTUALIZATION & CLOUD SECURITY

Subject Code: MITE2-264 **L T P C** **Duration: 45 Hrs**
3 1 0 4

UNIT-I (11 Hrs.)

Security Concepts: Confidentiality, privacy, integrity, authentication, non-repudiation, availability, access control, defence in depth, least privilege, how these concepts apply in the cloud, what these concepts mean and their importance in PaaS, IaaS and SaaS. e.g. User authentication in the cloud; **Cryptographic Systems**: Symmetric cryptography, stream ciphers, block ciphers, modes of operation, public-key cryptography, hashing, digital signatures, public-key infrastructures, key management, X.509 certificates, OpenSSL.

UNIT-II (12 Hrs.)

Multi-tenancy Issues: Isolation of users/VMs from each other. How the cloud provider can provide this; **Virtualization System Security Issues**: e.g. ESX and ESXi Security, ESX file system security, storage considerations, backup and recovery; **Virtualization System**

Vulnerabilities: Management console vulnerabilities, management server vulnerabilities, administrative VM vulnerabilities, guest VM vulnerabilities, hypervisor vulnerabilities, hypervisor escape vulnerabilities, configuration issues, malware (botnets, etc.).

UNIT-III (10 Hrs)

Virtualization System-Specific Attacks: Guest hopping, attacks on the VM (delete the VM, attack on the control of the VM, code or file injection into the virtualized file structure), VM migration attack, hyperjacking.

UNIT-IV (12 Hrs.)

Technologies for Virtualization-Based Security Enhancement: IBM security virtual server protection, virtualization-based sandboxing; **Storage Security**: HIDPS, log management, Data Loss Prevention. Location of the Perimeter.

Legal and Compliance Issues: Responsibility, ownership of data, right to penetration test, local law where data is held, examination of modern Security Standards (PCIDSS), how standards deal with cloud services and virtualization, compliance for the cloud provider vs. compliance for the customer.

Recommended Books

1. Tim Mather, Subra Kumaraswamy, Shahed Latif, 'Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance', O'Reilly Media Inc., **2009.**
2. Ronald L. Krutz, Russell Dean Vines, 'Cloud Security'.
3. John Rittinghouse, James Ransome, 'Cloud Computing'.
4. J.R. ("Vic") Winkler, 'Securing the Cloud'.
5. Cloud Security Alliance, 'Security Guidance for Critical Areas of Focus in Cloud Computing', **2009.**

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DATA WAREHOUSING & DATA MINING

Subject Code: MITE2-265 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

UNIT-I (11 Hrs.)

Basic Concepts of Data Warehousing Introduction, Meaning and characteristics of Data Warehousing, Online Transaction Processing (OLTP), Data Warehousing Models, Data warehouse architecture & Principles of Data Warehousing Data Mining.

Building a Data Warehouse Project Structure of the Data warehouse, Data warehousing and Operational Systems, organizing for building data warehousing, Important considerations – Tighter integration, Empowerment, Willingness Business Considerations: Return on Investment Design Considerations, Technical Consideration, Implementation Consideration, Benefits of Data warehousing.

UNIT-II (11 Hrs.)

Managing and Implementing a Data Warehouse Project Management Process, Scope Statement, Work Breakdown Structure and Integration, initiating a Data Warehouse project Project Estimation, Analysing Probability and Risk, Managing Risk: Internal and External, Critical Path Analysis.

UNIT-III (12 Hrs.)

Data Mining What is Data mining (DM)? Definition and description, Relationship and Patterns, KDD vs Data mining, DBMS vs Data mining, Elements and uses of Data Mining, Measuring Data Mining Effectiveness: Accuracy, Speed & Cost Data Information and Knowledge, Data Mining vs. Machine Learning, Data Mining Models. Issues and challenges in DM, DM Applications Areas.

Techniques of Data Mining Various Techniques of Data Mining Nearest Neighbour and Clustering Techniques, Decision Trees, Discovery of Association Rules, Neural Networks, Genetic Algorithm.

UNIT-IV (11 Hrs.)

OLAP Need for OLAP, OLAP vs. OLTP Multidimensional Data Model Multidimensional verses Multirelational OLAP Characteristics of OLAP: FASMI Test (Fast, Analysis Share, Multidimensional and Information), Features of OLAP, OLAP Operations Categorization of OLAP Tools: MOLAP, ROLAP.

Recommended Books

1. Pieter Adriaans, Dolf Zantinge, 'Data Mining', Pearson Education.
2. George M. Marakas 'Modern Data Warehousing, Mining, and Visualization: Core Concepts', Prentice Hall.
3. Alex Berson, Stephen J. Smith, 'Data Warehousing, Data Mining and OLAP (Data Warehousing/Data Management)', McGraw Hill.
4. Margaret H. Dunham, 'Data Mining', Prentice Hall.
5. J.H. David, 'Principles of Data Mining' (Adaptive Computation and Machine Learning), Prentice Hall.

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AD HOC AND SENSOR NETWORKS

Subject Code: MITE2-266 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

UNIT –I (11 Hrs.)

Introduction to Wireless Networks, Evolution of 3G Mobile Systems, Wireless LANs, Bluetooth, Scatternet, Piconet, Ad hoc Networks, Heterogeneity in Mobile Devices, Types of Ad hoc Mobile Communications, Types of Mobility, Challenges in Ad hoc Mobile Networks, Energy Management, Scalability, Addressing and Service Discovery, Deployment Considerations.

UNIT-II (10 Hrs.)

MAC protocols for Ad hoc Networks: Design issues, Classifications, Contention based protocols, MACAW, FAMA, BTMA, DBTMA, MACABI, Real-Time MAC protocol, Multichannel protocols, Power aware MAC, Routing protocols: Design issues, Table-driven protocols - DSDV, WRP, CGSR, On-Demand protocols - DSR, AODV, TORA, LAR, ABR, Zone Routing Protocol, Power Aware Routing protocols.

UNIT-III (12 Hrs.)

Multicast Routing, Preferred Link based Multicast, Mesh-based protocols, Core-Assisted Mesh protocol, Issues in Transport layer protocols, TCP over Ad hoc Networks, TCP Reno, Tahoe, Vegas, TCP SACK, Indirect TCP, Snooping TCP, Split-TCP, TCP-BuS, Quality of Service issues, MAC layer solutions, Network layer solutions, QoS framework for Ad hoc networks, INSIGNIA, INORA, SWAN.

Wireless Sensor Networks, Unique constraints and challenges, Applications, Collaborative processing, Architecture, Data Dissemination, MAC protocols, S-MAC, IEEE 802.15.4 and ZigBee, Geographic, Energy-Aware Routing, Attribute-based routing, Directed Diffusion, Rumor Routing, Geographic Hash Tables -GHT, Data Gathering, PEGASIS, Location Discovery, Localization, Communication and Sensing Coverage.

UNIT-IV (12 Hrs.)

Topology Control, Time Synchronization, Sensor Taking and Control, Sensor Selection, IDSQ, Cluster Leader-based Protocol, Joint Routing and Information Aggregation, Sensor Network Databases, Challenges, In-Network Aggregation, TinyDB query processing, DataCentric Storage, Data Indices and Range Queries, Distributed Hierarchical Aggregation, Temporal Data, Platforms and Tools, Berkeley Motes, Programming Challenges, TinyOS, nesC, TinyGALS, ns2 extensions, TOSSIM, Actuators.

Recommended Books

1. C. Siva Ram Murthy and B. S. Manoj, 'Ad Hoc Wireless Networks: Architectures and Protocols', Pearson Education, **2007.**
2. C.K. Toh, 'Ad Hoc Mobile Wireless Networks: Protocols and Systems', Pearson Education, **2007.**
3. Feng Zhao and Leonidas Guibas, 'Wireless Sensor Networks: An Information Processing Approach', Morgan Kaufman Publishers, **2007.**
4. Jochen Schiller, 'Mobile Communications', Pearson Education, **2009.**
5.

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ENTERPRISE RESOURCE PLANNING

Subject Code: MITE2-267	**L T P C** **3 1 0 4**	**Duration: 45 Hrs.**

UNIT-I (12 Hrs.)

Introduction to ERP Evolution of ERP; what is ERP? Reasons for the Growth of ERP; Scenario and Justification of ERP in India; Evaluation of ERP; Various Modules of ERP; Advantage of ERP. Integrated Management Information; Business Modelling; ERP for Small Business; ERP for Make to Order Companies; Business Process Mapping for ERP Module Design; Hardware Environment and its Selection for ERP Implementation.

UNIT-II (11 Hrs.)

ERP and Related Technologies; Business Process Reengineering (BPR); Management Information System (MIS); Executive Information System (EIS); Decision support System (DSS); Supply Chain Management (SCM). ERP system Introduction; Finance, Plant Maintenance, Quality Management, Materials Management.

UNIT-III (10 Hrs.)

ERP Market: Introduction, SAP AG, Baan Company, Oracle Corporation, People Soft, JD Edwards World Solutions Company, System Software Associates, Inc. (SSA); QAD; A Comparative Assessment and Selection of ERP Packages and Modules.

UNIT-IV (12 Hrs.)

ERP Implementation Lifecycle: Issues in Implementing ERP Packages; Pre-evaluation Screening; Package Evaluation; Project Planning Phase; Gap Analysis; Reengineering; Configuration; Implementation; Team Training; Testing; Going Live; End-User Training; Post Implementation (Maintenance Mode).

Recommended Books

1. Khalid Sheikh, 'Manufacturing Resource Planning (MRP II) with Introduction to ERP, SCM; an CRM', McGraw-Hill.
2. Christian N. Madu, 'ERP and Supply Chain Management', CHI.
3. Glynn C. Williams, 'Implementing SAP ERP Sales & Distribution', McGraw-Hill.

PARALLEL COMPUTING

Subject Code: MITE2-368	**L T P C** **3 1 0 4**	**Duration: 45 Hrs.**

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UNIT-I (10 Hrs.)

Introduction: Paradigms of parallel computing: Synchronous - vector/array, SIMD, Systolic; Asynchronous - MIMD, reduction paradigm.

UNIT-II (11 Hrs)

Hardware Taxonomy: Flynn's classifications, Handler's classifications. Software taxonomy: Kung's taxonomy, SPMD. Abstract parallel computational models: Combinational circuits, Sorting network, PRAM models, Interconnection RAMs. Parallelism approaches - data parallelism, control parallelism.

UNIT-III (12 Hrs.)

Performance Metrics: Laws governing performance measurement, Metrics- speedups, efficiency, utilization, communication overheads, single/multiple program performances, bench marks. Theoretical Models: Taxonomy and topology - shared memory multiprocessors, distributed memory networks. Processor organization - Static and Dynamic interconnections, Embedding and simulations.

UNIT-IV (12 Hrs.)

Parallel Programming: Shared Memory Programming, Distributed memory programming, Object oriented programming, Data parallel programming, functional and dataflow programming. Scheduling and Parallelization: Scheduling parallel programs. Loop scheduling. Parallelization of sequential programs, Parallel programming support environments

Recommended Books

1. M.J. Quinn, 'Parallel Computing: Theory and Practice', McGraw Hill, New York.
2. T.G. Lewis and H. El-Rewini, 'Introduction to Parallel Computing', Prentice Hall, New Jersey.
3. T.G. Lewis, 'Parallel Programming: A Machine-Independent Approach', IEEE Computer Society Press, Los.

DIGITAL IMAGE PROCESSING

Subject Code: MITE2-369 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

UNIT-I (10 Hrs.)

Fundamental of image processing: Introduction, Origin, Areas of Image Processing, steps in Digital Image Processing, Components of Image Processing System, Image Sensing, Sampling and Quantization, Neighbouring of Pixels

UNIT-II (11 Hrs.)

Image Enhancement and Restoration: Enhancement: Spatial Filtering, Introduction to Fourier Transformation Restoration: A model of the Image Degradation/ Restoration Process. Color Image Processing**:** Color fundamentals, models, transformation and segmentation, Noise in color Images.

UNIT-III (12 Hrs.)

Wavelets: Wavelet functions, Wavelet transformations in one and two dimensions, fast wavelet transform. Image Compression: Image compression models, Error free compression, Lossy compression. Image segmentation**:** Line detection, edge detection, Edge linking and boundary detection, region based Segmentation.

UNIT-IV (12 Hrs.)

Representation and Description: Representation, Boundary and Regional Descriptors, Relational Descriptors. Object Recognition**:** Pattern and pattern classes, recognition based on Decision Theoretic Methods, Structural Methods.

Recommended Books

Rafael C. Gonzalez, Richard E. Woods, 'Digital Image Processing' Addison-Wesley Pub (Sd).

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SOFT COMPUTING

Subject Code: MITE2-370 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

UNIT-I (11 Hrs.)

Module I - Introduction - What is soft computing? Differences between soft computing and hard computing, Soft Computing constituents, Methods in soft computing, Applications of Soft Computing

Module II - Introduction to Genetic Algorithms- Introduction to Genetic Algorithms (GA), Representation, Operators in GA, Fitness function, population, building block hypothesis and schema theorem.; Genetic algorithms operators- methods of selection, crossover and mutation, simple GA(SGA), other types of GA, generation gap, steady state GA, Applications of GA

UNIT-II (12 Hrs.)

Module III - Neural Networks- Concept, biological neural system. Evolution of neural network, McCullochPitts neuron model, activation functions, feedforward networks, feedback networks, learning rules – Hebbian, Delta, Perceptron learning and Windrow-Hoff, winner-take-all.

Module IV - Supervised learning- Perceptron learning, single layer/multilayer perceptron, linear separability, hidden layers, back propagation algorithm, Radial Basis Function network; Unsupervised learning - Kohonen, SOM, Counter-propagation, ART, Reinforcement learning, adaptive resonance architecture, applications of neural networks to pattern recognition systems such as character recognition, face recognition, application of neural networks in image processing.

UNIT-III (12 Hrs.)

Module V: Fuzzy systems - Basic definition and terminology, set-theoretic operations, Fuzzy Sets, Operations on Fuzzy Sets, Fuzzy Relations, Membership Functions, Fuzzy Rules & Fuzzy Reasoning, Fuzzy Inference Systems, Fuzzy Expert Systems, Fuzzy Decision Making; Neuro-fuzzy modeling- Adaptive Neuro-Fuzzy Inference Systems, Coactive Neuro-Fuzzy Modelling, Classification and Regression Trees, Data Clustering Algorithms, Rulebase Structure Identification and Neuro-Fuzzy Control , Applications of neuro-fuzzy modelling.

UNIT-IV (10 Hrs.)

Module VI: Swarm Intelligence- What is swarm intelligence? Various animal behavior which have been used as examples, ant colony optimization, swarm intelligence in bees, flocks of birds, shoals of fish, ant-based routing, particle swarm optimization

Recommended Books

1. S.N. Shivanandam, 'Principle of Soft Computing', Wiley. ISBN13: 9788126527410, **2011.**
2. Jyh-Shing Roger Jang, Chuen-Tsai Sun, Eiji Mizutani, 'Neuro-Fuzzy and Soft Computing', Prentice Hall of India, **2003**.
3. George J. Klir and Bo Yuan, 'Fuzzy Sets and Fuzzy Logic-Theory and Applications', Prentice Hall, **1995**.
4. James A. Freeman and David M. Skapura, 'Neural Networks Algorithms, Applications and Programming Techniques', Pearson Edn., **2003**.
5. Mitchell Melanie, 'An Introduction to Genetic Algorithm', Prentice Hall, **1998**.
6. David E. Goldberg, 'Genetic Algorithms in Search, Optimization & Machine Learning', Addison Wesley, **1997**.

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M.Tech. CSE (E. Security) (1^{ST} SEM.)
TOTAL CONTACT HRS. = 24, TOTAL CREDITS = 22

Course		Contact Hrs.			Marks			Credits
Code	**Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
MCSE4-101	Advanced Data Structures and Algorithm	**3**	**1**	**0**	**40**	**60**	**100**	**4**
MREM0-101	Research Methodology	**4**	**0**	**0**	**40**	**60**	**100**	**4**
MCSE4-103	Soft Computing	**3**	**1**	**0**	**40**	**60**	**100**	**4**
Departmental Elective-I		**3**	**1**	**0**	**40**	**60**	**100**	**4**
MCSE4-156	Agile Software Development							
MCSE4-157	Information Security							
MCSE4-158	Emerging Technologies							
MCSE4-159	Cyber Laws							
Departmental Elective-II		3	1	0	40	60	100	4
MCSE4-160	Advanced Computer Networks							
MCSE4-161	Wireless and Mobile Networking							
MCSE4-162	Advanced Operating Systems							
MCSE4-163	Digital Defense							
MCSE4-104	Practical Lab.-I	**0**	**0**	**4**	**60**	**40**	**100**	**2**
Total 5 Theory & 1 Lab. Courses		**16**	**4**	**04**	**260**	**340**	**600**	**22**

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M.Tech. CSE (E-Security) (2^{nd} SEM.)
TOTAL CONTACT HRS. = 24, TOTAL CREDITS = 22

Course		Contact Hrs.			Marks			Credits
Code	**Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
MCSE4-205	Ethical Hacking	**3**	**1**	**0**	**40**	**60**	**100**	**4**
MCSE4-206	Cryptography & Network Security	**3**	**1**	**0**	**40**	**60**	**100**	**4**
Departmental Elective-III		**3**	**1**	**0**	**40**	**60**	**100**	**4**
MCSE4-264	Information Retrieval							
MCSE4-265	Computer and Cyber Forensics							
MCSE4-266	Biometric Security							
MCSE4-267	Advanced Databases							
Departmental Elective-IV		**3**	**1**	**0**	**40**	**60**	**100**	**4**
MCSE4-268	Python Programming							
MCSE4-269	Information Security risk Management							
MCSE4-270	Security Engineering							
MCSE4-271	Open Source Technology							
Open Elective-I		3	1	0	40	60	100	4
MCSE4-207	Practical Lab.-II	0	0	4	60	40	100	2
Total 5 Theory & 1 Lab. Courses		15	5	04	260	340	600	22

M.Tech E-Security (3rd SEM.)
TOTAL CONTACT HRS. = 1, TOTAL CREDITS = 21

Course		**Contact Hrs.**			**Marks**			**Credits**
Code	**Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
Departmental Elective-V		3	1	0	40	60	100	4
MCSE4-372	Software Vulnerability Analysis							
MCSE4-373	Data Warehousing and Data Mining							
MCSE4-374	Computer Security Audit and Assurance							
Open Elective-II		3	0	0	40	60	100	3
MCSE4-308	**Project**	-	-	-	60	40	100	10
MCSE4-309	**Seminar**	-	-	-	60	40	100	4
Total 1 Theory & Course		6	1	0	200	200	400	21

M.Tech. E-Security (4th SEM.)
TOTAL CONTACT HRS. = 0, TOTAL CREDITS = 25

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Course		**Contact Hrs.**			**Marks**			**Credits**
Code	**Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
MCSE4-410	Dissertation	**0**	**0**	**0**	**60**	**40**	**100**	**25**
Total		**0**	**0**	**0**	**60**	**40**	**100**	**25**

Total Marks = 600 + 600 + 400 + 100 = 1700

Total Credits = 22 + 22 + 21 + 25 = 90

ADVANCED DATA STRUCTURES AND ALGORITHMS

MCSE1-101, MCSE2-101, MCSE3-101, MCSE4-101	**L T P C 3 1 0 4**	**Duration: 45 Hrs.**

LEARNING OBJECTIVES:

To learn the advanced concepts of data structure and algorithms and its implementation. The course has the main ingredients required for a computer science graduate and has all the necessary topics for assessment of data structures and algorithms.

LEARNING OUTCOMES:

CO1: Ability to apply and implement various data structures to algorithms and to solve problems.

CO2: Basic ability to analyze algorithms and to determine algorithm correctness and time efficiency class.

CO3: Ability to apply various traversing, finding shortest path and text pattern matching algorithm.

CO4: Know the concepts of tractable and intractable problems and the classes P, NP and NP-complete problems.

UNIT-I (10 Hrs.)

Introduction to Basics: Significance and need of various data structures and algorithms, Arrays, Linked lists, Stacks, Queues, Priority queues, Heaps; Strategies for choosing the appropriate data structures.

Advanced Data Structures: Binary Search Tree**,** AVL Trees, Red-Black Trees, Splay Trees, B-trees, Fibonacci heaps, Data Structures for Disjoint Sets, Augmented Data Structures.

UNIT-II (5 Hrs.)

Algorithms Complexity and Analysis: Probabilistic Analysis, Amortized Analysis, Competitive Analysis, Internal and External Sorting algorithms: Quick Sort, Heap Sort, Merge Sort, Counting Sort, Radix Sort.

UNIT-III (15 Hrs.)

Graphs & Algorithms: Representation, Type of Graphs, Paths and Circuits: Euler Graphs, Hamiltonian Paths & Circuits; Cut-sets, Connectivity and Separability, Planar Graphs, Isomorphism, Graph Coloring, Covering and Partitioning, bridges, Depth- and breadth-first traversals, Minimum Spanning Tree: Prim's and Kruskal's algorithms, Shortest-path Algorithms: Dijkstra's and Floyd's algorithm, Topological sort, Max flow: Ford-Fulkerson algorithm, max flow – min cut.

String Matching Algorithms: Suffix arrays, Suffix trees, Brute Force, Rabin-Karp, Knuth-Morris-Pratt, Boyer-Moore algorithm.

UNIT-IV (15 Hrs.)

Approximation Algorithms: Need of approximation algorithms: Introduction to P, NP, NP-Hard and NP-Complete; Deterministic, non-Deterministic Polynomial time algorithms; Knapsack, TSP, Set Cover, Open Problems.

Randomized Algorithms: Introduction, Type of Randomized Algorithms, 2-SAT; Game Theoretic Techniques, Random Walks.

Recommended Books:

1. E. Horowitz, S. Sahni and Dinesh Mehta, 'Fundamentals of Data Structures in C++', Galgotia, **1999**.
2. Thomas H. Corman, Charles E. Leiserson, Ronald L. Rivest, 'Introduction to Algorithms', 3rd Edn., PHI, **2009**.

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3. Adam Drozdex, ‘Data Structures and Algorithms in C++’, 2nd Edn., Thomson Learning–Vikas Publishing House, **2001**.
4. G. Brassard and P. Bratley, ‘Algorithmics: Theory and Practice’, Prentice Hall, **1988**.

RESEARCH METHODOLOGY

Subject Code – MREM0-101	**L T P C** **4 0 0 4**	**Duration: 45 Hrs.**

UNIT–I (11 Hrs.)

Introduction to Research: Meaning, Definition, Objective and Process

Research Design: Meaning, Types - Historical, Descriptive, Exploratory and Experimental

Research Problem: Necessity of Defined Problem, Problem Formulation, Understanding of Problem, Review of Literature

Design of Experiment: Basic Principal of Experimental Design, Randomized Block, Completely Randomized Block, Latin Square, Factorial Design.

Hypothesis: Types, Formulation of Hypothesis, Feasibility, Preparation and Presentation of Research Proposal

UNIT–II (10 Hrs.)

Sources of Data: Primary and Secondary, Validation of Data

Data Collection Methods: Questionnaire Designing, Construction

Sampling Design & Techniques – Probability Sampling and Non Probability Sampling

Scaling Techniques: Meaning & Types

Reliability: Test – Retest Reliability, Alternative Form Reliability, Internal Comparison Reliability and Scorer Reliability

Validity: Content Validity, Criterion Related Validity and Construct Validity

UNIT–III (13 Hrs.)

Data Process Operations: Editing, Sorting, Coding, Classification and Tabulation

Analysis of Data: Statistical Measure and Their Significance, Central Tendency, Dispersion, **Correlation:** Linear and Partial, Regression: Simple and Multiple Regression, Skewness, Time series Analysis, Index Number

Testing of Hypothesis: T-test, Z- test, Chi Square, F-test, ANOVA

UNIT–IV (11 Hrs.)

Multivariate Analysis: Factor Analysis, Discriminant Analysis, Cluster Analysis, Conjoint Analysis, Multi-Dimensional Scaling

Report Writing: Essentials of Report Writing, Report Format

Statistical Software: Application of Statistical Softwares like SPSS, MS Excel, Mini Tab or MATLAB Software in Data Analysis

**Each Student has to Prepare Mini Research Project on Topic/ Area of their Choice and Make Presentation. The Report Should Consists of Applications of Tests and Techniques Mentioned in The Above UNITs*

Recommended Books:

1. R.I. Levin and D.S. Rubin, ‘Statistics for Management’, 7th Edn., Pearson Education New Delhi.
2. N.K. Malhotra, ‘Marketing Research–An Applied Orientation’, 4th Edn., Pearson Education, New Delhi.
3. Donald Cooper, ‘Business Research Methods’, Tata McGraw Hill, New Delhi.
4. Sadhu Singh, ‘Research Methodology in Social Sciences’, Himalaya Publishers.
5. Darren George & Paul Mallery, ‘SPSS for Windows Step by Step’, Pearson Education New Delhi.

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6. C.R. Kothari, ‘Research Methodology Methods & Techniques’, 2nd Edn., New Age International Publishers.

SOFT COMPUTING

MCSE1-103, MCSE2-103, MCSE3-103, MCSE4-103	**L T P C 3 1 0 4**	**Duration: 45 Hrs.**

LEARNING OBJECTIVES:

The objective of this course is to teach basic neural networks, fuzzy systems, Genetic Algorithms and optimization algorithms concepts and their relations**.**

LEARNING OUTCOMES:

CO1: Able to comprehend techniques and applications of Soft Computing in real world problems.

CO2: Able to follow fuzzy logic methodology and design fuzzy systems for various applications.

CO3: Able to design feed forward Artificial Neural Networks (ANN) and implement various methods of supervised learning.

CO4: Able to design feedback Artificial Neural Networks (ANN) and implement various methods of unsupervised learning

CO5: Able to appreciate the methodology of GA and its implementation in various applications.

UNIT–I (12 Hrs.)

Soft Computing: Introduction of soft computing, soft computing vs. hard computing, various types of soft computing techniques, applications of soft computing.

Fuzzy Logic: Fuzzy set versus crisp set, basic concepts of fuzzy sets, membership functions, basic operations on fuzzy sets and its properties. Fuzzy relations versus Crisp relation,

Fuzzy rule base system: Fuzzy propositions, formation, decomposition & aggregation of fuzzy rules, fuzzy reasoning, Fuzzy Inference Systems (FIS) – Mamdani Fuzzy Models – Sugeno Fuzzy Models – Tsukamoto Fuzzy Models, Fuzzification and Defuzzification, fuzzy decision making & Applications of fuzzy logic.

UNIT–II (12 Hrs.)

Structure and Function of a single neuron: Biological neuron, artificial neuron, definition of ANN and its applications. Neural Network architecture: Single layer and multilayer feed forward networks and recurrent networks. Learning rules and equations: Perceptron, Hebb’s, Delta, winner take all and out-star learning rules. Supervised Learning Network: Perceptron Networks, Adaptive Linear Neuron, Multiple Adaptive Linear Neuron, Back Propagation Network, Associative memory networks, Unsupervised Learning Networks: Competitive networks, Adaptive Resonance Theory, Kohnen Self Organizing Map

UNIT–III (11 Hrs.)

Genetic Algorithm: Fundamentals, basic concepts, working principle, encoding, fitness function, reproduction, Genetic modeling: selection operator, cross over, mutation operator, Stopping Condition and GA flow, Constraints in GA, Applications of GA, Classification of GA.

UNIT–IV (10 Hrs.)

Hybrid Soft Computing Techniques: An Introduction, Neuro-Fuzzy Hybrid Systems, Genetic Neuro-Hybrid systems, Genetic fuzzy Hybrid and fuzzy genetic hybrid systems

Recommended Books:

1. S. Rajasekaran & G.A. Vijayalakshmi Pai, Neural Networks, Fuzzy Logic & Genetic Algorithms, Synthesis & Applications, PHI Publication.
2. S.N. Sivanandam & S.N. Deepa, 'Principles of Soft Computing', Wiley Publications.
3. Michael Negnevitsky, 'Artificial Intelligence', Pearson Education, New Delhi, **2008**.
4. Timothy J. Ross, 'Fuzzy Logic with Engineering Applications', Wiley, **2010**.
5. Bose, 'Neural Network fundamental with Graph, Algo. & Applications', TMH.
6. Kosko, 'Neural Network & Fuzzy System', PHI Publication.
7. Klir &Yuan, 'Fuzzy Sets & Fuzzy Logic: Theory & Applications', PHI Publication.
8. Hagen, 'Neural Network Design', Cengage Learning.

AGILE SOFTWARE DEVELOPMENT APPROACHES

MCSE1-156,	**L T P C**	**Duration: 45 Hrs.**
MCSE2-156	**3 1 0 4**	
MCSE4-156		
MCSE3-205		

LEARNING OBJECTIVES:

This course makes student learn the fundamental principles and practices associated with each of the agile development methods. To apply the principles and practices of agile software development on a project of interest and relevance to the student.

LEARNING OUTCOMES:

CO1: To learn the basics concepts of Agile software and their principles design

CO2: To explain different agile development method, project tools requirement, risk and measurements related with different development methods.

CO3: To understand the overview of Agile methods, strategies, requirements and testing.

CO4: Describe and explain agile measurement, configuration and risk management. Principles of Astern and tools.

UNIT-I (10 Hrs.)

Introduction: Basics and Fundamentals of Agile Process Methods, Values of Agile, Principles of Agile, stakeholders, Challenges.

Agile and Its Significance: Agile development, Classification of methods, the agile manifesto and principles, Practices of XP, Scrum Practices, working and need of Scrum, advanced Scrum Applications, Scrum and the Organization.

UNIT-II (11 Hrs.)

Agile Project Management: Embrace communication and feedback, Simple practices and project tools, Empirical Vs defined and prescriptive process – Principle-based versus Rule-Based – Sustainable discipline: The human touch – Team as a complex adaptive system – Agile hype – Specific agile methods. Quality, Risk, Metrics and Measurements, the facts of change on software projects – Key motivations for iterative development – Meeting the requirements challenge iteratively – Problems with the waterfall. Research evidence – Early historical project evidence – Standards-Body evidence, Expert and thought leader evidence – A Business case for iterative development – The historical accident of waterfall validity.

UNIT- III (12 Hrs.)

Agile Methodology: Method overview – Lifecycle – Work products, Roles and Practices values – Common mistakes and misunderstandings – Sample projects – Process mixtures – Adoption strategies – Fact versus fantasy – Strengths versus "Other" history.

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Agile Requirements: User Stories, Backlog Management. Agile Architecture: Feature-Driven Development. Agile Risk Management: Risk and Quality Assurance, Agile Tools.

UNIT-IV (12 Hrs.)

Agile Testing: Agile Testing Techniques, Test-Driven Development, User Acceptance Test.

Agile Review: Agile Metrics and Measurements, The Agile approach to estimating and project variables, Agile Measurement, Agile Control: the 7 control parameters. Agile approach to Risk, The Agile approach to Configuration Management, The Atern Principles, Atern Philosophy, the rationale for using Atern, Refactoring, Continuous integration, Automated Build Tools.

Recommended Books:

1. Elisabeth Hendrickson, ‘Agile Testing, Quality’, Tree Software Inc., **2008**.
2. Craig Larman, ‘Agile and Iterative Development – A Manager’s Guide’, Pearson Education, **2004**.
3. Robert C. Martin, ‘Agile Software Development, Principles, Patterns, and Practices’, Alan Apt Series, **2011**.
4. Alistair, ‘Agile Software Development Series’, Cockburn, **2001**.
5. ‘Succeeding with Agile: Software Development Using Scrum’, Pearson, **2010**.

INFORMATION SECURITY

MCSE1-162	**L T P C**	**Duration: 45 Hrs.**
MCSE4-157	**3 1 0 4**	
MCSE2-157		

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LEARNING OBJECTIVES:

It will help the students to understand the various concepts related to network security. The students will learn various techniques/algorithms that can be used to achieve security. They will also learn the security basics for wireless networks.

LEARNING OUTCOMES:

CO1: To understand the concepts of network security

CO2: To learn the techniques for authentication and authorization

CO3: To be able to understand the confidentiality requirement and the ways to achieve it.

CO4: To know about wireless network security.

UNIT-I (10 Hrs.)

Overview: Computer Security Concepts, Challenges, Requirements, OSI security Architecture: services, mechanism and attacks, network security model, Classical encryption techniques, latest security trends, need of security strategy,

UNIT-II (13 Hrs.)

Authentication: Message authentication, message authentication techniques: Hash, MAC, digital Signatures, User Authentication: one-way authentication, mutual authentication, Password-based authentication, token based authentication, Biometric authentication, Remote User authentication.

Authorization: Identification, authorization, Access Control: Principles, Access Rights, Discretionary Access Control, Role Based Access Control, Unix File Access Control, Role Based Access Control Internet Authentication Applications: Kerberos, X.509, PKI, Federated Identity Management.

UNIT-III (13 Hrs.)

Confidentiality: Encryption, attacks, Symmetric Encryption: DES, AES, Asymmetric Encryption: RSA, Key Distribution scenario, Email security: S/ MIME, PGP.

Wireless Network Security: IEEE 802.11 wireless LAN, 802.11i wireless LAN security, Wireless Application Protocol, Wireless transport layer security, WAP End to End security.

UNIT-IV (10 Hrs.)

Database Security: The Need for Database Security, Database Management Systems, Relational Databases, Database Access Control, Inference, Statistical Databases, Database Encryption, Cloud Security.

Recommended Books:

1. William Stalling & Lawrie Brown, 'Computer Security: Principles and Practice', Pearson, Indian Edn., **2010**.
2. Chuck Easttom, 'Computer Security Fundamentals', Pearson, **2011**.
3. M. Stamp, 'Information Security: Principles and Practice', 2nd Edn., Wiley, **2011**.
4. M.E. Whitman and H.J. Mattord, 'Principles of Information Security, Course Technology', 4th Edn., **2011**.
5. M. Bishop, 'Computer Security: Art and Science', Addison Wesley, 2002.

EMERGING TECHNOLOGIES

Subject Code: MCSE4-158	**L T P C** **3 1 0 4**	**Duration: 45 Hrs.**

LEARNING OBJECTIVES:

The objective of this course is to introduce emerging technologies in the field of Information technology. The security related issues in these technologies will also be discussed.

LEARNING OUTCOMES

CO1: To introduce students to concepts and theories of Grid Computing.
CO2: To understand the benefits and various services of Cloud Computing.
CO3: To introduce students to concept and theories of mobile computing.
CO4: To provide an overview of issues and challenges related to Big data.

UNIT-I (10 Hrs.)

Grid Computing: Introduction to GRID Computing, How Grid Computing Works, Grid Middleware, Grid Architecture, Types of Grids, Grid Computing Applications, Technologies for Grid Computing, Clustering and Grid Computing, Issues in Data Grids, Key Functional Requirements in Grid Computing.

UNIT-II (12 Hrs.)

Cloud Computing: Introduction to Cloud Computing, Definition, Characteristics, Components, Cloud provider, SAAS, PAAS, IAAS and Others, Organizational scenarios of clouds, Administering & Monitoring cloud services, benefits and limitations, Comparison among SAAS, PAAS, IAAS Cloud security fundamentals, Privacy and Security in cloud, Cloud computing security architecture: Architectural Considerations- General Issues.

UNIT-III (13 Hrs.)

Mobile Computing: History of mobile communication, Types of Networks, Architecture for Mobile Computing, 3-tier Architecture, Design Considerations for Mobile Computing introduction to GSM system, GSM background, GSM operational and technical requirements. Cell layout and frequency planning, mobile station, base station systems, Security issues in mobile computing, Authentication, encryption.

UNIT-IV (10 Hrs.)

Big Data: Introduction to Big Data, Big Data Tools and Techniques, Application of Big Data, Apache Hadoop, Map Reduce, SMAQ Stack.

Recommended Books:

1. Prabhu CSR, 'Grid and Cluster Computing', PHI, **2008**.

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2. J. Hurwitz, R. Bloor, M. Kanfman, F. Halper, ‘Cloud Computing for Dummies’, Wiley India, **2010**.
3. C.Y. William, Lee, ‘Mobile Communication Design Fundamentals’, John Wily and Sons, **2010**.
4. ‘2012 Big Data Now’, O'Reilly Media, Inc., **2012**.
5. R. Krutz and R.D. Vines, ‘Cloud Security’, Wiley-India, **2010**.
6. J. Schiller, ‘Mobile Communication’, Pearson Education Asia, **2008**.

CYBER LAWS

Subject Code: MCSE4-159	**L T P C** **3 1 0 4**	**Duration: 45 Hrs.**

LEARNING OBJECTIVES:

The objective of this course is to provide knowledge about the basic information on cyber law and also provide the basic information about amendment right and copyright issues. To understand ethical laws of computer for different countries this course also will be helpful.

UNIT-I (13 Hrs.)

Introduction: Fundamentals of Cyber Space, Understanding Cyber Space, Interface of Technology and Law Defining Cyber Laws, Jurisdiction in Cyber Space, Concept of Internet Jurisdiction, Indian Context of Jurisdiction, International position of Internet Jurisdiction Cases in Cyber Jurisdiction.

UNIT-I3 (10 Hrs.)

Specific Issues: E-commerce- Legal issues, Legal Issues in Cyber Contracts, Cyber Contract and IT Act2000, The UNCITRAL Model law on Electronic Commerce, Intellectual Property Issues and Cyberspace. The Indian Perspective Overview of Intellectual, Property related Legislation in India Copyright law & Cyberspace, Trademark law & Cyberspace, Law relating to Semiconductor Layout & Design.

UNIT-III (11 Hrs.)

Understanding Cyber Crimes: Defining Crime, Crime in context of Internet –Actus Rea/Mens Rea, Types of crime in Internet, Computing damage in Internet crime, Frauds: Hacking, Mischief, Trespass, Defamation, Stalking, Spam.

UNIT-IV (11 Hrs.)

Obscenity and Pornography: Internet and Potential of Obscenity, Indian Law on Obscenity & Pornography, International efforts, Changes in Indian Law. Penalties & Offences: IT Act 2001, Offences under the Indian Penal Code, Investigation & adjudication issues Digital evidence.

Recommended Books:

1. Y. Singh, ‘Cyber Laws’, 5th Edn., Universal law Publishing Company, **2012**.
2. A. Gupta, ‘Commentary on Information Technology Act’, 2nd Edn., **2011**.
3. A. Viswanathan, ‘Cyber Laws: Indian and International Perspectives on Key Topics including Data Security, E-commerce, Cloud Computing and Cyber Crimes’, 1st Edn., Lexis Nexis, **2012**.

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ADVANCED COMPUTER NETWORKS

MCSE2-160	**L T P C**	**Duration: 45 Hrs.**
MCSE4-160	**3 1 0 4**	
MCSE1-206		

LEARNING OBJECTIVES:

This course provides knowledge about computer network related hardware and software using a layered architecture. It is also offer good understanding of the concepts of network security, wireless, Adhoc and various emerging network technologies.

LEARNING OUTCOMES:

CO1: Able to explain the Fundamentals of Computer Networks and their layered architecture. Also acquire knowledge about ATM Layered model and LAN Emulation.

CO2: Able to explain about various Transport and Application Layer Protocols. Also acquire knowledge about various congestion control mechanisms and network management.

CO3: Able to explain Features, advantages and applications of Adhoc Networks, Adhoc versus Cellular networks, Network architecture and Technologies. Evolution with the examples of wireless communication systems other techniques of Cellular Networks like 2G, 2.5G and 3G Technologies. Also able to explain wireless local loop (WLL), Wireless and local Area Networks (WLANs)

CO4: Able to define the Fundamentals of network security, various authentication protocols and E-mail Security.

UNIT-I (10 Hrs.)

Computer networks: Layered architecture, Asynchronous Transfer Mode-ATM layered model, switching and switching fabrics, network layer in ATM, QOS, LAN emulation.

UNIT-II (10 Hrs.)

Transport Layer: Elements of transport protocols; Internet transport protocols: TCP and UDP, TCP connection management, congestion control. Application Layer-Network application architectures: Client-server, P2P and hybrid; Application layer protocols: DNS, FTP, TFTP, TELNET, HTTP and WWW, SMTP and electronic mail; Network management and SNMP.

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UNIT-III (15 Hrs.)

Adhoc and Cellular networks: Features, advantages and applications, Adhoc versus Cellular networks, Network architecture, Protocols: MAC protocols, Routing protocols, Technologies. Wireless Communication Systems- Evolution, examples of wireless communication systems, 2G Cellular networks, Evolution for 2.5G TDMA Standards, IS-95B for 2.5G CDMA. Wireless and Mobile Networks-Wireless links and network characteristics, wireless local loop (WLL), Local Multipoint Distribution System (LMDS), Wireless local Area Networks (WLANs), Bluetooth and Personal Area Networks.

UNIT-IV (10 Hrs.)

Introduction to Network Security: Cryptography, symmetric and public-key algorithms, digital signatures, communication security, and authentication protocols, E-mail security, PGP and PEM.

Recommended Books:

1. B.A. Forouzan, 'Data Communication and Networking', 3rd Edn. Tata McGraw-Hill.
2. A.S. Tanenbaum, 'Computer Networks', 4th Edn., Pearson Education.
3. W. Stallings, 'Network Security and Cryptography', 4th Edn., Prentice-Hall of India.
4. Theodore S. Rappaport, 'Wireless Communication: Principles and Practices', 2nd Edn., Pearson Education.
5. D.E. Comer, and R.E., Computer Networks and Internets, 4th Edn., Prentice-Hall.

6. Sunil Kumar, S. Man Droms, Mahabaleshwar S. Kakkasageri, ‘Wireless and Mobile Networks: Concepts and Protocols’, Wiley India.

WIRELESS AND MOBILE NETWORKING

Subject Code: MCSE4-161 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

LEARNING OBJECTIVES:

Students will familiarize themselves with mobile communication networks. They will gain insight into media access control mechanisms dedicated to wireless communication and have a thorough understanding of mechanisms based on the network and the transport layers, with a focus on ad hoc and mesh networks. Moreover, the students will acquire knowledge about the connections between the different protocol layers and will be able to apply the acquired knowledge on methodological analysis of real communication systems.

LEARNING OUTCOMES:

CO1: to familiarize with the fundamentals of wireless and mobile networking
CO2: to understand the issues and management of mobility
CO3: to apprehend the development of cellular and wireless networks
CO4: to outline the advances in wireless and mobile networks

UNIT-I (13 Hrs.)

Fundamental Concepts: Propagation phenomena, mobile environment, Cellular systems: SIR calculations, reuse, Channel assignment algorithms, power control, Radio Channel Modelling, Digital modulation techniques, FDMA, TDMA, CDMA, comparative capacity calc., Error control, Second Generation, Circuit-Switched, Cellular Systems: D-AMPS(IS-136), GSM, IS-95 Third Generation, Packet-Switched System: IMT-2000, UMTS, GSM+, Fading Mitigation, Intersymbol Interference, Mitigation Error Control.

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UNIT-II (12 Hrs.)

Mobile Computing and Communications: Introduction to Mobile Networking, Mobile IP, route optimization, Transport layer issues: interaction with TCP, Ad Hoc Networking, Mobility Management, Mobile Agents, Multimedia and Adaptive Wireless Networking.

UNIT-III (10 Hrs.)

Cellular and Wireless Internet: 2/2.5 G, GSM, GPRS, 3G(IMT-2000),4G Movement (3GPP, 3GIP, etc.), Mobile IP, Wireless TCP, Wireless QOS (Scheduling, adaptive systems).

UNIT-IV (10 Hrs.)

IP-based Mobile Telecommunications Networks: Advances in Mobile IP, Micro Mobility, Services.

Pervasive Networking: Bluetooth, Home RF, Ad Hoc Networking, Sensor Networks.

Recommended Books:

1. Dharma P. Aggrawal, Qing-an Zeng, ‘Introduction to Wireless and Mobile Systems’, 3rd Edn., Cenage Learning Engineering.
2. Istojmenovic, ‘Handbook of Wireless Networks and Mobile Computing’, John Wiley & Sons, Inc.
3. Yi-binglin and Imrichchlamtac, ‘Wireless and Mobile Network Architectures’, 1st Edn., Wiley Publications.
4. Sunil kumar, S. Manvi, ‘Wireless and Mobile Networks: Concepts and Protocols’, Wiley Publications.
5. William Stallings, ‘Wireless Communications & Networks’, 2nd Edn., Pearson.

ADVANCED OPERATING SYSTEM

MCSE1-161	**L T P C**	**Duration: 45 Hrs.**
MCSE2-161	**3 1 0 4**	
MCSE4-162		
MCSE3-161		

LEARNING OBJECTIVES:

- To learn the fundamentals of Operating Systems.
- To gain knowledge on Distributed operating system concepts that includes architecture, Mutual exclusion algorithms, Deadlock detection algorithms and agreement protocols.
- To gain insight on to the distributed resource management components viz. the algorithms for implementation of distributed shared memory, recovery and commit protocols.
- To know the components and management aspects of Real time, Mobile operating systems.

LEARNING OUTCOMES:

CO1: Discuss the various synchronization, scheduling and memory management issues.

CO2: Demonstrate the Mutual exclusion, Deadlock detection and agreement protocols of Distributed operating system.

CO3: Discuss the various resource management techniques for distributed systems.

CO4: Identify the different features of real time and mobile operating systems.

UNIT-I (12 Hrs.)

Fundamentals of Operating Systems: Strategies of operating system, Structures of operating system, overview – Synchronization Mechanisms – Processes and Threads - Process Scheduling –Deadlocks: Detection, Prevention and Recovery – Models of Resources – Memory Management Techniques.

Distributed Operating Systems: Issues in Distributed Operating System – Architecture – Communication Primitives – Lamport's Logical clocks – Causal Ordering of Messages – Distributed Mutual Exclusion Algorithms – Centralized and Distributed Deadlock Detection Algorithms – Agreement Protocols.

UNIT-II (11 Hrs.)

Distributed Resource Management: Distributed File Systems – Design Issues - Distributed Shared Memory – Algorithms for Implementing Distributed Shared memory–Issues in Load Distributing – Scheduling Algorithms – Synchronous and Asynchronous Check Pointing and Recovery – Fault Tolerance – Two-Phase Commit Protocol – Non blocking Commit Protocol – Security and Protection.

UNIT-III (11 Hrs.)

Real Time and Mobile Operating Systems: Basic Model of Real Time Systems - Characteristics- Applications of Real Time Systems –Real Time Task Scheduling - Handling Resource Sharing - Mobile Operating Systems –Micro Kernel Design - Client Server Resource Access – Processes and Threads – Memory Management – File system, Networked file system

UNIT-IV (11 Hrs.)

Case Studies: Linux System: Design Principles - Kernel Modules - Process Management Scheduling –Memory Management - Input-Output Management - File System – Interprocess Communication. iOS and Android: Architecture and SDK Framework - Media Layer - Services Layer - Core OS Layer – File System.

Recommended Books:

1. Andrew S. Tanenbaum and Maarten van Steen, 'Distributed Systems: Principles and Paradigms', 2nd Edn., Prentice Hall, **2007**.

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2. Mukesh Singhal and Niranjan G. Shivaratri, ‘Advanced Concepts in Operating Systems – Distributed, Database, and Multiprocessor Operating Systems’, Tata McGraw-Hill, **2001**.
3. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, ‘Operating System Concepts’, 7th Edn., John Wiley & Sons, **2004**.
4. Daniel P. Bovet and Marco Cesati, ‘Understanding the Linux Kernel’, 3rd Edn., O’Reilly, **2005**.
5. Rajib Mall, ‘Real-Time Systems: Theory and Practice’, Pearson Education India, **2006**.
6. Neil Smyth, ‘iPhone iOS 4 Development Essentials – Xcode’, 4th Edn., Payload Media, **2011**.

DIGITAL DEFENCES

Subject Code: MCSE4-163 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

LEARNING OBJECTIVES: The course teaches Cyber Security techniques with a core focus on cellular/mobile devices, computer hardware and software functionality.

LEARNING OUTCOMES:

CO1: Introduction to viruses, worms, malicious codes, etc.
CO2: Understanding the concept of DOS and testbeds.
CO3: Get overview of architectures for internet.
CO4: Understanding the concept of information security and data management.

UNIT-I (10 Hrs.)

Viruses, worms, malicious codes, Trojan Horses etc.: History, Threats, Components, models of propagation and their epidemic spread, defence against worms, viruses and malicious codes.

UNIT-II (14 Hrs.)

DOS attacks, DDOS: Introduction, History, Effects, Evolution, Semantic Levels of DDOS, IP Spoofing, DDOS defence approaches.

Design of Testbeds for simulation of attacks against critical infrastructures: Attack vectors, Attack simulation their analysis and modelling.

UNIT-III (10 Hrs.)

Architectures for Internet: Design Principles, Architectural Constraints, Principles of avoiding failures.

UNIT-IV (11 Hrs.)

Information Security and Data Management: Information Security, Information Management Technologies, Issues, Discretionary and Mandatory policies for information security, secure distributed and heterogeneous database systems Introduction to secure data warehousing and data mining for security applications.

Recommended Books:

1. Ed Skoudis, Lenny Zeltser, ‘Malware: Fighting Malicious Code’, Prentice Hall, **2003**.
2. Jelena Mirkovic, Sven Dietrich, David Dittrich and Peter Reiher, ‘Internet Denial of Service: Attack and Defense Mechanisms’, Prentice Hall.
3. Olu Akindeinde, ‘Attack Simulation and Thread Modelling’, **2008**.
4. Barbara van Schewick, ‘Internet Architecture and Innovations’, MIT Press, **2010**.
5. Thoe Schlossnagle, ‘Scalable Internet Architecture’, **2007**.
6. Bhavani Thuraisingham, ‘Database and Applications Security: Integrating Information Security and Data Management’, Auerbach Publications.

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PRACTICAL LAB.-I

Subject Code: MCSE4-104 **L T P C**
0 0 4 2

- Practical's should be related to the core subjects of the same semester

ETHICAL HACKING

Subject Code: MCSE4-205 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

LEARNING OBJECTIVES:
This course helps to gain knowledge of a range of computer network security technologies, tools and services related to ethical hacking.

LEARNING OUTCOMES:

CO1: To understand various fundamentals of Ethical hacking.
CO2: To understand how to extract information about hosts and networks.
CO3: To develop knowledge of various forms of attacks.
CO4: To understand about judicious and ethical use of various tools.

UNIT-I (11 Hrs.)

Introduction: Security, Functionality and ease of use Triangle, Essential Terminology, Elements of Security, Difference between Penetration Testing and Ethical Hacking, Deliverables ethics and legality, Computer Crimes and Implications.

Reconnaissance and Scanning: Information Gathering Methodology, Locate the Network Range, Active and Passive reconnaissance, Scanning, Elaboration phase, active scanning, scanning tools NMAP, hping2. Enumeration, DNS Zone transfer. Detecting live systems on the target network, discovering services running /listening on target systems, understanding port scanning techniques, Identifying TCP and UDP services running on the target network, Understanding active and passive fingerprinting

UNIT-II (12 Hrs.)

Trojans and Backdoors: Effect on Business, Trojan, Overt and Covert Channels, Working of Trojans, Different Types of Trojans, Different ways a Trojan can get into a system, Indications of a Trojan Attack, some famous Trojans and ports used by them

Sniffing: Definition of sniffing, Sniffer working, Passive Sniffing, Active Sniffing, Ethereal tool, Man-in-the-Middle Attacks, Spoofing and Sniffing Attacks, ARP Poisoning and countermeasures.

Social Engineering: Social Engineering, Art of Manipulation, Human Weakness, Common Types of Social Engineering, Human Based Impersonation, Example of Social Engineering, Computer Based Social Engineering, Reverse Social Engineering, Policies and Procedures, Security Policies-checklist.

UNIT-III (11 Hrs.)

Session Hijacking: Understanding Session Hijacking, spoofing vs Hijacking, Steps in Session Hijacking, Types of Session Hijacking, TCP Concepts 3 Way and shake, Sequence numbers

Hacking Web Servers: Types of web server vulnerabilities, Attacks against web servers, IIS Unicode exploits, Patch management techniques, Web Application Scanner, Metasploit Framework, Web server hardening methods

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UNIT-IV (11 Hrs.)

Ethical Hacking: System Hacking and Hacking Wireless Networks: Aspect of remote password guessing, Role of eavesdropping, Various methods of password cracking, Keystroke Loggers, Understanding Sniffers, Comprehending Active and Passive Sniffing, ARP Spoofing and Redirection, DNS and IP Sniffing, HTTPS Sniffing. Introduction to 802.11, Role of WEP, Cracking WEP Keys, Sniffing Traffic, Wireless DOS attacks, WLAN Scanners, WLAN Sniffers, Hacking Tools, Securing Wireless Networks.

Recommended Books:

1. Kimberly Graves, 'Certified Ethical Hacking Expert Study Guide', Wiley Publishing Inc., **2007**.
2. Eric Core, 'Hackers Beware', EC-Council Press, **2003**.
3. William Stallings, 'Network Security Essentials', 5th Edn., Prentice Hall, **2013**.
4. William R. Cheswick and Steven M. Bellovin, 'Firewalls and Internet Security', 2nd Edn., Addison-Wesley Professional, **2003**.
5. W. Stallings, 'Cryptography and Network Security', 5th Edn., Prentice Hall, **2010**.

CRYPTOGRAPHY & NETWORK SECURITY

Subject Code: MCSE4-206 **L T P C** **Duration: 45 Hrs.**

3 1 0 4

LEARNING OBJECTIVES:

The main objective of this course is to make student able to understand the basic concepts, services, threats and principles in network security, various security services and mechanisms in the network protocol stack.

LEARNING OUTCOMES:

CO1: Understand security trends.

CO2: Implement various cryptographic algorithms.

CO3: Explain the hash function.

CO4: Understand the network security and system level security used.

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UNIT-I (11 Hrs.)

Security trends, Attacks and services, Classical crypto systems, Different types of ciphers, LFSR sequences, Basic Number theory, Congruences, Chinese Remainder theorem, Modular exponentiation, Fermat and Euler's theorem, Legendre and Jacobi symbols, Finite fields, continued fractions.

UNIT-II (11 Hrs.)

Simple DES, Differential crypto analysis, DES – Modes of operation, Triple DES, AES, RC4, RSA, Attacks – Primality test – factoring.

UNIT-III (12 Hrs.)

Discrete Logarithms, Computing discrete logs, Diffie-Hellman key exchange, ElGamal Public key cryptosystems, Hash functions, Secure Hash, Birthday attacks, MD5, Digital signatures, RSA, ElGamal DSA.

UNIT IV (11 Hrs.)

Authentication applications – Kerberos, X.509, PKI – Electronic Mail security – PGP, S/MIME – IP security – Web Security – SSL, TLS, SET. Intruders, Malicious software, viruses and related threats, Firewalls, Security Standards.

Recommended Books:

1. Wade Trappe, Lawrence C. Washington, 'Introduction to Cryptography with Coding Theory', 2nd Edn., Pearson, **2007**.

2. William Stallings, 'Cryptography and Network Security Principles and Practices', 4th Edn., Pearson/PHI, **2006**.
3. W. Mao, 'Modern Cryptography – Theory and Practice', Pearson Education, 2nd Edn., **2007**.
4. Charles P. Pfleeger, Shari Lawrence Pfleeger – 'Security in Computing', 3rd Edn., Prentice Hall of India, **2006**.
5. Behrouz Forouzan, 'Cryptography & Network Security', McGraw-Hill, 2005.

INFORMATION RETRIEVAL

Subject Code: MCSE4-264 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

LEARNING OBJECTIVES:

To learn the underlying technologies of modern information retrieval system.

LEARNING OUTCOMES:

CO1: Able to understand the basic concepts of modern information retrieval system
CO2: Able to understand the search engine architecture.
CO3: Able to learn the retrieval models and apply the algorithms of retrieval algorithms.
CO4: Able to evaluate the quality of retrieval system.

UNIT-I (11 Hrs.)

Introduction: The nature of unstructured and semi-structured text, Boolean queries, World Wide Web, History of Hypertext, Hypertext systems, Problems due to Uniform accessibility, types of Hypertext data, Text and multimedia data indexing, PageRank, HITS, XML and Semantic web.

UNIT-II (11 Hrs.)

Search engine architecture: the basic building blocks of a modern search engine system, including web crawler, basic text analysis techniques, inverted index, query processing, search result interface.

UNIT-III (12 Hrs.)

Retrieval models: Boolean, vector space, probabilistic and language models, latent semantic indexing, ranking algorithm, Introduction to the most recent development of learning-based ranking algorithms, i.e., learning-to-rank, Relevance feedback, query expansion, link analysis and search applications.

UNIT-IV (11 Hrs.)

Performance Evaluation: Evaluating search engines, User happiness, precision, recall, F-measure.

Recommended Books:

1. Christopher D. Manning, Prabhakar Raghavan, and Hinrich Schutze, 'Introduction to Information Retrieval', Cambridge University Press, 1st Edn., **2008**.
2. Bruce Croft, Donald Metzler, and Trevor Strohman, 'Search Engines: Information Retrieval in Practice', 1st Edn., Pearson Education, **2009**.
3. Yates Ricardo and Berthier Ribeiro-Neto, 'Modern Information Retrieval', 2nd Edn., Addison-Wesley, **2011**.
4. Soumen Chakrabarti, 'Mining the Web', 1st Edn., Morgan-Kaufmann, **2002.**

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COMPUTER AND CYBER FORENSICS

Subject Code: MCSE4-265 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

LEARNING OBJECTIVES:

This course offers a good understanding of network Investigation, web attack and DOS investigation and will prepare students to be in a position to perform network forensics. This course also helps to provide understanding of email system and tracking.

UNIT-I (11 Hrs.)

Introduction to Network Forensics; Need of Cyber Forensics, Cyber Evidence: Incidents and Evident, Search and Seizure, Identification, Preservation, Analysis and Preparation, Documentation and Management of Crime Sense. Data image: Image Capturing and its importance, Partial Volume Image.

UNIT-II (12 Hrs.)

Hidden Data Extraction: Data Hiding Techniques, Recovery of deleted files, Cracking Passwords, Data Extraction tools, Windows Registry Analysis, Network Forensics: Introduction to Network Forensics and Investigating Logs, Wired and Wireless Network Traffic capture and Analysis. Document Forensics: Information in Metadata.

UNIT-III (11 Hrs.)

Web Attack Investigations: Introduction to Investigating Web Attacks, Indication of a Web Attack, Types of Web Attack. Denial of Service Investigations, Internet Crime Investigations: Introduction to Investigating Internet Crimes, Internet Forensics, Steps for Investigating Internet Crime.

UNIT-IV (11 Hrs.)

Email Crime Investigations: Email Structure, Email Addressing, Email Headers Analysis. Malware Forensics: Botnets, Automatic Self Updates, Fast Flux DNS, Network Behavior of Malware: Propagation, Command & Control, Payload Behavior.

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Recommended Books:

1. Council, Ec. ‘Computer Forensics: Investigating Network Intrusions and Cyber-Crime’, Cengage Learning, **2009**.
2. Linda Volonino, ‘Computer Forensics for Dummies’, Willey Publishing, Inc., **2012.**
3. Sherri Davidoff and Jonathan Ham, ‘Network Forensics Tracking Hackers through Cyberspace’, Prentice Hall, **2012**.
4. Michael G. Solomon, K. Rudolph, Ed Tittel, Neil Broom and Diane Barrett, ‘Computer Forensics Jump Start’, 2nd Edn., Willey Publishing, Inc., **2011**.
5. E. Casey, ‘Handbookof Digital Forensics and Investigation’, Academic Press, **2009**.

BIOMETRIC SECURITY

Subject Code: MCSE4-266 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

LEARNING OBJECTIVES:

Cover a broad range of approaches to biometrics reflecting both fundamental principles and the current state-of-the-art practices.

LEARNING OUTCOMES:

After completion of course, student would be able to:

CO1: Modern biometric technologies and the generic components of a biometric system.

CO2: Pattern recognition and feature extraction in biometrics, Voice and face recognition systems.

CO3: Select the most appropriate biometric for a given application.
CO4: Work with signal and image acquisition systems, Deploying biometric systems.

UNIT-I (11 Hrs.)

Biometrics Introduction: Benefits of biometrics over traditional authentication systems, benefits of biometrics in identification systems, comparison of various biometric traits, selecting a biometric for system, Applications. Key biometric terms and processes, biometric verification and identification, how biometric matching works, Accuracy in biometric systems, Metrics for evaluating biometric systems: FAR, FRR, ERR etc.

UNIT-II (12 Hrs.)

Physiological Biometric Technologies: Fingerprints: Technical description, characteristics, Competing technologies, strengths, weaknesses and deployment. Facial scan: Technical description, characteristics, weaknesses and deployment.

Iris scan: Technical description, characteristics, strengths, weaknesses and deployment.

Retina Vascular Pattern: Technical description, characteristics, strengths, weaknesses and deployment.

Hand Scan: Technical description, characteristics, strengths, weaknesses and deployment.

UNIT-III (11 Hrs.)

Behavioral Biometric Technologies: Handprint Biometrics, Signature and handwriting technology: Technical description, classification, keyboard /keystroke dynamics, Voice: data acquisition, feature extraction, characteristics, strengths, weaknesses, deployment.

Multi biometrics: Multi-modal biometric Systems: Face and Hand geometry, Fingerprint and iris recognition etc., Multimodal fusion techniques- score fusion, z-norm fusion etc., Normalization techniques.

UNIT-IV (11 Hrs.)

Biometric Security Modals: Sensor level security, database security, template security techniques, Channel level security, various remedial solutions available.

Recommended Books:

1. Anil K. Jain, Michigan State University, USA, Patrick Flynn University of Notre Dame, USA, Arun A. Ross West Virginia University, USA, 'Handbook of Biometrics', **2008**.
2. John Chirillo, Scott Blaul. 'Implementing Biometric Security', Wiley Red Books.

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ADAVANCED DATABASES

Subject Code: MCSE4-267 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

LEARNING OBJECTIVES:

The objective of this course is to study principal of database management system, distributed databases, parallel databases and emerging database technologies. To understand the basic principles, concepts and applications of data warehousing and data mining.

LEARNING OUTCOMES:

CO1: Be able to acquire the essential concept of ER Model and object oriented Databases and Schema Designs.

CO2: Be able to understand essential concept of parallel, distributed systems with concurrency control and their recovery.

CO3: Be able to cope up with XML databases and related advance topic.

CO4: Ability to do Conceptual, Logical, and Physical design of Data Warehouses OLAP applications and OLAP deployment and Data Mining.

UNIT-I (12 Hrs.)

Extended Entity Relationship Model and Object Model: ER model, Subclasses, Super classes, Inheritance, Specialization and Generalization, Constraints and Characteristics of Specialization and Generalization. Relationship Types.

Object−Oriented Databases: Overview of Object−Oriented Concepts. Object Identity, Object Structure, and Type Constructors, Encapsulation of Operations, Methods, and Persistence, Type Hierarchies and Inheritance, Type extents and Queries, Complex Objects; Database Schema Design for OODBMS; OQL, Persistent Programming Languages; OODBMS Architecture and Storage Issues; Transactions and Concurrency control. Example of ODBMS.

UNIT-II (11 Hrs.)

Object Relational and Extended Relational Databases: Database Design for an ORDBMS − Nested Relations and Collections; Storage and Access methods, Query processing and Optimization; An Overview of SQL3, Implementation Issues for Extended Type; Systems. Comparison of RDBMS, OODBMS, ORDBMS. Parallel and Distributed Databases and Client−Server Architecture: Architectures for Parallel Databases, Parallel Query Evaluation; Parallelizing Individual Operations, Sorting, Joins; Distributed Database Concepts, Data Fragmentation, Replication, and Allocation techniques for Distributed Database Design; Query Processing in Distributed Databases; Concurrency Control and Recovery in Distributed Databases. An Overview of Client−Server Architecture

UNIT-III (11 Hrs.)

Databases on the Web and Semi Structured Data: Web Interfaces to the Web, Overview of XML; Structure of XML Data, Document Schema, Querying XML Data; Storage of XML Data, XML Applications; The Semi Structured Data Model, Implementation Issues. Indexes for Text Data

Enhanced Data Models for Advanced Applications: Active Database Concepts. Temporal Database Concepts; Spatial Databases, Concepts and architecture; Deductive Databases and Query processing; Mobile Databases, Geographic Information Systems

UNIT-IV (11 Hrs.)

Introduction to Data Warehousing: Creating and maintaining a warehouse. Introduction to Data warehouse and OLAP, Multidimensional data model, Data Warehouse architecture, OLAP and data cubes, Operations on cubes, Data preprocessing need for preprocessing, Multidimensional data model, OLAP and data cubes, Data warehousing Concepts, Study of Data preprocessing need for preprocessing, Simulating and maintaining a Warehouse, Analysis of Data preprocessing. Introduction to data Mining-Data mining functionalities, clustering - k means algorithm, classification - decision tree, Bayesian classifiers, Outlier analysis, association rules - apriori algorithm, Introduction to text mining

Recommended Books:

1. R. Elmasri, S.B. Navathe, ‘Fundamentals of Database Systems’, 6th Edn., Pearson Education, **2010**.
2. Abraham Silberschatz, Henry. F. Korth and S. Sudharsan, ‘Database System Concepts’, 4th Edn., Tata McGraw Hill, **2004**.
3. Raghu Ramakrishna and Johannes Gehrke, ‘Database Management Systems’, 3rd Edn., Tata McGraw Hill, **2003**.
4. Arihant Khitcha, Neeti /kapoor, ‘Advance Database Management System’, **2011.**
5. S.S. Khandare, ‘Database Management and Oracle Programming’, 2nd Revised Edn., S. Chand, N. Delhi, **2010.**

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PYTHON PROGRAMMING

Subject Code: MCSE4-268 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

LEARNING OBJECTIVES:
The course is structured to understand fundamentals of Python Programing Language. The course also covers the use of Python Programming in Ethical Hacking/Network Security.
LEARNING OUTCOMES:

UNIT-I (11 Hrs.)

Python Introduction: Installing and setting Python environment in Windows and Linux, basics of Python interpreter, Execution of python program, Editor for Python code, syntax, variable, types. Flow control: if, ifelse, for, while, range () function, continue, pass, break. Strings: Sequence operations, String Methods, Pattern Matching.

UNIT-II (12 Hrs.)

Lists: Basic Operations, Iteration, Indexing, Slicing and Matrixes; Dictionaries: Basic dictionary operations; Tuples and Files; Functions: Definition, Call, Arguments, Scope rules and Name resolution; Modules: Module Coding Basics, Importing Programs as Modules, Executing Modules as Scripts, Compiled Python files (.pyc), Standard Modules: OS and SYS, The dir() Function, Packages.

UNIT-III (11 Hrs.)

Input output and file handling: Object Oriented Programming features in Python: Classes, Objects, Inheritance, Operator Overloading, Errors and Exceptions: try, except and else statements, Exception Objects, Regular expressions, Multithreading, Networking: Socket module.

UNIT-IV (11 Hrs.)

Role of Python in Hacking and Cyber Forensics: Debugging in python: introduction to PyDBG and immunity debugger; Hooking: Soft Hooking with PyDbg, Hard Hooking with Immunity Debugger, DLL and code injection: Remote Thread Creation, DLL Injection, Code Injection.

Recommended Books:

1. Mark Lutz., 'Learning Python',4th Edn., O'REILLY Media, Inc., **2009**.
2. Justin Seitz, 'Gray Hat Python: Python Programming with Hackers and Reverse Engineers', No Starch Press, Inc., **2009**.
3. Paul Berry, 'Head First Python'. O'REILLY Media, Inc., **2011**.

INFORMATION SECURITY RISK MANAGEMENT

Subject Code: MCSE4-269 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

UNIT-I (11 Hrs.)

Risk Management: Definition of Risk, Risk Management, Importance of Risk Management, Integration of Risk Management Into SDLC

Risk Assessment: Risk Assessment Methodologies, System Characterization, Threat identification, Vulnerability identification, Control analysis, Likelihood determination, Impact analysis, Risk determination, Control recommendations.

UNIT-II (12 Hrs.)

Risk Mitigation: Risk Mitigation Options, Risk Mitigation Strategy, Approach for Control Implementation, Control Categories, Cost-Benefit Analysis, Residual Risk

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Risk Analysis: Effective Risk Analysis, Qualitative risk Analysis, Value Analysis, Facilitated Risk Analysis Process, Case Studies of Risk Analysis.

UNIT-III (12 Hrs.)

Vulnerability in Information System: Vulnerability Management, Types of network Vulnerability, Procedure of Vulnerability, Managing Vulnerability, Known Software Vulnerability, Vulnerability Assessment Process. Vulnerability of Critical Infrastructure. Vulnerability Scanning Tools.

Threats and Attacks: Principles of Security, Understanding the Attackers, Reducing the Risk of attack, Tools used for the attack, Respond to an Attack.

UNIT-IV (11 Hrs.)

Post Assessment Activities: IT Security Architecture and framework, Defining the structure and Hierarchy, Sample IT Security Architecture and Framework, Hierarchical IT Security Architecture and Framework, Security incident Response team.

Recommended Books:

1. Risk management guide for Information technology systems, Special Publication National institute of Standard and technology, Gaithersburg, MD, **2006**.
2. Thomas R. Peltier, 'Information Security Risk Analysis', Illustrated Edn., Auerbach Publications, **2001**.
3. Michael Gregg and David Kim, 'Inside Network Security Assessment: Guarding Your IT Infrastructure', Sams, **2005**.
4. Douglas J. Landoll and Douglas J. Landoll, 'The Security Risk Assessment Handbook: A Complete Guide for Performing Security Risk Assessments', Auerbach Publications, 1st Edn., **2005**.

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SECURITY ENGINEERING

Subject Code: MCSE4-270	L T P C 3 1 0 4	Duration: 45 Hrs.

UNIT-I (11 Hrs.)

Security Engineering: Introduction, Framework and definition.

Usability and Psychology: Attacks Based on Psychology: Pretexting; Passwords; and System Issues **Access Control**: Operating System Access Controls; Hardware Protection.

UNIT-II (12 Hrs.)

Distributed Systems: Introduction; Concurrency; Fault Tolerance and Failure Recovery; Naming and Types of Name.

Multilevel Security: Introduction; The Bell-LaPadula Security Policy Model; Historical Examples of MLS Systems; Future MLS Systems; Broader Implications of MLS.

UNIT-III (11 Hrs.)

Multilateral Security: Introduction; Compartmentation, the Chinese Wall and the BMA Model; Inference Control; Residual Problem.

Physical Protection: Introduction; Threats and Barriers; Alarms.

Monitoring and Metering: Introduction; Prepayment Meters; Taxi Meters, Tachographs and Truck Speed Limiters; Postage Meters.

UNIT-IV (11 Hrs.)

Telecom System Security: Introduction; Phone Phreaking; Mobile Phones; Security Economics of Telecomms.

Managing the Development of Secure Systems: Introduction; Managing a Security Project; Methodology; Security Requirements Engineering; Risk Management; Managing the Team.

Recommended Systems:

1. Ross Anderson, 'Security Engineering: A Guide to Building Dependable Distributed Systems', 1st Edn., Wiley, **2001**.
2. Ross Anderson, 'Security Engineering: A Guide to Building Dependable Distributed Systems' 2nd Edn., Wiley, **2008**.
3. Julia H. Allen, Sean Barnum, Robert J. Ellison, Gary McGraw; Nancy R. Mead, 'Software Security Engineering: A Guide for Project Managers', Addison-Wesley Professional, **2008**.
4. George Coulouris Jean Dollimore Tim Kindberg, 'DISTRIBUTED SYSTEMS: Concepts and Design', 4th Edn., Addison-Wesley, **2005**.

OPEN SOURCE TECHNOLOGIES

Subject Code: MCSE4-271 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

LEARNING OBJECTIVES:

To give a brief introduction to the open source technology. Through interactive sessions enabling students to enhance their skills in contributing and implementing their technical knowledge.

LEARNING OUTCOMES:

CO1: Open source software history, initiatives and principles. Open standards, Licenses and FOSS.

CO2: Learn about the Open Source Operating system and its distributions like Fedora, Google chrome OS, Ubuntu.

CO3: Study of Web technologies based on open Software's LAMP (Linux Apache MySqland PHP/Python).

CO4: To Learn HTML, XHTML, PHP and JavaScript.

UNIT-I (11 Hrs.)

Introduction: Open Source Definition, Free Software vs. Open Source Software, Public Domain Software, Open Source History, Initiatives, Principle and Methodologies. Open Standards.

Open Source Development Model Licenses and Patents: What Is a License, Important FOSS Licenses (Apache, BSD, GPL, LGPL), copyrights and copy lefts, Patents Economics of FOSS: Zero Marginal Cost, Income-generation opportunities, Problems with traditional commercial software, Internationalization.

UNIT- II (12 Hrs.)

Open Source Operating Systems: Different open source operating systems. Google Chrome OS, BSD, Linux Distributions – Fedora and Ubuntu, Installation, Disk Partitioning, Boot loader. Using Linux – Shell, File system familiarity, Linux Administration – Managing users, services and software, Network Connectivity, Configurations and Security.

Open Source Web Technologies: Two Tier and Three Tier Web based Application Architecture. LAMP Terminologies, Advantages. Apache, Web server conceptual working, Web browser, HTTP, Installation and Configuration, httpd.conf file, Logging, Security, Running a website, MySQL, Database management system, ER diagram, Relational database, Installation, Configuration, Administration, Common SQL queries.

UNIT-III (11 Hrs.)

Programming on XHTML and XML: Editing XHTML, W3C XHTML validation services, designing XHTML by using XHTML tables, frames, forms and other elements. CSS and its

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types. XML, XML namespaces, DTD, XML schema, XML vocabularies, DOM and its methods, SOAP.

UNIT-IV (11 Hrs.)

Programming on PHP and JavaScript: JavaScript: JavaScript variables, control structures, functions, arrays and objects. Cascading Style Sheets, Client Side Scripting - Java Script, PHP: Form processing and business logic, stream processing and regular expressions, viewing client/server environment variables, connecting to database and handling of cookies. SQL, Accessing databases with PHP.

Open Source Ethics: Open source vs. closed source Open source government, Open source ethics. Social and Financial impacts of open source technology, shared software, Shared source.

Case Studies: Mozilla (Firefox), Wikipedia, Joomla, Open Office, GCC.

Recommended Books

1. B. Ware, B. Lee J., 'Open Source Development with Lamp: Using Linux, Apache, MySQL, Perl, and PHP', Addison-Wesley Professional, **2006**.
2. Deitel, 'Internet and World wide web, How to program', 4th Edn., Prentice Hall, **2008.**
3. P. DuBois, 'MySQL', 4th Edn,, Addison-Wesley Professional.
4. M. Zandstra, 'Teach Yourself PHP', 2nd Edn., Sams Publishing, **2004**.

PRACTICAL LAB.-II

Subject Code: MCSE4-207 **L T P C**
0 0 4 2

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- Practical's should be related to the core subjects of the same semester

SOFTWARE VULNERABILITY ANALYSIS

Subject Code: MCSE4 -372 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

LEARNING OBJECTIVES:

Student will learn awareness of various security failures, Job of security implementer & knowledge UNIX access control model, Protection from buffer overflows & protection of socket from network intrusion, Various counter measures for security problem.

LEARNING OUTCOMES:

CO1: Recognize various threats to the software system.
CO2: Knowledge of various permissions to different types of files
CO3: Knowledge to deal the various software hijacks.
CO4: Know about the Implementation of Daemons for protection of software.

UNIT-I (11 Hrs.)

Introduction to security & Authentication: Software Security - Dealing with Widespread Security Failures, Bugtraq, CERT Advisories, RISKS Digest, Technical Trends Affecting Software Security, the 'ilities, Beyond Reliability, Penetrate and Patch, On Art and Engineering, Security Goals, Prevention, Traceability and Auditing, Monitoring, Privacy and Confidentiality, Multilevel Security, Anonimity, Authentication, Integrity, Know Your Enemy – Common Software Security Pitfalls. Software Project Goals.

UNIT-II (12 Hrs.)

Application Security & Malicious Code: Managing Software Security Risk: An Overview Of Software Risk Management For Security, The Role Of Security Personnel, Software Security Personnel In The Life Cycle, Deriving Requirements, Risk Assessment, Design For Security, Implementation and Testing, A Dose Of Reality, Getting People To Think About Security, Software Risk Management In Practice, When Development Goes Astray, Code Review (Tools) - Architectural Risk Analysis - Penetration Testing - Risk-Based Security Testing - Abuse Cases - Security Requirements - Security Operations

Access Control & Physical Protection: The LINUX Access Control Model, How LINUX Permissions Work? Modifying File Attributes, Modifying Ownership, The umask, The Programmatic Interface, Setuid Programming, Compartmentalization, Fine-Grained Privileges.

UNIT-III (11 Hrs.)

Buffer Overflow & Rootkits: Buffer Overflows as Security Problems, Defending Against Buffer Overflow, Major Gotchas, Internal Buffer Overflows, More Input Overflows, Other Risks, Tools for handling buffer overflows, Smashing Heaps and Stacks, Heap Overflows, Stack Overflows, Decoding The Stack, To Infinity … And Beyond! Attack Code.

UNIT-IV (11 Hrs.)

Network Security & Intrusion: Brief Review of OSI Model, Sockets, Socket Functions, Socket Addresses, Network Byte Order, Internet Address Conversion, Simple Server and Web Clients, Tinyweb Server. Peeling Back the Lower Layers - Data-Link Layer - Network Layer- Transport Layer - Network Sniffing - Raw Socket Sniffer - libpcap Sniffer - Decoding the Layers - Active Sniffing - Denial of Service – SYN Flooding - The Ping of Death - Teardrop - Ping Flooding - Amplification Attacks - Distributed DoS Flooding - TCP/IP Hijacking - RST Hijacking - Continued Hijacking - Port Scanning - Stealth SYN Scan - FIN, X-mas, and Null Scans - Spoofing Decoys - Idle Scanning - Proactive Defense (shroud) - Reach Out and Hack Someone - Analysis with GDB - Almost Only Counts with Hand Grenades - Port-Binding Shellcode.

Recommended Books:

1. John Viega, Gary McGraw, 'Building Secure Software: How to Avoid Security Problems the Right Way', Addison-Wesley Professional Computing Series, **2001.**
2. Gary McGraw, 'Software Security: Building Security', Addison-Wesley Professional Computing Series, **2006.**
3. Michael Howard, David LeBlanc, John Viega: '19 Deadly Sins of Software Security: Programming', 1st ed., McGraw-Hill Education, **2009**.
4. Michael Howard, David Leblanc, John Viega 'Flaws and How to Fix Them (Security One-off)', 1st ed., McGraw-Hill Education, **2009.**
5. Jon Erickson, 'Hacking: The Art of Exploitation', 2nd Ed, No Starch Press, **2008.**
6. Richard Sim, 'Software Security, Theory Programming and Practice', 1st ed., Cengage Learning, **2008.**

DATA WAREHOUSING AND DATA MINING

Subject Code: MCSE4-373 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

LEARNING OBJECTIVES:

Data warehousing and data mining are two major areas of exploration for knowledge discovery in databases. The course aims to cover powerful data mining techniques including clustering, association rules, and classification. It then teaches high volume data processing mechanisms by building warehouse schemas such as snowflake, and star. OLAP query retrieval techniques are also introduced.

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LEARNING OUTCOMES:

CO1: To introduce the basic concepts of Data Warehouse and Data Mining techniques.

CO2: To process raw data to make it suitable for various data mining algorithms.

CO3: To discover interesting patterns, analyze supervised and unsupervised models and estimate the accuracy of the algorithms

CO4: Apply the techniques of clustering, classification, association finding, feature selection and visualization to real world data

UNIT-I (11 Hrs.)

Data Warehousing: Introduction, ETL, Data warehouses– design guidelines for data warehouse implementation, Multidimensional Models; OLAP- introduction, Characteristics, Architecture, Multidimensional view and data cube, Data cube operations, data cube computation.

Review of the Basic Data Analytic Methods using R: Introduction to R –look at the data, Analyzing and Exploring the Data, Statistics for Model Building and Evaluation.

UNIT-II (12 Hrs.)

Data Mining: Introduction, association rules mining, Naive algorithm, Apriori algorithm, direct hashing and pruning (DHP), Dynamic Item set counting (DIC), Mining frequent pattern without candidate generation (FP, growth), performance evaluation of algorithms,

UNIT-III (11 Hrs.)

Classification: Introduction, decision tree, tree induction algorithms – split algorithm based on information theory, split algorithm based on Gini index; naïve Bayes method; estimating predictive accuracy of classification method;

UNIT-IV (11 Hrs.)

Cluster Analysis: Introduction, partitional methods, hierarchical methods, density based methods, dealing with large databases, cluster software; Search engines: Characteristics of Search engines, Search Engine Functionality, Search Engine Architecture, Ranking of web pages, The search engine history, Enterprise Search, Enterprise Search Engine Software.

Web Data Mining: Web Terminology and Characteristics, Locality and Hierarchy in the web, Web Content Mining, Web Usage Mining, Web Structure Mining, Web mining Software.

Recommended Books:

1. Carlo Vercellis, 'Business Intelligence: Data Mining and Optimization for Decision Making', WILEY, **2009**.
2. J. Han, M. Kamber and J. Pei, 'Data mining concepts and techniques', 3rd Edn., Morgan Kaufmann Publishers, **2011**.
3. V. Pudi, P.R. Krishana, 'Data Mining', Oxford University Press, 1st Edn., **2009**.
4. P. Adriaans, D. Zantinge, 'Data mining', Pearsoneducation Press, 1st Edn., **1996**.
5. P. Pooniah, 'Data Warehousing Fundamentals', 1st Edn., Willey Interscience Publication, **2001**.

COMPUTER SECURITY AUDIT AND ASSURANCE

Subject Code: MCSE4-374 **L T P C** **Duration: 45 hrs.**

3 1 0 4

LEARNING OBJECTIVES:

To introduce the basic concepts of Information Security and new approaches to solve a wide variety of research-oriented problem.

LEARNING OUTCOMES:

CO1: To give an overview of various security threats, issues and their sources.

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CO2: To study Public Key Cryptography and its key management
CO3: To learn Certificate management life cyle.
CO4: To understand the XML Security.

UNIT-I (12 Hrs.)

Security Policy frameworks: Practices and Procedures, Policy authority and practices, Policy elements, Information security policy framework, Organizational security policies & procedures, Asset classification and control policies & procedures, Personnel security policies & procedures, Physical and environmental security policies & procedures, Communications and operations management policies & procedures, business practice disclosures.

UNIT-II (11 Hrs.)

PKIs: Public Key Infrastructure, Various PKIs, Core PKI services, Issues of revocation, Anonymity and Privacy issues.

Key Management: Key generation, key distribution, key storage, key backup and recovery, key management schemes, Threats to key management and protection against those threats, key management Principles and Issues

UNIT-III (12 Hrs.)

Certificate Management Life Cycle: Certificate types, Certificate Classes, Certificate Profile, Certificate Application, Certificate Issuance, listing of certificates, distributing certificates, publishing certificates, storing certificates, Retrieving certificates, Certificate Acceptance, Certificate Suspension and Revocation.

UNIT-IV (10 Hrs.)

XML Security: XML security standards, XML security applications, XML frameworks for security policy specification, Various case studies like X-GTRBAC: An XML-Based Policy Specification Framework and Architecture for Enterprise-Wide Access Control.

Recommended Books:

1. Carlisle Adams, Steve Lloyd, 'Understanding PKI: Concepts, Standards, and Deployment Considerations', 2nd Ed., Addison-Wesley Professional, **2003**.
2. Sari Stern Greene, 'Security policies and procedures principles and practices',2nd ed., Pearson Prentice Hall, **2014**.
3. Mark O'Neill, 'Web Services Security', McGraw- Hill, **2003.**
4. Jalal Feghhi, Peter Williams, 'Digital Certificates: Applied Internet Security' Pap/cdr ed., Addison Wesley, **1998**.

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M. TECH. ECE (MICRO ELECTRONICS)

Total Contact Hours = 24 Total Marks = 600 Total Credits = 22

SEMESTER 1st		Contact Hrs			Marks			Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
MECE5-101	Hardware Description Languages and VLSI Design	4	0	0	40	60	100	4
MECE5-102	Microelectronics	4	0	0	40	60	100	4
MECE5-103	Advanced Semiconductor Physics	4	0	0	40	60	100	4
MECE5-104	Research Lab-I	0	0	4	60	40	100	2
Departmental Elective – I (Select any one)		4	0	0	40	60	100	4
MECE5-156	Nanoscale Devices and Systems							
MECE5-157	Electronic System Design							
MECE5-158	Information Theory and Coding							
MECE5-159	Digital Signal Processing							
Departmental Elective – II (Select any one)		4	0	0	40	60	100	4
MECE5-160	Sensors & Transducers							
MECE5-161	Optoelectronics							
MECE5-162	Materials Science & Engineering							
MECE5-163	Soft Computing							
Total		**20**	**0**	**4**	**260**	**340**	**600**	**22**

Total Contact Hours = 24 Total Marks = 600 Total Credits = 22

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SEMESTER 2nd		Contact Hrs			Marks			Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
MECE5-205	Micro & Nano Electromechanical Systems (MEMS and NEMS)	4	0	0	40	60	100	4
MECE5-206	CPLD and FPGA Architectures and Applications	4	0	0	40	60	100	4
MECE5-207	Research Lab -II	0	0	4	60	40	100	2
Departmental Elective – III (Select any one)		4	0	0	40	60	100	4
MECE5-264	Satellite Communication							
MECE5-265	Testing & Fault Tolerance							
MECE5-266	MOS Integrated Circuit Modelling							
MECE5-267	Parallel Processing							
Departmental Elective – IV (Select any one)		4	0	0	40	60	100	4
MECE5-268	CAD Tools for VLSI Design							
MECE5-269	Nano Electronics							
MECE5-270	Multimedia Communication System							
MECE5-271	Low Power VLSI Design							
Open Elective – I (Select any One)		4	0	0	40	60	100	4
Total		**20**	**0**	**4**	**260**	**340**	**600**	**22**

Total Contact Hours = 26 Total Marks = 500 Total Credits = 22

SEMESTER 3rd		Contact Hrs			Marks			Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
MREM0-101	Research Methodology	4	0	0	40	60	100	4
MECE5-308	Project	0	0	10	100	0	100	8
MECE5-309	Seminar	0	0	4	100	0	100	2
Departmental Elective – V (Select any one)		4	0	0	40	60	100	4
MECE5-372	Digital Signal Processors and Architectures							
MECE5-373	Error Control and Coding							
MECE5-374	Measurement & Characterisation Techniques							
MECE5-375	CMOS VlSI Design							
Total		**12**	**0**	**14**	**320**	**180**	**500**	**22**

Total Credits = 24

SEMESTER 4th		Contact Hrs			Evaluation Criteria	Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Satisfactory/ Unsatisfactory**	
MECE5-410	Thesis	0	0	24		24

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Overall

Semester	**Marks**	**Credits**
1st	600	22
2nd	600	22
3rd	500	22
4th	--	24
Total	**1700**	**90**

Subject Code: MECE5-101 **L T P C** **Duration: 45 Hrs.**
4 0 0 4

UNIT-I (11 Hrs.)

MOS TRANSISTOR THEORY: Introduction, Ideal I-V Characteristics, Second Order Effects, CMOS Logic, CMOS Fabrication and Layout, VLSI Design Flow.

CIRCUIT CHARACTRIZATION AND PERFORMANCE ESTIMATION: CMOS Inverter, DC Transfer Characteristics, Delay Estimation, Logical Effort, Power Dissipation, Scaling and Latch-up.

UNIT-II (11 Hrs.)

COMBINATIONAL AND SEQUENTIAL CIRCUIT DESIGN: Static CMOS, Ratioed Circuits, Differential Cascode Voltage Switch Logic, Dynamic Circuits, Domino Logic-Pass Transistor Circuits, CMOS D Latch and Edge Triggered Flip-flop and Schmitt trigger.

UNIT-III (12 Hrs.)

HDL PROGRAMMING USING BEHAVIORAL AND DATA FLOW MODELS: Verilog, Introduction, Typical Design Flow, Modules and Ports, Instances, Components, Lexical Conventions, Number Specification, Strings, Identifiers and Keywords, Data Types, System Tasks and Compiler Directives, Behavioural Modelling, Dataflow Modelling, RTL, Gate Level Modelling, Programs For Combinational and Sequential.

UNIT-IV (11 Hrs.)

HDL PROGRAMMING WITH STRUCTURAL AND SWITCH LEVEL MODELS: Tasks and Functions, Difference between Tasks and Functions, Switch Level, MOS Switches, CMOS Switches, Examples: CMOS NAND and NOR, MUX using Transmission Gate, CMOS Flip-Flop.

RECOMMENDED/REFERENCE BOOKS:

1. Neil H.E. Weste, David Harris and Ayan Banenjee, 'CMOS VLSI Design', 3rd Edn., Pearson, **2004.**
2. Sung Mu Kang and Yusuf Leblebici, 'CMOS Digital Integrated Circuits', 3rd Edn., Tata Mc-Graw Hill, **2002.**
3. Samir Palnitkar, 'Verilog HDL', 2nd Edn., Pearson, **2004.**

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MICRO ELECTRONICS

Subject Code: MECE5-102 **L T P C** **Duration: 45 Hrs.**
4 0 0 4

UNIT-I (11 Hrs.)

CRYSTAL GROWTH AND WAFER PREPARATION:

Clean room concept, safety requirements, crystal growth techniques: czochralski and gradient freeze techniques, physics involved in CZ growth, Energy flow balance, pull rate-considerations, problems and solutions, defects involved in CZ method, effects due to carbon and oxygen impurities, modelling of dopant incorporation, float zone growth for high purity silicon, liquid encapsulated growth for GaAs, material characterization- wafer shaping, crystal characterization, wafer cleaning.

CURRENT ELEMENT CHARACTERISTICS:

Growth mechanism and kinetic oxidation, thin oxides, oxidation techniques and systems, oxide properties, characterization of oxide films, growth and properties of dry and wet oxidation, charge distribution during oxidation, oxide characterization, anomalies with thin oxide regime.

UNIT-II (10 Hrs.)

DIFFUSION:

The nature of diffusion, diffusion mechanisms – interstitial, substitution, interstitial-substitution combined, interstitially and grain boundary, Fick's law of diffusion, limited and constant source diffusion, models of diffusion in solid, diffusion equation, atomic diffusion mechanisms, diffusion system for silicon and gallium arsenide. Measurement techniques, experimental analysis of diffused profiles.

ION IMPLANTATION:

Introduction, physics of implantation, range theory, projected range, ion stopping mechanisms- channelling, nuclear stopping, electronic stopping, implantation damage, implantation equipment, annealing, shallow junction, application to silicon and gallium arsenide, RTA mechanism.

UNIT-III (12 Hrs.)

LITHOGRAPHY:

Pattern generation and mask making, exposure sources, photolithography, photoresists, optical lithography, electron lithography, X-ray lithography, ion lithography, mask defects, atomic force microscopy based lithography system, dip pen lithography system.

DEPOSITION:

Need for film deposition, film deposition methods- physical and chemical, deposition processes, CVD techniques for deposition of polysilicon, silicon dioxide, silicon nitride and metal films, sputter deposition, sputter unit, Epitaxy –types, techniques, advantages, vapour phase epitaxy, molecular beam epitaxy.

UNIT-IV (12 Hrs.)

ETCHING:

Directionality and selectivity issues, wet chemical etching, wet etchants, dry physical etching, dry etchants, plasma etching, advantages and disadvantages, issues involved, dry etching systems, dry chemical etching, reactive ion etching, etching induced damage, cleaning.

METALLIZATION:

Introduction, metallization applications, metallization choices, physical vapour deposition, patterning, metallization problems.

RECOMMENDED BOOKS:

1. S.M. Sze, 'VLSI Technology', TMH.
2. S.K. Gandhi, 'VLSI Fabrication Principles'.

REFERENCE BOOKS:

1. S.M. Sze, 'Semiconductor Devices Physics and Technology'.
2. K.R. Botkar, 'Integrated Circuits'.

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ADVANCED SEMICONDUCTOR PHYSICS

Subject Code: MECE5-103 **L T P C** **Duration: 45 Hrs.**
4 0 0 4

UNIT-I (12 Hrs.)

Preparation and Characterization of Semiconductors: Types of semiconductors, charge carrier statistics, crystal growth, preparation and doping techniques of elemental and compound semiconductors, Metallization, Lithography and Etching, Bipolar and MOS device fabrication characterization (electrical, thermoelectric, magnetic and optical properties) of semiconductor materials.

UNIT-II (10 Hrs.)

Optical Properties of Semiconductors: Dipolar elements in direct gap semiconductors, optical susceptibility of a semiconductor, absorption and spontaneous emission, bimolecular recombination coefficient, condition for optical amplification in semiconductors.

UNIT-III (12 Hrs.)

Electronic and Electric Properties of Semiconductors: Boltzmann equation, scattering mechanisms, hot electrons, recombination, transport equation in a semiconductor, Electronic and ionic conductivity, solid oxide fuel cells, ceramic semiconductors, linear dielectrics, dielectric properties, Ferroelectric materials, piezoelectrics, ferro-piezoceramics, actuators and electrostrictions, pyroelectrics, electro-optics photorefractives, thin film capacitors. Ferroic crystals, primary and secondary ferroics, proper ferroics, magnetoferroelectricity.

UNIT-IV (11 Hrs.)

Application in Semiconductor Devices: Ge, Si, GaAs, Semiconductor device: metal-semiconductor and semiconductor heterojunctions, physics of bipolar devices, fundamentals of MOS and field effect devices, basics of solar cell, photodiodes, photodetectors.

RECOMMENDED BOOKS:

1. S.M. Sze and Kwok. K. Ng, ‘Physics of Semiconductor Devices’, 3rd Edn., Wiley, **2008.**
2. J. Wilson and J.F.B. Hawkes, ‘Optoelectronics: An Introduction’. Prentice-Hall, **1989.**
3. R.A. Smith, ‘Semiconductors’, Academic Press, **1963.**
4. M. Shur, ‘Physics of Semiconductor Devices’, Prentice Hall, **1990.**
5. A. Paul, ‘Chemistry of Glasses’, Chapman and Hall, **1982.**
6. Bishnu P. Pal, ‘Fundamentals of Fibre Optics in Telecommunication and Sensor Systems’, New Age International Publishers, **2005.**
7. Kwan Chi Kao, ‘Dielectric Phenomena in Solids’, Elsevier Academic Press, **2004.**
8. Vinod K. Vadhawan, ‘Introduction to Ferroic Materials’, Gordon and Breach Science Publications, **2000.**

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RESEARCH LAB.-I

Subject Code: MECE5-104 **L T P C**
0 0 4 2

Every Subject In-charge will define atleast one project to each student of his/her (preferably different) concerned subject to be performed in Research- Lab.

NANOSCALE DEVICES AND SYSEMS

Subject Code: MECE5-156 **L T P C** **Duration: 45 Hrs.**
4 0 0 4

UNIT-I (10 Hrs.)

CMOS scaling challenges in nanoscale regimes: Moor and Koomey's law, Leakage current mechanisms in nanoscale CMOS, leakage control and reduction techniques, process variations in devices and interconnects.

UNIT-II (13 Hrs.)

Device and technologies for sub 100nm CMOS: Silicidation and Cu-low k interconnects, strain silicon – biaxial stain and process induced strain; Metal-high k gate; Emerging CMOS technologies at 32nm scale and beyond – FINFETs, surround gate nanowire MOSFETs, heterostructure (III-V) and Si-Ge MOSFETs.

UNIT-III (11 Hrs.)

Device scaling and ballistic MOSFET: Two dimensional scaling theory of single and multigate MOSFETs, generalized scale length, quantum confinement and tunnelling in MOSFTEs, velocity saturation, carrier back scattering and injection velocity effects, scattering theory of MOSFETs.

UNIT-IV (11 Hrs.)

Emerging nanoscale devices: Si and hetero-structure nanowire MOSFETs, carbon nanotube MOSFETs, Tunnel FET, quantum wells, quantum wires and quantum dots; Single electron transistors, resonant tunnelling devices.

Recommended Books:

1. M. Lundstrom, ‘Nanoscale Transport: Device Physics, Modeling, and Simulation’, Springer, **2005.**
2. Sandip Kundu, Aswin Sreedhar, ‘Nanoscale CMOS VLSI Circuits: Design for Manufacturability’, McGraw Hill, **2010.**
3. C.K. Maiti, S. Chattopadhyay and L.K. Bera, ‘Strained-Si and Hetrostructure Field Effect Devices’, Taylor and Francis, **2007.**
4. G.W. Hanson, ‘Fundamentals of Nanoelectronics’, Pearson India, **2008.**

ELECTRONIC SYSTEM DESIGN

Subject Code: MECE5-157 **L T P C** **Duration: 45 Hrs.**
4 0 0 4

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UNIT-I (10 Hrs.)

MSI and LSI Circuits and Their Applications: Review of Digital electronics concept, Arithmetic Circuits, Comparators, Multiplexers, Code Converters, XOR and AND OR INVERTER Gates, Wired Logic, Bus Oriented Structures, Tri-State Bus System, Propagation Delay.

UNIT-II (12 Hrs.)

Sequential Machines: The Concept of Memory, The Binary Cell, The Cell And The Bouncing Switch, Set/Reset, D, Clocked T, Clocked JK Flip Flop, Design Of Clock F/F, Conversion, Clocking Aspects, Clock Skew, State Diagram Synchronous Analysis Process, Design Steps For Traditional Synchronous Sequential Circuits, State Reduction, Design Steps For Next State Decoders, Design Of Out Put Decoders, Counters, Shift Registers and Memory.

UNIT-III (11 Hrs.)

Multi Input System Controller Design: System Controllers, Design Phases And System Documentation, Defining The System, Timing And Frequency Considerations, Functional, Position And Detailed Flow Diagram Development, MDS Diagram, Generation, Synchronizing Two System And Choosing Controller, Architecture, State Assignment, Next State Decoders And Its Maps, Output Decoders, Clock And Power Supply Requirements, MSI Decoders, Multiplexers In System Controllers, Indirect Addressed Multiplexers Configurations, Programmable System Controllers, ROM, PLA And PAL Based Design.

UNIT-IV (12 Hrs.)

Asynchronous Finite State Machines: Scope, Asynchronous Analysis, Design Of Asynchronous Machines, Cycle And Races, Plotting And Reading The Excitation Map, Hazards, Essential Hazards Map Entered Variable, MEV Approaches To Asynchronous Design, Hazards In Circuit Developed By MEV Method, Electromagnetic Interference And Electromagnetic Compatibility Grounding And Shielding of Digital Circuits. Interfacing digital system with different media like fiber cable, co-axial cable etc.

Recommended Books:

1. Fletcher, 'An Engineering Approach to Digital Design', PHI, **1990.**
2. 'Designing with TTL Circuits', Texas Instruments.
3. Related IEEE/IEE Publications.

INFORMATION THEORY AND CODING

Subject Code: MECE5-158 **L T P C** **Duration: 45 Hrs.**
4 0 0 4

UNIT-I (11 Hrs.)

Elements of information theory Source coding theorem, Huffman coding, Channel coding theorem, channel capacity theorem, Shenonfano theorem, entropy

UNIT-II (11 Hrs.)

Sampling Process Base band and band pass sampling theorems reconstruction from samples, Practical aspects of sampling and signal recovery TDM

UNIT-III (11 Hrs.)

Waveform Coding Techniques PCM Channel noise and error probability DPCM and DM Coding speech at low bit rates Prediction and adaptive filters. Base band shaping for data transmission, PAM signals and their power spectra Nyquist criterion ISI and eye pattern Equalization.

UNIT-IV (12 Hrs.)

Digital Modulation Techniques Binary and M-ary modulation techniques, Coherent and non-coherent detection, Bit Vs symbol error probability and bandwidth efficiency. Bit error analysis, using orthogonal Signaling. Error Control Coding Rationale for coding Linbear block codes, cyclic codes and convolution codes Viterbi decoding algorithm and trellis codes.

Books Recommended:

1. J. Dass, S.K. Malik & P.K. Chatterjee, ,'Principles of digitals communication', Wiley-Blackwel, **1991**.
2. Vera Pless,'Introduction to the Theory of Error Correcting Codes', 3rd Edn., **1998.**
3. Robert G. Gallanger, 'Information Theory and Reliable Communication', Mc Graw Hill, **1992.**

DIGITAL SIGNAL PROCESSING

Subject Code: MECE5-159 **L T P C** **Duration: 45 Hrs.**
4 0 0 4

UNIT-I (12 Hrs.)

DISCRETE TIME SIGNALS AND SYSTEMS

Signals, Classification of signals, Signal processing, Basic elements of a digital signal processing system, Advantages of digital signal processing over analog signal processing, Sampling, Aliasing, Discrete-time systems, Analysis of discrete-time linear shift-invariant systems, Linearity, Causality and stability criterion, Discrete-time systems described by difference equations, Convolution.

UNIT-II (13 Hrs.)

DISCRETE TRANSFORMS

The Fourier transform of discrete-time signals (DTFT), Properties of the DTFT, The frequency response of an LTI discrete-time system, Frequency domain sampling and DFT: Properties of DFT, Linear filtering using DFT, Frequency analysis of signals using DFT, radix 2, Goertzel algorithm, Efficient computation of the DFT: Decimation-in-time and decimation-in frequency, Linear convolution using DFT, Fast Fourier transform algorithms,

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Applications of FFT algorithm, Introduction to the Z-transform & the inverse Z-transform, Properties of the Z-transform, Relationship between the Fourier transform and the Z-transform, System function, Analysis of linear time-invariant systems in the Z-domain.

UNIT-III (9 Hrs.)

IMPLEMENTATION OF DISCRETE TIME SYSTEMS:

Direct form, Cascade form, Frequency sampling and lattice structures for FIR systems. Direct forms, Transposed form, Cascade form, Parallel form. Lattice and lattice ladder structures for IIR systems.

UNIT-IV (11 Hrs.)

DESIGN OF FIR IIR FILTERS:

General considerations of digital filter design, Characteristics of practical frequency selective filters. Filters design specifications, Design of FIR filters using windows, Gibbs phenomenon, Design of FIR filters by frequency sampling method, Design of optimum equiripple FIR filters. Comparison of design methods for FIR filters. Design of IIR filters from analog filters, Design by approximation of derivatives, Impulse invariance method, Bilinear transformation method, Characteristics of Butterworth, Chebyshev and Elliptical analog filters, Frequency transformation, Least square methods.

Recommended Books:

1. John G. Proakis & Dimitris G. Manolakis, ‘Digital Signal Processing: Principles, Algorithms and Applications’, 2nd Edn., Pearson Education.
2. A.V. Openheim & R.W. Schafer, ‘Discrete Time Signal Processing’, 2nd Edn., PHI, **1998**.

Reference Books:

1. Alan V. Oppenheim & Ronald W. Schafer; ‘Digital Signal Processing’, 1st Edn., PHI Publication, **2007**.

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SENSORS & TRANSDUCERS

Subject Code: MECE5-160 **L T P C** **Duration: 45 Hrs.**
4 0 0 4

UNIT-I (9 Hrs.)

Sensors/Transducers: Principles, Classification, Parameters, Characteristics (Static and Dynamic), Environmental Parameters (EP), Characterization.

Mechanical and Electromechanical Sensors: Introduction, Resistive Potentiometer, Strain Gauge (Resistance and Semiconductor), Inductive Sensors: Sensitivity and Linearity of the Sensor, Types-Capacitive Sensors, Electrostatic Transducer, Force/Stress Sensors Using Quartz Resonators, Ultrasonic Sensors.

UNIT –II (13 Hrs.)

Thermal Sensors: Introduction, Gas Thermometric Sensors, Thermal Expansion Type Thermometric Sensors, Acoustic Temperature Sensor, Dielectric Constant and Refractive Index Thermosensors, Helium Low Temperature Thermometer, Nuclear Thermometer, Magnetic Thermometer, Resistance Change Type Thermometric Sensors, Thermoemf Sensors, Junction Semiconductor Types, Thermal Radiation Sensors, Quartz Crystal Thermoelectric Sensors, NQR Thermometry, Spectroscopic Thermometry, Noise Thermometry and Heat Flux Sensors.

Magnetic sensors: Introduction, Sensors and the Principles Behind, Magnetoresistive Sensors (Anisotropic and Semiconductor), Hall Effect and Sensors, Inductance and Eddy Current Sensors, Angular/Rotary Movement Transducers (Synchros and Synchro-resolvers), Eddy Current Sensors, Electromagnetic Flowmeter, Switching Magnetic Sensors and SQUID Sensors.

UNIT-III (11 Hrs.)

Radiation Sensors: Introduction, Basic Characteristics, Types of Photosensistors/Photo Detectors, X-ray and Nuclear Radiation Sensors and Fiber Optic Sensors.

Electroanalytical Sensors: Introduction, The Electrochemical Cell, The Cell Potential, Standard Hydrogen Electrode (SHE), Liquid Junction and Other Potentials, Polarization (Concentration, Reactive, Adsorption and Charge Transfer), Reference Electrodes, Sensor Electrodes and Electroceramics in Gas Media.

UNIT-IV (12 Hrs.)

Smart Sensors: Introduction, Primary Sensors, Excitation, Amplification, Filters, Converters, Compensation, Information Coding/Processing, Data Communication (Standards for Smart Sensor Interface) and The Automation

Sensor's Applications: Introduction, On-board Automobile Sensors (Automotive Sensors), Home Appliance Sensors, Aerospace Sensors, Sensors for Manufacturing and Sensors for Environmental Monitoring.

RECOMMENDED/REFERENCE BOOKS:

1. D. Patranabis, 'Sensors and Transducers', 2nd Edn., PHI, **2003.**
2. W. Bolton, 'Mechatronics', 4th Edn., Pearson, **2011.**

OPTOELECTRONICS

Subject Code: MECE5-161 **L T P C** **Duration: 45 Hrs.**

4 0 0 4

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UNIT-I (11 Hrs.)

Nature of light, light sources, black body, colour temperature, units of light, radio metric and photometric units, basic semiconductors, PN junction, carrier recombination and diffusion, injection efficiency, heterojunction, internal quantum efficiency, external quantum efficiency, double hetero junction, fabrication of heterojunction, quantum wells and super lattices.

UNIT-II (11 Hrs.)

Optoelectronic devices, Optical modulators, modulation methods and modulators, transmitters, optical transmitter circuits, LED and laser drive circuits, LED-Power and efficiency, double hereostructure LED, LED structures, LED characteristics, laser modes, strip geometry, gain guided lasers, index guided lasers.

UNIT-III (11 Hrs.)

Modulation of light, birefringence, electro-optic effect, Electro-Optic materials and applications, Kerr modulators, scanning and switching, self-electro-optic devices, Magneto-Optical devices, Acousto-Optic devices, Acousto-Optic modulators.

UNIT-IV (12 Hrs.)

Display devices, Photoluminescence, cathodoluminescence, EL display, LED display, drive circuitry, plasma panel display, liquid crystals, properties, LCD displays, numeric displays.

Photo detectors, thermal detectors, photoconductors, detectors, photon devices, PMT, photodiodes, photo transistors, noise characteristics of photo-detectors, PIN diode, APD characteristics, Design of detector arrays, CCD, Solar cells.

RECOMMENDED BOOKS:

1. John Wilson and J.F.B. Hawkes, 'Optoelectronics: An Introduction', Prentice-Hall India, **1996.**
2. J.M. Senior, 'Optical Fibre Communication', Prentice Hall India, **1985.**
3. J. Gowar, 'Optical Fibre Communication Systems', Prentice Hall, **1995.**
4. J. Palais, 'Introduction to Optical Electronics', Prentice Hall, **1988.**
5. Jasprit Singh, 'Semiconductor Optoelectronics', McGraw-Hill, **1995.**

6. P. Bhattacharya, ‘Semiconductor Optoelectronic Devices’, PHI, **1995.**
7. R.P. Khare, ‘Fibre Optics and Optoelectronics’, Oxford University Press, **2004.**

MATERIAL SCIENCE & ENGINEERING

Subject Code: MECE5-162 **L T P C** **Duration: 45 Hrs.**
4 0 0 4

UNIT-I (12 Hrs.)

Atomic Structure, Bonding Classifications, Seven Systems and Fourteen Lattices, Metal, Ceramic, Polymeric and Semiconductor Structures, X-ray Diffraction, and Defects (Point, Linear and Planar), Diffusion, Mechanical Behavior: Stress versus Strain, Elastic and Plastic Deformation, Hardness, Creep and Stress Relaxation, Viscoelastic Deformation. Thermal Behavior: Heat capacity, Thermal expansion, conductivity and shock, Failure Analysis & Prevention.

UNIT-II (13 Hrs.)

Phase Diagrams-Equilibrium Microstructural Development: Phase Rule and Diagram, Lever Rule, Heat Treatment, Metals, Ceramics and Glasses, Polymerization, Structural Features of Polymers, Thermoplastic and Thermosetting Polymers, Composites (Fiber Reinforced and Aggregate), Mechanical Properties and Processing of Composites, Electrical Behavior, Optical Behavior, Corrosion & Oxidation Semiconductor Materials, Magnetic Materials, Environmental Degradation.

UNIT-III (14 Hrs.)

Superconductivity, Band Structure, Carrier Concentration, Electrical, Mechanical and Optical properties of Gallium Nitride (GaN), Aluminum Nitride (AlN), Indium Nitride (InN), Boron Nitride (BN), Silicon Carbide (SiC), Silicon-Germanium(Si1-xGex).

UNIT-IV (6 Hrs.)

Materials of Special Applications viz. Cryogenic, High Temperature, High Frequency Application.

RECOMMENDED/REFERENCE BOOKS:

1. Michael E. Levinshtein, Sergey L. Rumyantsev and Michael S. Shur, ‘Properties of Advanced Semiconductor Materials: GaN, AlN, InN, BN, SiC and SiGe’, John Wiley & Sons, **2001**.
2. James F. Shackelford, ‘Introduction to Materials Science for Engineers’, 6th Edn., Prentice Hall, **2001**.
3. ‘Fundaments of Semiconductors: Physics and Materials Properties by Yu and M Cardona’, Springer, **1996.**
4. K.M. Gupta, ‘Materials Science & Engineering’, 5th Edn., Umesh Publications, **2012**.

SOFT COMPUTING

Subject Code: MECE5-163 **L T P C** **Duration: 45 Hrs.**
4 0 0 4

UNIT – I (12 Hrs.)

Soft Computing: Introduction of soft computing, soft computing vs. hard computing, various types of soft computing techniques, applications of soft computing.

Fuzzy Logic: Fuzzy set versus crisp set, basic concepts of fuzzy sets, membership functions, basic operations on fuzzy sets and its properties. Fuzzy relations versus Crisp relation,

Fuzzy rule base system: Fuzzy propositions, formation, decomposition & aggregation of fuzzy rules, fuzzy reasoning, Fuzzy Inference Systems (FIS) – Mamdani Fuzzy Models –

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Sugeno Fuzzy Models – Tsukamoto Fuzzy Models, Fuzzification and Defuzzification, fuzzy decision making & Applications of fuzzy logic.

UNIT – II (13 Hrs.)

Structure and Function of a single neuron: Biological neuron, artificial neuron, definition of ANN and its applications. Neural Network architecture: Single layer and multilayer feed forward networks and recurrent networks. Learning rules and equations: Perceptron, Hebb's, Delta, winner take all and out-star learning rules. Supervised Learning Network: Perceptron Networks, Adaptive Linear Neuron, Multiple Adaptive Linear Neuron, Back Propagation Network, Associative memory networks, Unsupervised Learning Networks: Competitive networks, Adaptive Resonance Theory, Kohnen Self Organizing Map

UNIT – III (12 Hrs.)

Genetic Algorithm: Fundamentals, basic concepts, working principle, encoding, fitness function, reproduction, Genetic modelling: selection operator, cross over, mutation operator, Stopping Condition and GA flow, Constraints in GA, Applications of GA, Classification of GA.

UNIT – IV (8 Hrs.)

Hybrid Soft Computing Techniques: An Introduction, Neuro-Fuzzy Hybrid Systems, Genetic Neuro-Hybrid systems, Genetic fuzzy Hybrid and fuzzy genetic hybrid systems

Recommended Books

1. S. Rajasekaran & G.A. Vijayalakshmi Pai, 'Neural Networks, Fuzzy Logic & Genetic Algorithms, Synthesis & Applications', PHI Publication.
2. S.N. Sivanandam & S.N. Deepa, 'Principles of Soft Computing', Wiley Publications.

Reference Books

1. Michael Negnevitsky, 'Artificial Intelligence', Pearson Education, New Delhi, **2008**.
2. Timothy J. Ross, 'Fuzzy Logic with Engineering Applications', Wiley, **2010**.

MICRO & NANO ELECTRO MECHANICAL SYSTEM (MEMS & NEMS)

Subject Code: MECE5-205 **L T P C** **Duration: 48 Hrs.**
4 0 0 4

Course Objectives

The course aims to give the students a basic knowledge about state-of-the-art MEMS including technology, device architecture, design and modelling, scalability, figures of merit and RF IC novel functionality and performance.

Course Outcomes:

Students will attain analytical and design oriented feature knowledge about NEMS and MEMS. Reliability and packaging are also considered as key issues for industrial applications.

Unit-1 (12 Hrs.):

Micro Electro Mechanical System (MEMS) Origins. MEMS Impetus / Motivation. Material for MEMS. The toolbox: Processes for Micro machining.

Unit-II (12 Hrs.)

MEMS Fabrication Technologies. Fundamental MEMS Device Physics: Actuation.

Unit-III (12 Hrs.)

Fundamental MEMS Devices: The Cantilever Beam. Microwave MEMS Applications: MEM Switch

Unit-IV (12 Hrs.)

Design Considerations. The Micromachined Transmission Line. MEMS-Based Microwave Circuit and System.

Recommended Books

1. Hector J. De Los Santos, 'Micro-Electromechanical (MEM) Microwave Systems', Artechhouse.
2. Nadim Maluf, 'An Introduction to Micro-Electromechanical System', Artechhouse.

CPLD AND FPGA ARCHITECTURE AND APPLICATIONS

Subject Code: MECE5-206 **L T P C** **Duration: 48 Hrs.**
4 0 0 4

Learning Objectives:

1. To learn fundamentals of Programmable Logic Devices.
2. To enrich the ideas of field programmable gate arrays.
3. To explore the ideas of SRAM programmable FPGAs
4. To facilitate the knowledge of anti-fuse programmed FPGAs.

Learning Outcomes:

1. Understanding of Programmable logic devices and its architecture.
2. Knowledge of FPGAs and its applications.
3. Fundamental understanding of SRAM and anti-fuse programmed FPGAs

UNIT-I (12 Hrs.)

Introduction to Programmable Logic Devices:

Introduction, Simple Programmable Logic Devices – Read Only Memories, Programmable Logic Arrays, Programmable Array Logic, Programmable Logic Devices/Generic Array Logic; Complex Programmable Logic Devices – Architecture of Xilinx Cool Runner XCR3064XL CPLD, CPLD Implementation of a Parallel Adder with Accumulation.

UNIT-II (12 Hrs.)

Field Programmable Gate Arrays:

Organization of FPGAs, FPGA Programming Technologies, Programmable Logic Block Architectures, Programmable Interconnects, and Programmable I/O blocks in FPGAs, Dedicated Specialized Components of FPGAs, Applications of FPGAs.

UNIT –III (12 Hrs.)

SRAM Programmable FPGAs:

Introduction, Programming Technology, Device Architecture, The Xilinx XC2000, XC3000 and XC4000 Architectures.

UNIT –IV (12 Hrs.)

Anti-Fuse Programmed FPGAs:

Introduction, Programming Technology, Device Architecture, The Actel ACT1, ACT2 and ACT3 Architectures.

RECOMMENDED BOOKS

1. Stephen M. Trimberger, 'Field Programmable Gate Array Technology', International Edition Springer.
2. Charles H. Roth Jr, Lizy Kurian John, 'Digital Systems Design', Cengage Learning.

REFERENCE BOOKS:

1. John V. Oldfield, Richard C. Dorf, 'Field Programmable Gate Arrays', Wiley India.
2. Pak K. Chan/Samiha Mourad, 'Digital Design Using Field Programmable Gate Arrays', Pearson Low, Price Edition.
3. Ian Grout, 'Digital Systems Design with FPGAs and CPLDs', Elsevier, Newnes.

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4. Wayne Wolf, 'FPGA based System Design', Prentice Hall Modern Semiconductor Design Series.

RESEARCH LAB. - II

Subject Code: MECE5-207 **L T P C**
0 0 4 2

Students will be made familiar with maximum available softwares like optisystem, optsim, Matlab, Virtual instrumentation, Network simulator, HFSS etc.so that student can opt any one as per his/her interest for thesis work. Students will be advised to go through maximum research papers and conclude a particular domain to work further.

SATELLITE COMMUNICATION

Subject Code: MECE5-264 **L T P C** **Duration: 48 Hrs.**
4 0 0 4

Learning Objectives

This course provides an introduction to the fundamentals of orbital mechanics and launchers, link budgets, modulation, coding, multiple access techniques, propagation effects, and earth terminals. This course provides an understanding how analog and digital technologies are used for satellite communications networks.

Learning Outcomes:

The students will gain teaching skills in this area. They will gain skills for performance improvement for different available satellites by calculating power Budgets

UNIT I (12 Hrs.)

Introduction: Origin of Satellite Communication, Current state of Satellite Communication, Advantages of Satellite Communication, Active & Passive satellite, Orbital aspects of Satellite Communication, System Performance. Communication Satellite Link Design - Introduction, general link design equation, system noise temperature, C/N & G/T ratio, atmospheric & econospheric effects on linkdesign, complete link design, interference effects on complete link design, earth station
parameters.

UNIT II (12 Hrs.)

Satellite analog & digital communication Baseband analog (voice) signal, FDMA techniques, S/N ration, SCPC & CSSB systems, digital baseband signals & modulation techniques.

Multiple Access Techniques TDMA frame structure, burst structure, frame efficiency, superframe, frame acquisition & synchronization, TDMA vs FDMA, burst time plan, beam hopping, satellite switched, Erlang call congestion formula, demand assignment ctrl, DA-FDMA system, DATDMA.

UNIT III (12 Hrs.)

Laser & Satellite Communication Link analysis, optical satellite link Tx& Rx, Satellite, beam acquisition, tracking & pointing, cable chaanel frequency, head end equation, distribution of signal, n/w specifications and architecture, optical fibre CATV system.

UNIT IV (12 Hrs.)

Satellite Applications Satellite TV, telephone services via satellite, data Communication services, satellites for earth observation, weather forecast, military appliances, scientific studies.

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Recommended Books

1. Timothy Pratt, 'Satellite Communication', Addison Wesley, **2010**.
2. D.C Aggarwal 'Satellite Communication', Willey Sons, **2010**.

TESTING & FAULT TOLERANCE

Subject Code: MECE5-265 **L T P C** **Duration: 48 Hrs.**
4 0 0 4

Course Objective: The objective of this course is to familiarize with concept of reliability. The course provides introduction to fault tolerant so that students will able to understand the testable combinational circuits.

Course Outcomes:

#1. Able to differentiate between fault, error and failure.
#2. Able to calculate reliability of a system and can use tools for reliability modelling.
#3. Comparative analysis of different tolerant design tests.
#4. Analysis of fault tolerant design for VLSI chips.

UNIT I (12 hrs)

Basic concepts of Reliability: Failures and faults, Reliability and failure rate, Relation between reliability & mean time between failure, Maintainability & Availability, reliability of series and parallel systems, Modelling of faults, Test generation for combinational logic circuits: conventional methods (path sesitisation,Boolean difference), Random testing, transition count testing and signature analysis.

UNIT II (14 hrs)

Fault Tolerant DesignI: Basic concepts,static,(NMR,use of error correcting codes), dynamic, hybrid and self-purging redundancy, Siftout Modular Redundancy (SMR), triple modular redundancy, SMR reconfiguration.

Fault Tolerant DesignII: Time redundancy, software redundancy, failsoft operation, examples of practical fault tolerant systems, introduction to fault tolerant design of VLSI chips.

UNIT III (12 hrs)

Self-checking circuits: Design of totally self-checking checkers, checkers using m-out of acode, Berger codes and low cost residue code, selfchecking sequential machines, partially selfchecking circuits. Fail safe Design: Strongly fault secure circuits, failsafe design ofsequential circuits using partition theory and Berger codes, totally self checkingPLA design.

UNITIV (10 hrs)

Design for testable combination logic circuits: Basic concepts of testability, controllability and observability, The Read Muller expansion technique, level OR-AND-OR design, use of control and syndrometesting design, Built-in-test, built-in-test of VLSI chips, design for autonomous self-test, design in testability into logic boards.

Recommended Books:

1. Parag K. Lala, Fault Tolerant & Fault Testable Hardware Design, PHI,**1985**
2. Parag K. Lala, Digital systems Design using PLD's, PHI**1990**.
3. N.N. Biswas, Logic Design Theory, PHI**1990**.
4. Konad Chakraborthy & Pinaki Mazumdar, Fault tolerance and Reliability Techniques for high – density random – access memories Reason, **2002.**

MOS INTEGRATED CIRCUIT MODELLING

Subject Code: MECE5-266 **L T P C** **Duration: 48 Hrs.**

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4 0 0 4

Learning Objectives

1. To provide students with a comprehensive understanding on design of MOSFET devices.
2. To enable students to understand modelling and design of bipolar devices.
3. To understand the concept of CMOS and its characteristics.

Learning Outcomes

After successful completion of this course the students will be able to:

1. Demonstrate understanding of basic characteristics such as scaling, threshold voltage, drain current etc. of MOSFET.
2. Compute and evaluate CMOS performance factor.
3. Understand design of bipolar devices.

Unit-I (12 Hrs.)

Basic Device Physics: Energy bands in solids, p-n Junctions, MOS Capacitors, Metal-Silicon Effects, MOSFET Devices Design: Long Channel MOSFET, Short-Channel MOSFETS, MOSFET Scaling, Threshold Voltage. MOSFET DC Model: Drain Current Calculations, Pao-Sah Model, Charge Sheet Model, Piece-Wise Drain Current Model for Enhancement Devices

Unit-II (12 Hrs.)

CMOS Performance Factors: Basic CMOS Circuit Elements, Parasitic Elements, Sensitivity of CMOS delay to device parameters, Performance Factors of Advanced CMOS Devices.

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Unit-III (12 Hrs.)

Bipolar Devices Design: npn & pnp Transistors, Ideal Current-Voltage Characteristics, Bipolar Device Models for Circuit and Time-Dependent Analyses, Modern Bipolar Transistor Structures, Figures of Merit of a Bipolar Transistors, Digital Bipolar Circuits.

Unit-IV (12 Hrs.)

MOSFET DC Model: Drain Current Calculations, Pao-Sah Model, Charge Sheet Model, Piece-Wise Drain Current Model for Enhancement Devices.

Recommended Books

1. M.S. Tyagi, 'Introduction to Semiconductor Materials and Devices', Wiley.
2. Ben G. Streetman, 'Solid State Electronic Devices', Pearson Prentice-Hall.
3. Yuan Taur and T.H. Ning, 'Fundamentals of Modern VLSI Devices', Cambridge.

PARALLEL PROCESSING

Subject Code: MECE5-267	**L T P C** **4 0 0 4**	**Duration: 48 Hrs.**

Learning Objectives

This course will help students to achieve the following objectives:

1. Describe the principles of computer design and classify instruction set architectures.
2. Describe the operation of performance enhancements such as pipelines, dynamic scheduling, branch prediction, caches, and vector processors.
3. Describe the operation of virtual memory, modern architectures such as RISC, Super Scalar, VLIW (very large instruction word), and multi-core and multi-CPU systems.

Learning Outcomes

Students will have skills in RISC as well as CISC architures and can design or analyses different problems associated with this domain

Parallel computer models: The state of computing, Classification of parallel computers, Multiprocessors and multicomputer, Multivector and SIMD computers. Conditions of parallelism, Data and resource Dependences, Hardware and software parallelism, Program partitioning and scheduling, Grain Size and latency, Program flow mechanisms, Control flow versus data flow, Data flow Architecture, Demand driven mechanisms, Comparisons of flow mechanisms.

Unit II (12 Hrs.)

System Interconnect Architectures: Network properties and routing, Static interconnection Networks, Dynamic interconnection Networks, Multiprocessor system Interconnects, Hierarchical bus systems, Crossbar switch and multiport memory, Multistage and combining network. Advanced processor technology, Instruction-set Architectures, CISC Scalar Processors, RISC Scalar Processors, Superscalar Processors, VLIW Architectures, Vector and Symbolic processors.

Unit III (12 Hrs)

Pipelining: Linear pipeline processor, nonlinear pipeline processor, Instruction pipeline Design, Mechanisms for instruction pipelining, Dynamic instruction scheduling, Branch Handling techniques, branch prediction, Arithmetic Pipeline Design, Computer arithmetic principles, Static Arithmetic pipeline, Multifunctional arithmetic pipelines.

Unit III (12 Hrs)

Multiprocessor Architectures: Symmetric shared memory architectures, distributed shared memory architectures, models of memory consistency, cache coherence protocols (MSI, MESI, MOESI), scalable cache coherence, overview of directory based approaches, design challenges of directory protocols, memory based directory protocols, cache based directory protocols, protocol design tradeoffs, synchronization.

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Recommended Books

1. Kai Hwang, 'Advanced Computer Architecture', 18th Reprint, TMH, **2003**.
2. D.A. Patterson and J.L. Hennessey, 'Computer Organization and Design', 4th Edn., Morgan Kaufmann.
3. J.P. Hayes, 'Computer Architecture and Organization', 2nd Edn., MGH, **1988**.
4. Harvey G. Cragon, 'Memory System and Pipelined Processors', Narosa Publication, **1996**.
5. V. Rajaranam & C.S.R. Murthy, 'Parallel Computer', PHI.
6. R.K. Ghose, Rajan Moona & Phalguni Gupta, 'Foundation of Parallel Processing', Narosa Publications.

CAD TOOLS FOR VLSI DESIGN

Subject Code: MECE5-268 **L T P C** **Duration: 48 Hrs.**
4 0 0 4

UNIT 1 (12 Hrs.)

An overview of OS commands. System settings and configuration. Introduction to Unix commands. Writing Shell scripts. VLSI design automation tools., Leonardo spectrum, ISE 8.1i, Quartus II, VLSI backend tools.

UNIT 2 (12 Hrs.)

Introduction to VLSI design methodologies and supporting CAD tool environment. Overview of C and Data structures, Graphics and CIF, concepts and structure and algorithm for some of the CAD tools, schematic editor, layout editor, Module generator, silicon compilers, placement and routing tools, Behavioural, functional, logic and circuit simulators, Aids for test vector generator and testing.

UNIT 3 (12 Hrs.)

Synthesis and simulation using HDLs-Logic synthesis using verilog and VHDL. Memory and FSM synthesis. Performance driven synthesis, Simulation- Types of simulation. Static timing analysis. Formal verification. Switch level and transistor level simulation.

UNIT 4 (12 Hrs.)

Circuit simulation using Spice - circuit description. AC, DC and transient analysis. Advanced spice commands and analysis. Models for diodes, transistors and opamp. Digital building blocks. A/D, D/A and sample and hold circuits. Design and analysis of mixed signal circuits.

Recommended Books

1. M.J.S. Smith, 'Application Specific Integrated Circuits,Pearson', **2002.**
2. M.H. Rashid, 'Spice for Circuits and Electronics using Pspice', 2nd Edn., PHI.
3. T. Grdtkeretal, 'System Design with System C', Kluwer, **2004**.
4. P.J. Ashendenetal, 'The System Designer's Guide to VHDL-AMS', Elsevier, **2005.**

NANO ELECTRONICS

Subject Code: MECE5-269 **L T P C** **Duration: 48 Hrs.**
4 0 0 4

Course Objectives:

The main aim of this course is to introduce the students about Nano sciences. Actual chemistry involved in semiconductor physics will be discussed. How this will be helpful for Designing of different circuits.

Learning Outcomes:

Students learn skills for handling basic concepts of Nano sciences for different applications for various fields.

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UNIT I (12 Hrs.)

Basics and Scale of Nanotechnology: Introduction – Scientific revolutions – Time and length scale in structures, Definition of a nano-system, Top down and bottom up approaches – Evolution of band structures and Fermi surface – introduction to semi conducting Nanoparticles, introduction to quantum Dots, wells, wires, Dimensionality and size dependent phenomena – Fraction of surface atoms – Surface energy and surface stress, Misconceptions of Nanotechnology.

UNIT II (12 Hrs)

The carbon age and nanotubes: New forms of carbon, Types of nanotubes, Formation of nanotubes, methods and reactants- Arcing in the presence of cobalt, Laser method, Chemical vapor deposition method, ball milling, properties of Nanotubes Electrical properties, vibrational properties, Mechanical properties, applications of Nanotubes in electronics, hydrogen storage, materials, space elevators.

UNIT III (12 Hrs.)

Characterization Techniques in Nano-electronics:

Principle, construction and working: Electron microscopy (SEM and TEM), Infrared and Raman Spectroscopy, Photoemission and X-RD spectroscopy, AFMs, Magnetic force microscope.

UNIT IV (12 Hrs)

Nano-scale Devices:

Introduction: Quantum Electron Devices; High Electron Mobility Transistor, Quantum Interference Transistor, Single Electron Transistor and Carbon Nanotube Transistor, DNA Computing; Structure of DNA, Basic Operation on DNA and DNA Computer.

Recommended Books

1. C.P. Polle and F.J. Owens, "Introduction to Nanotechnology" Willey India Pvt. Ltd, Edition 2011.
2. Daniel Minoli 'Nanotechnology Applications to Telecommunications and Networking', Willey India Pvt. Ltd., **2011**.

MULTIMEDIA COMMUNICATION SYSTEM

Subject Code: MECE5-270 **L T P C** **4 0 0 4** **Duration: 48 Hrs.**

Learning Objectives:

The objective of this course is to get aware the students about various multimedia systems, components associated and possibilities available for this particular domain.

Learning Outcomes:

Student will acquire teaching as well as analytical knowledge to design different Multimedia oriented systems.

Unit –I (12 Hrs.)

Introduction:

Concept of Multimedia, Multimedia Applications, Hardware Software requirements, Multimedia products & its evaluation.

Unit –II (12 Hrs.)

Components of multimedia: Text, Graphics, Audio, Video. Design & Authoring Tools, Categories of Authority Tools, Types of products.

Unit –III (12 Hrs.)

Animation: Introduction, Basic Terminology techniques, Motion Graphics 2D & 3D animation.

Unit –IV (12 Hrs.)

Introduction to MAYA (Animating Tool): Fundamentals, Modelling: NURBS, Polygon, Organic, animation, paths & boxes, deformers. Working with MEL: Basics & Programming Rendering & Special Effects: Shading & Texturing Surfaces, Lighting, Special effects.

Recommended Books:

1. David Hillman, 'Multimedia Technology & Applications', Galgotia Publications.
2. Rajneesh Agrawal, 'Multimedia Systems', Excel Books.
3. Nigel Chapman & Jenny Chapman, 'Digital Multimedia', Wiley Publications.
4. D.P. Mukherjee, 'Fundamentals of Computer Graphics and Multimedia', PHI.

LOW POWER VLSI DESIGN

Subject Code: MECE5-271 **L T P C** **4 0 0 4** **Duration: 48 Hrs.**

Unit 1 (12 Hrs.)

Introduction

Hierarchy of limits of power, Sources of power consumption, power estimation

Unit 2 (12 Hrs.)

Analysis and Synthesis Approach

Synthesis for low power, Voltage scaling approaches, Design and test of low power circuits

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Unit 3 (12 Hrs.)

Switching Techniques

Adiabatic switching, Minimizing switched. Capacitance, low power static RAM architecture, Low energy computing using energy recovery techniques,

Unit 4 (12 Hrs.)

Power Computation

Low power programmable computation, Software design for low power.

Recommended Books:

1. Kaushik Roy and Sharat Parsad, 'Low Power CMOS VLSI Circuit Design', John Wiley & Sons, **1998**.
2. A.P. Chandrakasan and R.W. Broadersen, 'Low power Digital CMOS Design', Kluwer Academic Publishers, **1995**.
3. J.M. Rabaey and M. Pedram, 'Low Power Design Methologies', Kluwer Academic Publishers, **2001**.
4. Dimitrios Soudris, Christian Piguet and Costas Goutis, 'Designing CMOS Circuits for Low Power', Kluwer Academic Publishers, **2000**.

RESEARCH METHODOLOGY

Subject Code – MREM0-101	L T P C 4 0 0 4	Duration – 45 Hrs.

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UNIT–I (11 Hrs)

Introduction to Research: Meaning, Definition, Objective and Process

Research Design: Meaning, Types - Historical, Descriptive, Exploratory and Experimental

Research Problem: Necessity of Defined Problem, Problem Formulation, Understanding of Problem, Review of Literature

Design of Experiment: Basic Principal of Experimental Design, Randomized Block, Completely Randomized Block, Latin Square, Factorial Design.

Hypothesis: Types, Formulation of Hypothesis, Feasibility, Preparation and Presentation of Research Proposal

UNIT–II (10 Hrs)

Sources of Data: Primary and Secondary, Validation of Data

Data Collection Methods: Questionnaire Designing, Construction

Sampling Design & Techniques – Probability Sampling and Non Probability Sampling

Scaling Techniques: Meaning & Types

Reliability: Test – Retest Reliability, Alternative Form Reliability, Internal Comparison Reliability and Scorer Reliability

Validity: Content Validity, Criterion Related Validity and Construct Validity

UNIT–III (13 Hrs)

Data Process Operations: Editing, Sorting, Coding, Classification and Tabulation

Analysis of Data: Statistical Measure and Their Significance, Central Tendency, Dispersion, Correlation: Linear and Partial, Regression: Simple and Multiple Regression, Skewness, Time series Analysis, Index Number

Testing of Hypothesis: T-test, Z- test, Chi Square, F-test, ANOVA

UNIT – IV (11 Hrs)

Multivariate Analysis: Factor Analysis, Discriminant Analysis, Cluster Analysis, Conjoint Analysis, Multi Dimensional Scaling

Report Writing: Essentials of Report Writing, Report Format

Statistical Software: Application of Statistical Softwares like SPSS, MS Excel, Mini Tab or MATLAB Software in Data Analysis

**Each Student has to Prepare Mini Research Project on Topic/ Area of their Choice and Make Presentation. The Report Should Consists of Applications of Tests and Techniques Mentioned in The Above UNITs*

Recommended Books

1. R.I. Levin and D.S. Rubin, 'Statistics for Management', 7th Edn., Pearson Education New Delhi.
2. N.K. Malhotra, 'Marketing Research–An Applied Orientation', 4th Edn., Pearson Education New Delhi, Donald Cooper, 'Business Research Methods', Tata McGraw Hill New Delhi
3. Sadhu Singh, 'Research Methodology in Social Sciences', Himalaya Publishers.
4. Darren George & Paul Mallery, 'SPSS for Windows Step by Step', Pearson Education New Delhi.
5. C.R. Kothari, 'Research Methodology Methods & Techniques', 2nd Edn., New Age International Publishers.

PROJECT

Subject Code: MECE5-308 **L T P C**

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Learning Objectives

1. To propose engineering based project in a clear and concise manner.
2. Allow students to develop problem solving, analysis, synthesis and evaluation skills.

Learning Outcomes

1. Synthesis of knowledge.
2. To demonstrate the aptitude of applying the own knowledge to solve a specific problem.
3. To mature the knowledge.
4. Able to organize, compile and record all work details in an efficient manner.

Each student will be required to complete a Project and submit a Project Report on a topic on any of the areas of modern technology related to Electronics & Communication Engineering including interdisciplinary fields.

SEMINAR

Subject Code: MECE5-310 **L T P C**
0 0 4 4

Learning Objectives

1. To identify, understand and discuss current advanced research topic.
2. To gain experience in the critical assessment of the available scientific literature
3. To practice the use of various resources to locate and extract information using offline & online tools, journals

Learning Outcomes:

1. An ability to utilize technical resources
2. An ability to write technical documents and give oral presentations related to the work completed.
3. To learn preparation and presentation of scientific papers in an exhaustive manner

Each student will be required to prepare a Seminar Report and present a Seminar on a topic in any of the areas of modern technology related to Electronics & Communication Engineering including interdisciplinary fields.

DIGITAL SIGNAL PROCESSORS & ARCHITECTURES

Subject Code: MECE5-372	**L T P C** **4 0 0 4**	**Duration: 45 Hrs.**

Learning Objectives: The objective of this course is to familiarize the students with signal processing system. The students will study digital signal processors and will introduce about programming in digital signal processors.

Learning Outcomes

1. Design of digital filters.
2. Develop a programme for interfacing of external peripheral to digital processors.
3. Design and develop programme on different general purpose digital signal processors.
4. Develop a programme to interface external devices with signal processors.

UNIT-I (11 Hrs)

Introduction to Digital Signal Processing: Introduction, A Digital signal-processing system, The sampling process, Discrete time sequences. Discrete Fourier Transform (DFT) and Fast Fourier Transform (FFT), Linear time-invariant systems, Digital filters, Decimation and interpolation.

UNIT-II (11 Hrs)

General purpose digital signal processors – fixed point DSP's, Architecture of first generation fixed point DSP processors, Architecture of second generation fixed point DSP's, Architecture of third generation fixed point DSP's, Architecture of fourth generation fixed point processors, floating point digital signal processors.

UNIT-III (10 Hrs)

Programmable Digital Signal Processors: Digital signal-processing Devices, TMS320C54XX DSP: Its Addressing modes, Memory space, Program Control, instructions and Programming, On-Chip Peripherals, Interrupts and Pipeline operation of processors.

UNIT-IV (13 Hrs)

Interfacing Memory and I/O Peripherals to Programmable DSP Devices: Memory space organization, External bus interfacing signals, Memory interface, Parallel I/O interface, Programmed I/O, Interrupts and I/O, Direct memory access (DMA).

Recommended Books

1. Avtar Singh and S. Srinivasan, 'Digital Signal Processing', Thomson Publications, **2004.**
2. Ananthi, S.K. Padmanabhan, R. Vijayarajeswaran, 'A Practical Approach to Digital Signal Processing', New Age International, **2006/2009.**
3. B. Venkataramani and M. Bhaskar, Digital Signal Processors, Architecture, Programming and Applications', TMH, **2002**
4. John G. Proakis, Dimitris Manolakis, Digital Signal Processing – Principles, Algorithms and Applications, Pearson Education, **2006**.
5. R. Chassaing, D.W. Horning, 'Digital Signal Processing with the TMS320C2S', Wiley Publications, **1990.**

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ERROR CONTROL AND CODING

Subject Code: MECE5-373 **L T P C** **Duration: 45 Hrs.**
4 0 0 4

Learning Objectives: The objective of this course is to familiarize the students with concept of Block Codes and Maximum Likelihood Decoding. They will be able to understand Generator Matrix, Parity-Check Matrix and Error-Correcting Capability of a Linear Code

Learning Outcomes

1. Describe the model and calculate the capacity of typical digital communication channels.
2. Analyze the encoding and decoding procedures of various error control codes.
3. Compare the error correction capability of different error control codes and their performances.
4. Apply error control coding to achieve error detection and correction in digital transmission systems
5. Design an error detecting and correcting system for semiconductor memory system to meet given system specification.

UNIT-I (11 Hrs.)

Review of Random Process: Review of Probability Theory, Basic concepts of random processes, random variables, basicconcepts from systems theory and stochastic processes, Stationary and non stationary process, correlation function, Ergodicity and power spectral density, transformation random process by linear system, Special random process: white Gaussian noise, Wiener levy, Shot noise, Markov Process

UNIT-II (11 Hrs.)

Hypothesis Testing: Simple binary hypothesis test, Decesion Criteria, Neyman Pearson tests, Bayes Criteria Multiple hypothesis testing, Composite hypothesis testing

UNIT-III (11 Hrs.)

Detection Theory: Sequential detection Walds test Detection of known signals in white noise, Detection of known signal in colored noise, Maximum SNR Criteria, Detection of signals with unknown parameters

UNIT-IV (12 Hrs.)

Coding: Error Control coding for wireless fading channels, Channel Estimation and Adaptive channel coding, Joint Source and Channel coding. Non binary Linear Block Codes, Hard and soft decision decoding, Coding and Decoding of BCH, Reed Solomon Codes, Convolution codes: Coding and Decoding , Distance bounds, Performance bounds Turbo codes: Coding, Decoding Algorithms, Performance comparison, Interleaver design Trellis coded Modulation, TCM Decoders, TCM for AWGN and Fading Wireless Channels, Performance comparison.

Recommended Books

1. C.W. Helstrom, ‘Elements of Signal Detection and Estimation’, Prentice Hall, NJ, **1995.**
2. H.L. Van Trees, ‘Detection, Estimation, and Modulation Theory’, Wiley, **1971.**
3. H.V. Poor, ‘An Introduction to Signal Detection and Estimation’. 2nd Edn., Springer-Verlag, New York.
4. Stephen G. Wilson, ‘Digital Modulation & Coding’, Prentice Hall Inc.
5. Ranjan Bose, ‘Information Theory Coding and Cryptography, TMH.
6. J.G. Proakis, ‘Digital Communication’, Pearson Education.

MEASUREMENT & CHARACTERISATION TECHNIQUES

Subject Code: MECE5-374 **L T P C** **Duration: 45 Hrs.**
4 0 0 4

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Learning Objectives The objective of this course is to study about different measurement techniques and introduction to X-ray diffraction techniques.

Learning Outcomes

1. Analysis of UV and visible spectrum.
2. Determination of crystal structure.
3. Electron diffraction analysis using electron microscopy.
4. Differentiate between scanning tunneling microscope & atomic force microscope and their applications.

UNIT-I (11 Hrs.)

Spectroscopy: Basics of UV and visible Spectroscopy: Electronic transitions, Beer-Lambert Law, visible spectrum and colour; Infrared Spectroscopy: Instrumentation and sample handling, overtones, applications of FT-IR and IR Spectroscopy

UNIT-II (12 Hrs.)

X-ray Diffraction Techniques: Production of X-rays, its properties and hazards, X-ray Diffraction and Bragg's law, Laue techniques, Debye-Scherrer techniques. Determination of crystal structure of powder sample, line broadening, particle size, residual stress measurement, Phase identification, phase quantification, introduction to pole figure and texture analysis; chemical/elemental analysis by X-ray Fluorescence.

UNIT-III (12 Hrs.)

Electron Microscopy: Electron diffraction, Principles and operation of scanning electron microscope. Geometry of electron microscopes, Electron Sources, Production of Vacuum, Pressure measurement, Specimen Handling and preparation, Secondary electron image, Backscattered electron image,

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UNIT-IV (10 Hrs.)

Scanning Probe Microscopy: Principles and operation of scanning probe microscopes: Scanning Tunnelling Microscope, Atomic Force Microscope

Recommended Books

1. Antony R. West, Solid State Chemistry & Its Applications, Wiley Student Edition.
2. V.A., 'Modern Metallographic Techniques and their Applications', Wiley Interscience, **1971.**
3. B.D. Cullity, 'Elements of X-ray Diffraction, 4th Edn., Addison Wiley, **1978.**
4. M.H. Loretto, 'Electron Beam Analysis of Materials', Chapman and Hall, **1984.**
5. Dawn Bonnell, 'Scanning Probe Microscopy and Spectroscopy: Theory, Techniques, and Applications', Wiley-VCH.

CMOS VLSI DESIGN

Subject Code: MECE5-375	**L T P C** **4 0 0 4**	**Duration: 45 Hrs.**

Learning Objectives in this course the students will be able to understand the MOS designing process. They will be familiarizing with MOS Combinational & Sequential Circuits and understand about semiconductor memories.

Learning Outcomes

1. Designing of CMOS Inverter logic and analysis of parameters like rise time, fall time etc.
2. Realization of Combinational circuits using MOS gates and its analysis
3. Analysis of sequential circuits using MOS gates.
4. Design & analysis of semiconductor memories.

UNIT-I (10 Hrs.)

MOS Design: Pseudo NMOS Logic – Inverter, Inverter threshold voltage, output high voltage, Output Low voltage, gain at gate threshold voltage, Transient response, Rise time, Fall time, Pseudo NMOS logic gates, Transistor equivalency, CMOS Inverter logic.

UNIT-II (11 Hrs.)

Combinational MOS Logic Circuits: MOS logic circuits with NMOS loads, Primitive CMOS logic gates – NOR & NAND gate, Complex Logic circuits design – Realizing Boolean expressions using NMOS gates and CMOS gates, CMOS full adder

UNIT-III (12 Hrs.)

Sequential MOS Logic Circuits: Behavior of bistable elements, SR Latch, clocked latch and flip flop circuits, CMOS D latch and edge triggered flip-flop.

UNIT-IV (12 Hrs.)

Semiconductor Memories: Types, RAM array organization, DRAM – Types, Operation, Leakage currents in DRAM cell and refresh operation, Flash Memory- NOR flash and NAND flash.

Recommended Books

1. Ken Martin, 'Digital Integrated Circuit Design', Oxford University Press, **2011**.
2. Sung-Mo Kang, Yusuf Leblebici, CMOS Digital Integrated Circuits Analysis and Design, TMH, 3rd Edn., **2011.**
3. Ming-BO Lin, Introduction to VLSI Systems: A Logic, Circuit and System Perspective, CRC Press, **2011.**
4. Jan M. Rabaey, Anantha Chandrakasan, Borivoje Nikolic, Digital Integrated Circuits – A Design Perspective, 2nd Edn., PHI.

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DISSERTATION

Subject Code: MECE5-411

Learning Objectives: To learn, practice, and critique effective scientific writing and to formulate the research objectives clearly, state claims and evidence clearly, assess validity of claims, evidence, outcomes, and results.

Learning Outcomes:

1. Design and execute a meaningful research project that demonstrates spatial thinking and uses the knowledge and skills.
2. Define and analyze a problem in latest research areas.
3. Formulate and write a research proposal.
4. Able to learn effectively record data and experiments so that others can understand them.
5. Communicate the findings by means of a thesis, written in the format specified by the department/institute.

Each student will be required to complete a Dissertation and submit a written Report on the topic on any of the areas of modern technology related to Electronics & Communication Engineering including interdisciplinary fields in the Final semester of M.Tech. Course.

Papers accepted in UGC approved journals will be given 10 marks as special incentive. It will be mandatory to publish one paper in conference/journal.

M. TECH. ELECTRONICS & COMMUNICATION ENGINEERING (ECE)

Total Contact Hours = 24 Total Marks = 600 Total Credits = 22

SEMESTER 1st		Contact Hrs			Marks			Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
MECE1-101	Advanced Communication Systems	4	0	0	40	60	100	4
MECE1-102	Microcontrollers and Embedded Systems	4	0	0	40	60	100	4
MECE1-103	Electronics System Design	4	0	0	40	60	100	4
MECE1-104	Research Lab 1	0	0	4	60	40	100	2
Departmental Elective – I (Select any one)		4	0	0	40	60	100	4
MECE1-156	Advance Semiconductor Physics							
MECE1-157	Biomedical Electronics							
MECE1-158	Information Theory and Coding							
MECE1-159	Hardware Description Languages and VLSI Design							
Departmental Elective – II (Select any one)		4	0	0	40	60	100	4
MECE1-160	Micro and Nano Sciences							
MECE1-161	Sensors and Transducers							
MECE1-162	Speech and Audio Processing							
MECE1-163	Soft Computing							
Total	**Theory = 5 Lab = 1**	**20**	**0**	**4**	**260**	**340**	**600**	**22**

Total Contact Hours = 24 Total Marks = 600 Total Credits = 22

SEMESTER 2nd		Contact Hrs			Marks			Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
MECE1-205	Optical Communication System	4	0	0	40	60	100	4
MECE1-206	Advanced Digital Signal Processing	4	0	0	40	60	100	4
MECE1-207	Research Lab 2	0	0	4	60	40	100	2
Departmental Elective – III (Select any one)		4	0	0	50	100	150	4
MECE1-264	Digital Image Processing							
MECE1-265	Satellite Communication							
MECE1-266	Information Security							
MECE1-267	Parallel Processing							
Departmental Elective – IV (Select any one)		4	0	0	50	100	150	4
MECE1-268	Nano electronics							
MECE1-269	Multimedia Communication System							
MECE1-270	Advanced Network Synthesis and Analysis							
MECE1-271	Micro & Nano Electromechanical Systems MEMS and NEMS							
Open Elective – I (Select any One)		4	0	0	50	100	150	4
Total	Theory = 5 Lab = 1	**20**	**0**	**4**	**260**	**340**	**600**	**22**

Total Contact Hours = 26 **Total Marks = 500** **Total Credits = 22**

SEMESTER 3rd		**Contact Hrs**			**Marks**			**Credits**
Subject Code	**Subject Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
MREM1-101	Research Methodology	4	0	0	40	60	100	4
MECE1- 308	Project	0	0	10	100	0	100	8
MECE1- 309	Seminar	0	0	4	100	0	100	2
Departmental Elective – V (Select any one)		4	0	0	40	60	100	4
MECE1- 372	Antenna System Design							
MECE1- 373	Error Control and Coding							
MECE1- 374	Wireless and Adhoc Networks							
MECE1- 375	Speech And Audio Processing							
Total		**12**	**0**	**14**	**320**	**180**	**500**	**22**

Total Credits = 24

SEMESTER 4th		**Contact Hrs**			**Evaluation Criteria**	**Credits**
Subject Code	**Subject Name**	**L**	**T**	**P**	**Satisfactory/ Unsatisfactory**	
MECE1 – 410	Thesis	0	0	20		24

Overall

Semester	**Marks**	**Credits**
1st	600	22
2nd	600	22
3rd	500	22
4th	--	24
Total	**1700**	**90**

Subject Code: MECE1-101 **L T P C** **Duration: 45 Hrs.**
4 0 0 4

UNIT-I (12 Hrs.)

Introduction: Digital Communication System (Description of different modules of the block diagram), Complex baseband representation of signals, Gram-Schmidt Orthogonalization procedure. M-ary orthogonal signals, bi-orthogonal signals, Simplex signal waveforms.

UNIT-II (10 Hrs.)

Band-limited channels: Pulse shape design for channels with ISI: Nyquist pulse, Partial response signaling (Duobinary and modified Duobinary pulses), demodulation, Maximum likelihood estimation technique.

UNIT-III (12 Hrs.)

Communication over fading channels: Characteristics of fading channels, Rayleigh and Rician channels, Receiver performance-average SNR, outage probability, Amount of Fading and Average Bit/Symbol Error Rate. Statistical channel modeling of Rayleigh and Rician fading channels.

UNIT-IV (11 Hrs.)

4G Technology /OFDM: Introduction to OFDM, Multicarrier Modulation and Cyclic Prefix, BER performance over AWGN and Rayleigh fading, OFDM Issues like PAPR, Frequency and Timing Offset.

Recommended Books:

1. G. Proakis and M. Salehi, 'Fundamentals of Communication Systems', Pearson Education, **2005**.
2. S. Haykins, 'Communication Systems', 5th Edn., John Wiley, **2008**.
3. M.K. Simon, S.M. Hinedi and W.C. Lindsey, 'Digital Communication Techniques: Signaling and detection', PHI, **1995**.
4. W. Tomasi, 'Advanced Electronic Communication Systems'. 4th Edn., Pearson Education, **1998**.
5. M.K. Simon and M.S. Alouini, 'Digital Communication over Fading Channels', **2000**.

MICROCONTROLLERS AND EMBEDDED SYSTEMS

Subject Code: MECE1-102 **L T P C** **Duration: 45 Hrs.**
4 0 0 4

UNIT-I (12 Hrs.)

Typical Embedded System: Core of the Embedded System, Memory, Sensors and Actuators, Communication Interface, Embedded Firmware, Other System Components. Characteristics and Quality Attributes of Embedded Systems: Hardware Software Co-Design and Program Modelling: Fundamental Issues in Hardware Software Co-Design, Computational Models in Embedded Design, Introduction to Unified Modelling Language, Hardware Software Trade-offs.

UNIT-II (10 Hrs.)

Embedded Hardware Design and Development: EDA Tools, how to Use EDA Tool, Schematic Design – Place wire, Bus, port, junction, creating part numbers, Design Rules check, Bill of materials, Netlist creation, PCB Layout Design – Building blocks, Component placement, PCB track routing.

UNIT-III (11 Hrs.)

ARM Architecture: ARM Design Philosophy, Registers, Program Status Register, Instruction Pipeline, Interrupts and Vector Table, Architecture Revision, ARM Processor Families. ARM Programming Model – I: Instruction Set: Data Processing Instructions, Addressing Modes, Branch, Load, Store Instructions, PSR Instructions, Conditional Instructions. ARM Programming Model – II: Thumb Instruction Set: Register Usage, Other Branch Instructions, Data Processing Instructions, Single-Register and Multi Register Load-Store Instructions, Stack, Software Interrupt Instructions

UNIT-IV (12 Hrs.)

ARM Programming: Simple C Programs using Function Calls, Pointers, Structures, Integer and Floating Point Arithmetic, Assembly Code using Instruction Scheduling, Register Allocation, Conditional Execution and Loops. UNIT –V: Memory Management: Cache Architecture, Polices, Flushing and Caches, MMU, Page Tables, Translation, Access Permissions, Context Switch.

RECOMMENDED BOOKS:

1. Andrew N. Sloss, Dominic Symes, Chris Wright, ‘ARM Systems Developer’s Guides-Designing & Optimizing System Software’, 1st Edn., Elsevier, **2008**.
2. K.V. Shibu, ‘Introduction to Embedded Systems’, 1st Edn., Tata McGraw Hill Education Private Limited, **2009**.

REFERENCE BOOKS:

1. Jonathan W. Valvano – Brookes / Cole, ‘Embedded Microcomputer Systems, Real Time Interfacing’, 1st Edn., Thomas Learning, **1999**.
2. James K. Peckol, ‘Embedded Systems – A contemporary Design Tool’, 2nd Edn., John Weily, **2008**.

ELECTRONICS SYSTEM DESIGN

Subject Code: MECE1-103 **L T P C** **Duration: 45 Hrs.**
4 0 0 4

UNIT-I (10 Hrs.)

MSI and LSI Circuits and Their Applications: Review of Digital electronics concept, Arithmetic Circuits, Comparators, Multiplexers, Code Converters, XOR and AND OR INVERTER Gates, Wired Logic, Bus Oriented Structures, Tri-State Bus System, Propagation Delay.

UNIT-II (12 Hrs)

Sequential Machines: The Concept of Memory, The Binary Cell, The Cell And The Bouncing Switch, Set/Reset, D, Clocked T, Clocked JK Flip Flop, Design Of Clock F/F, Conversion, Clocking Aspects, Clock Skew, State Diagram Synchronous Analysis Process, Design Steps For Traditional Synchronous Sequential Circuits, State Reduction, Design Steps For Next State Decoders, Design Of Out Put Decoders, Counters, Shift Registers and Memory.

UNIT-III (11 Hrs.)

Multi Input System Controller Design: System Controllers, Design Phases And System Documentation, Defining The System, Timing And Frequency Considerations, Functional, Position And Detailed Flow Diagram Development, MDS Diagram, Generation, Synchronizing Two System And Choosing Controller, Architecture, State Assignment, Next State Decoders And Its Maps, Output Decoders, Clock And Power Supply Requirements, MSI Decoders, Multiplexers In System Controllers, Indirect Addressed Multiplexers Configurations, Programmable System Controllers, ROM, PLA And PAL Based Design.

UNIT-IV (12 Hrs.)

Asynchronous Finite State Machines: Scope, Asynchronous Analysis, Design of Asynchronous Machines, Cycle and Races, Plotting and Reading the Excitation Map, Hazards, Essential Hazards Map Entered Variable, MEV Approaches To Asynchronous Design, Hazards In Circuit Developed By MEV Method, Electromagnetic Interference And Electromagnetic Compatibility Grounding And Shielding of Digital Circuits. Interfacing digital system with different media like fibre cable, co-axial cable etc.

Books Recommended:

1. Fletcher, 'An Engineering Approach to Digital Design', PHI, **1990.**
2. 'Designing with TTL Circuits', Texas Instruments.
3. Related IEEE/IEEP Publications.

RESEARCH LAB.-1

Subject Code: MECE1-104 **L T P C**
4 0 0 4

Every Subject In-charge will define atleast one project to each student of his/her (preferably different) concerned subject to be performed in Research- Lab.

ADVANCE SEMICONDUCTOR PHYSICS

Subject Code: MECE1-156 **L T P C** **Duration: 45 Hrs.**
4 0 0 4

UNIT-I (12 Hrs.)

Preparation and Characterization of Semiconductors: Types of semiconductors, charge carrier statistics, crystal growth, preparation and doping techniques of elemental and compound semiconductors, Metallization, Lithography and Etching, Bipolar and MOS device fabrication characterization (electrical, thermoelectric, magnetic and optical properties) of semiconductor materials.

UNIT-II (10 Hrs.)

Optical Properties of Semiconductors: Dipolar elements in direct gap semiconductors, optical susceptibility of a semiconductor, absorption and spontaneous emission, bimolecular recombination coefficient, condition for optical amplification in semiconductors.

UNIT-III (12 Hrs.)

Electronic and Electric Properties of Semiconductors: Boltzmann equation, scattering mechanisms, hot electrons, recombination, transport equation in a semiconductor, Electronic and ionic conductivity, solid oxide fuel cells, ceramic semiconductors, linear dielectrics, dielectric properties, Ferroelectric materials, piezoelectrics, ferro-piezoceramics, actuators and electrostrictions, pyroelectrics, electro-optics photorefractives, thin film capacitors. Ferroic crystals, primary and secondary ferroics, proper ferroics, magnetoferroelectricity.

UNIT-IV (11 Hrs.)

Application in Semiconductor Devices: Ge, Si, GaAs, Semiconductor device: metal-semiconductor and semiconductor heterojunctions, physics of bipolar devices, fundamentals of MOS and field effect devices, basics of solar cell, photodiodes, photodetectors.

RECOMMENDED BOOKS:

1. S.M. Sze and Kwok. K. Ng, 'Physics of Semiconductor Devices', 3rd Edn., Wiley, **2008.**
2. J. Wilson and J.F.B. Hawkes, 'Optoelectronics: An Introduction', Prentice-Hall, **1989.**
3. R.A. Smith, 'Semiconductors', Academic Press, **1963.**
4. M. Shur, 'Physics of Semiconductor Devices', Prentice Hall, **1990.**
5. A. Paul, 'Chemistry of Glasses', Chapman and Hall, **1982.**

6. Bishnu P. Pal, 'Fundamentals of Fibre Optics in Telecommunication and Sensor Systems', New Age International Publishers, **2005**.
7. Kwan Chi Kao, 'Dielectric Phenomena in Solids', Elsevier Academic Press, **2004.**
8. Vinod K. Vadhawan, 'Introduction to Ferroic Materials', Gordon and Breach Science Publications, **2000**.

BIOMEDICAL ELECTRONICS

Subject Code: MECE1-157 **L T P C** **Duration: 45 Hrs.**
4 0 0 4

UNIT-I (12 Hrs.)

Physiology & Human Nervous System: Cell, Bioelectricity, Sodium Potassium pump, Action and Resting potentials, Bioelectric Signals, Nervous System, Peripheral Nervous System, Autonomic Nervous System, SNS, PNS.

UNIT-II (12 Hrs.)

Electro-Physiological Measurements Basic components of biomedical electronics system, Electrodes: Micro, Needle and Surface electrodes, Electrical activity of heart, Generation and Recording of ECG signals, ECG Waves and Time Intervals, Heart Rhythms, Heart beat morphologies, Noise and artefacts, Respiratory system, EEG, EEG Rhythms and waveforms, Recording.

UNIT-III (11 Hrs.)

Non-Electrical Parameter Measurement: Blood pressure measurement, Cardiac output, Heart Sounds, Respiratory rate, Gas volume, Flow rate, pH value, ESR, GSR, Plethysmography.

UNIT-IV (10 Hrs.)

Assistive Restorative and Medical Imaging Equipment: Phonocardiography, Vectrocardiography, Defibrillators, Pacemakers, X-Ray, Ultrasonography, Computer Tomography, MRI.

RECOMMENDED BOOKS:

1. Joseph J. Carr and John M. Brown, 'Introduction to Biomedical Equipment Technology', 4th Edn., Pearson Education India, **2001.**
2. 'Biomedical Instrumentation and Measurements', Leslie Cromwell, J. Fred, Weibell and Erich A. Pfeiffer, Prentice Hall of India Pvt. Ltd, New Delhi, **1980.**
3. John G. Webster, 'Medical Instrumentation Application & Design', 3rd Edn., Wiley India.
4. R.S. Khandpur, 'Handbook on Biomedical Instrumentation', TMH.
5. Barbara Christe, 'Introduction to Biomedical Instrumentation: The Technology of Patient Care', Cambridge University Press, **2009.**

INFORMATION THEORY AND CODING

Subject Code: MECE1-158 **L T P C** **Duration: 45 Hrs.**
4 0 0 4

UNIT-1 (11 Hrs.)

Elements of information theory Source coding theorem, Huffman coding, Channel coding theorem, channel capacity theorem, Shenonfano theorem, entropy

UNIT-2 (11 Hrs.)

Sampling Process Base band and band pass sampling theorems reconstruction from samples, Practical aspects of sampling and signal recovery TDM

UNIT-3 (11 Hrs.)

Waveform Coding Techniques PCM Channel noise and error probability DPCM and DM Coding speech at low bit rates Prediction and adaptive filters. Base band shaping for data transmission, PAM signals and their power spectra Nyquist criterion ISI and eye pattern Equalization.

UNIT- 4 (12 Hrs.)

Digital Modulation Techniques Binary and M-ary modulation techniques, Coherent and non-coherent detection, Bit Vs symbol error probability and bandwidth efficiency. Bit error analysis, using orthogonal Signalling. Error Control Coding Rationale for coding Linbear block codes, cyclic codes and convolution codes Viterbi decoding algorithm and trellis codes.

Recommended Books

1. J. Dass., S.K. Malik & P.K. Chatterjee, 'Principles of Digitals Communication', Wiley-Blackwel, **1991**.
2. Vera Pless,'Introduction to the Theory of Error Correcting Codes', 3rd Edn., **1998.**
3. Robert G. Gallanger, 'Information Theory and Reliable Communication', McGraw Hill, **1992**.

HARDWARE DESCRIPTION LANGUAGES AND VLSI DESIGN

Subject Code: MECE1-159 **L T P C** **Duration: 45 Hrs.**
4 0 0 4

UNIT-I (11 Hrs.)

MOS TRANSISTOR THEORY: Introduction, Ideal I-V Characteristics, Second Order Effects, CMOS Logic, CMOS Fabrication and Layout, VLSI Design Flow.

CIRCUIT CHARACTRIZATION AND PERFORMANCE ESTIMATION: CMOS Inverter, DC Transfer Characteristics, Delay Estimation, Logical Effort, Power Dissipation, Scaling and Latch-up.

UNIT-II (11 Hrs.)

COMBINATIONAL AND SEQUENTIAL CIRCUIT DESIGN: Static CMOS, Ratioed Circuits, Differential Cascode Voltage Switch Logic, Dynamic Circuits, Domino Logic-Pass Transistor Circuits, CMOS D Latch and Edge Triggered Flip-flop and Schmitt trigger.

UNIT-III (12 Hrs.)

HDL PROGRAMMING USING BEHAVIORAL AND DATA FLOW MODELS: Verilog, Introduction, Typical Design Flow, Modules and Ports, Instances, Components, Lexical Conventions, Number Specification, Strings, Identifiers and Keywords, Data Types, System Tasks and Compiler Directives, Behavioural Modelling, Dataflow Modelling, RTL, Gate Level Modelling, Programs for Combinational and Sequential.

UNIT-IV (11 Hrs.)

HDL PROGRAMMING WITH STRUCTURAL AND SWITCH LEVEL MODELS: Tasks and Functions, Difference between Tasks and Functions, Switch Level, MOS Switches, CMOS Switches, Examples: CMOS NAND and NOR, MUX using Transmission Gate, CMOS Flip-Flop.

RECOMMENDED BOOKS:

1. Neil H.E. Weste, David Harris and Ayan Banenjee, 'CMOS VLSI Design', 3rd Edn., Pearson, **2004.**
2. Sung Mu Kang and Yusuf Leblebici, 'CMOS Digital Integrated Circuits', 3rd Edn., Tata Mc-Graw Hill, **2002.**
3. Samir Palnitkar, 'Verilog HDL', 2nd Edn., Pearson, **2004.**

MICRO AND NANO SCIENCES

Subject Code: MECE1-160 **L T P C** **Duration: 45 Hrs.**
4 0 0 4

UNIT-1 (10 Hrs.)

Introduction to semiconductor devices Introduction- material conductivity - Quantum mechanics - energy bands - crystalline structures - Density of states - band structures - Fermi - Dirac function - material classification - Band structure - electrons and holes - doping - Scattering - mobility - Diffusion transport - Einstein relation - Carrier generation and recombination- continuity equation.

UNIT-2 (13 Hrs.)

Crystal Growth, Wafer Preparation, Epitaxy and Oxidation Review of Semiconductor theory - Electronic Grade Silicon - Czochralski Crystal Growing - Silicon Shaping Processing consideration - Vapour Phase Epitaxy - Molecular Beam Epitaxy - Silicon on Insulators – Epitaxial Evaluation – Growth Mechanism and Kinetics – Thin Oxides – Oxidation Techniques and Systems – Oxide Properties. Lithography and Relative Plasma Etching Optical Lithography – Electron Lithography – X-Ray Lithography - Ion Lithography Plasma -Properties – Feature Size - Control and Anisotropic Etch Mechanism – Relative Plasma Etching Techniques and Equipment.

UNIT-3 (11 Hrs.)

Deposition, Diffusion, Lon Implementation and Metallization Deposition Processes – Polysilicon – Plasma Assisted Deposition – Models of Diffusion in Solids – Fick’s One Dimensional Diffusion Equation – Atomic Diffusion Mechanism – Measurement Techniques – Range Theory – Implantation Equipment. Annealing Shallow Junction – High Energy Implantation – Physical Vapour Deposition – Patterning.

UNIT-4 (11 Hrs.)

VLSI Process Integration, Analytical, Assembly Techniques and Packaging Of VLSI Devices NMOS IC Technology – CMOS IC Technology – MOS Memory IC Technology – Bipolar IC Technology – IC Fabrication. Analytical Beams – Beams Specimen interaction – Chemical Methods – Package Types Baking Design Considerations – VLSI Assembly Technology – Package Fabrication Technology.

Recommended Books:

1. S.M. Sze, ‘VLSI Technology’, McGraw-Hill, 2nd Edn., **1988.**
2. Duoglas A. Pucknell and Kamaran Eshragian,’Basic VLSI Design’, 3rd Edn., PHI, **1994**.
3. Wayne Wolf, ‘Modern VLSI design’, 2nd Edn., Prentice Hall Ptr, **1998**.
4. D.S. Grewal, ‘Nanotechnology’, Orient Longman’s, **2008.**

SENSORS AND TRANSDUCERS

Subject Code: MECE1-161 **L T P C** **Duration: 45 Hrs.**
4 0 0 4

UNIT-I (10 Hrs.)

Sensors/Transducers: Principles, Classification, Parameters, Characteristics (Static and Dynamic), Environmental Parameters (EP), Characterization.

Mechanical and Electromechanical Sensors: Introduction, Resistive Potentiometer, Strain Gauge (Resistance and Semiconductor), Inductive Sensors: Sensitivity and Linearity of the Sensor, Types-Capacitive Sensors, Electrostatic Transducer, Force/Stress Sensors Using Quartz Resonators, Ultrasonic Sensors.

UNIT–II (13 Hrs.)

Thermal Sensors: Introduction, Gas Thermometric Sensors, Thermal Expansion Type Thermometric Sensors, Acoustic Temperature Sensor, Dielectric Constant and Refractive Index Thermosensors, Helium Low Temperature Thermometer, Nuclear Thermometer, Magnetic Thermometer, Resistance Change Type Thermometric Sensors, Thermoemf Sensors, Junction Semiconductor Types, Thermal Radiation Sensors, Quartz Crystal Thermoelectric Sensors, NQR Thermometry, Spectroscopic Thermometry, Noise Thermometry and Heat Flux Sensors.

Magnetic Sensors: Introduction, Sensors and the Principles Behind, Magnetoresistive Sensors (Anisotropic and Semiconductor), Hall Effect and Sensors, Inductance and Eddy Current Sensors, Angular/Rotary Movement Transducers (Synchros and Synchro-resolvers), Eddy Current Sensors, Electromagnetic Flowmeter, Switching Magnetic Sensors and SQUID Sensors.

UNIT-III (12 Hrs.)

Radiation Sensors: Introduction, Basic Characteristics, Types of Photosensistors/Photo Detectors, X-ray and Nuclear Radiation Sensors and Fibre Optic Sensors.

Electroanalytical Sensors: Introduction, The Electrochemical Cell, The Cell Potential, Standard Hydrogen Electrode (SHE), Liquid Junction and Other Potentials, Polarization (Concentration, Reactive, Adsorption and Charge Transfer), Reference Electrodes, Sensor Electrodes and Electroceramics in Gas Media.

UNIT-IV (10 Hrs.)

Smart Sensors: Introduction, Primary Sensors, Excitation, Amplification, Filters, Converters, Compensation, Information Coding/Processing, Data Communication (Standards for Smart Sensor Interface) and The Automation

Sensor's Applications: Introduction, On-board Automobile Sensors (Automotive Sensors), Home Appliance Sensors, Aerospace Sensors, Sensors for Manufacturing and Sensors for Environmental Monitoring.

RECOMMENDED BOOKS:

1. D. Patranabis, 'Sensors and Transducers', 2nd Edn., PHI, **2003.**
2. W. Bolton, 'Mechatronics', 4th Edn., Pearson, **2011.**

SPEECH AND AUDIO PROCESSING

Subject Code: MECE1-162 **L T P C** **Duration: 45 Hrs.**
4 0 0 4

UNIT-1 (11 Hrs.)

Digital models for the speech signal - mechanism of speech production - acoustic theory - lossless tube models – digital models - linear prediction of speech - auto correlation - formulation of LPC equation - solution of LPC equations -Levinson Durbin algorithm - Levinson recursion - Schur algorithm - lattice formulations and solutions - PARCORcoefficients - Spectral analysis of speech - Short Time Fourier analysis - filter bank design. Auditory Perception: Psychoacoustics- Frequency Analysis and Critical Bands - Masking properties of human ear.

UNIT-2 (12 Hrs.)

Speech coding -sub band coding of speech - transform coding - channel vocoder - formant vocoder - cepstral vocoder -vector quantizer coder- Linear Predictive Coder. Speech synthesis - pitch extraction algorithms - gold rabiner pitch trackers - autocorrelation pitch trackers - voice/unvoiced detection - homomorphic speech processing – homomorphic systems for convolution - complex cepstrums - pitch extraction using homomorphic speech processing. Sound Mixtures and Separation - CASA, ICA & Model based separation.

UNIT-3 (11 Hrs.)

Speech Transformations - Time Scale Modification - Voice Morphing. Automatic speech recognition systems – isolated word recognition - connected word recognition -large vocabulary word recognition systems - pattern classification -DTW, HMM - speaker recognition systems - speaker verification systems - speaker identification Systems.

UNIT-4 (11 Hrs.)

Audio Processing : Non speech and Music Signals - Modelling -Differential, transform and sub-band coding of audio
signals & standards - High Quality Audio coding using Psychoacoustic models - MPEG Audio coding standard. Music
Production - sequence of steps in a bowed string instrument - Frequency response measurement of the bridge of a violin. Audio Data bases and applications - Content based retrieval.

Recommended Books

1. L.R. Rabiner & R.W. Schafer, 'Digital Processing of Speech Signals', Prentice Hall Inc.
2. D. O'Shaughnessy, 'Speech Communication, Human and Machine'. Addison-Wesley.
3. Thomas F. Quatieri , 'Discrete-Time Speech Signal Processing: Principles and Practice', Prentice Hall, Signal Processing Series.
4. J. Deller, J. Proakis and J. Hansen, 'Discrete-Time Processing of Speech Signals', Macmillan.
5. Ben Gold & Nelson Morgan, 'Speech and Audio Signal Processing', John Wiley & Sons, Inc.
6. F.J. Owens, 'Signal Processing of Speech', Macmillan New Electronics.
7. S. Saito & K. Nakata, 'Fundamentals of Speech Signal Processing', Academic Press, Inc.
8. P.E. Papamichalis, 'Practical Approaches to Speech Coding', Texas Instruments, Prentice Hall.
9. L.R. Rabiner & Gold, 'Theory and Applications of Digital Signal Processing', Prentice Hall of India.
10. N.S. Jayant and P. Noll, 'Digital Coding of Waveforms: Principles and Applications to Speech and Video. Signal Processing Series', Englewood Cliffs: Prentice-Hall.
11. Thomas Parsons, 'Voice and Speech Processing', McGraw Hill Series.

SOFT COMPUTING

Subject Code: MECE1-163	**L T P C** **4 0 0 4**	**Duration: 45 Hrs.**

UNIT – I (12 Hrs.)

Soft Computing: Introduction of soft computing, soft computing vs. hard computing, various types of soft computing techniques, applications of soft computing.
Fuzzy Logic: Fuzzy set versus crisp set, basic concepts of fuzzy sets, membership functions, basic operations on fuzzy sets and its properties. Fuzzy relations versus Crisp relation,
Fuzzy rule base system: Fuzzy propositions, formation, decomposition & aggregation of fuzzy rules, fuzzy reasoning, Fuzzy Inference Systems (FIS) – Mamdani Fuzzy Models – Sugeno Fuzzy Models – Tsukamoto Fuzzy Models, Fuzzification and Defuzzification, fuzzy decision making & Applications of fuzzy logic.

UNIT – II (13 Hrs.)

Structure and Function of a single neuron: Biological neuron, artificial neuron, definition of ANN and its applications. Neural Network architecture: Single layer and multilayer feed forward networks and recurrent networks. Learning rules and equations: Perceptron, Hebb's, Delta, winner take all and out-star learning rules. Supervised Learning Network: Perceptron Networks, Adaptive Linear Neuron, Multiple Adaptive Linear Neuron, Back Propagation Network, Associative memory networks, Unsupervised Learning Networks: Competitive networks, Adaptive Resonance Theory, Kohnen Self Organizing Map

UNIT – III (12 Hrs.)

Genetic Algorithm: Fundamentals, basic concepts, working principle, encoding, fitness function, reproduction, Genetic modelling: selection operator, cross over, mutation operator, Stopping Condition and GA flow, Constraints in GA, Applications of GA, Classification of GA.

UNIT – IV (8 Hrs.)

Hybrid Soft Computing Techniques: An Introduction, Neuro-Fuzzy Hybrid Systems, Genetic Neuro-Hybrid systems, Genetic fuzzy Hybrid and fuzzy genetic hybrid systems

Recommended Books

1. S. Rajasekaran & G.A. Vijayalakshmi Pai, 'Neural Networks, Fuzzy Logic & Genetic Algorithms, Synthesis & Applications', PHI Publication, **2011.**
2. S.N. Sivanandam & S.N. Deepa, 'Principles of Soft Computing', Wiley Publications, **2007.**

Reference Books

1. Michael Negnevitsky, 'Artificial Intelligence', Pearson Education, New Delhi, **2008**.
2. Timothy J. Ross, 'Fuzzy Logic with Engineering Applications', Wiley, **2010.**

OPTICAL COMMUNICATION SYSTEM

Subject Code: MECE1-205 **L T P C** **Duration: 48 Hrs.**
4 0 0 4

Learning Objectives

This Course provides knowledge about various types of optical sources and detectors available at receivers. It also imparts knowledge about communication system based on optical fibre and various techniques of multiplexing. Apart from this, various networking models for optical communication taught to complete all aspects of this subject.

Learning Outcomes

Students will attain various skills to develop different optical networks for single user and multiusers and can also attain the maximum benefit of this domain w.t.t. maximum data rate and available bandwidth.

UNIT I (11 Hrs.)

Nature of light and basic fibre optic communication system, principle of light transmission through a fibre, Classification of optical fibres: Single Mode and Multi-Mode Fibres, Step Index and Graded Index Fibres, Losses in Optical Fibres; Absorption, Scattering and Dispersion, Optical Windows for Fibre Optic Transmission system.

Fibre Materials: Glass Fibres and Plastic Glass Fibres, Fibre Fabrication Methods: Outside Vapour Phase Oxidation & Vapour Phase Axial Deposition and Double Crucible Method, Optical Fibre Cables.

UNIT II (13 Hrs.)

Optical Sources: PN junction Diode Theory, Light Emitting Diode& Laser Diode: Structure, Materials, Quantum Efficiency and Modulation. Optical Detectors: Semiconductor

Photodiodes &Avalanche Photodiodes and their characteristics, responsivity and quantum efficiency.

UNIT III (12 Hrs.)

Optical Fibre Splices: Fusion and Mechanical Splicing Technique and Fibre Connectors, Working Principle of OTDR and Applications of OTDR, Optical Fibre Measurements: Attenuation, Absorption, Dispersion and Scattering, Fibre Cut-Off Wavelength and Numerical Aperture Measurement.

UNIT IV (12 Hrs)

Optical Amplifiers: Semiconductor and Erbium Doped Fibre Amplifiers, Optical communication Techniques and Network Topologies: Wavelength division Multiplexing and SONET/SDH.

Recommended Books

1. Gerd Keiser, ‘Optical Fibre Communications’, 3rd Edn., McGraw-Hill International.
2. John M. Senior, ‘Optical Fibre Communications, Principles & Practice’, 3rd Edn., Pearson Publishers.

ADVANCED DIGITAL SIGNAL PROCESSING

Subject Code: MECE1-206 **L T P C** **Duration: 48 Hrs.**
4 0 0 4

Learning Objectives

The Digital Signal Processing is a fundamental and immensely important signal processing course keeping in view the modern day technological advancements. The objective of this course is to provide fundamental background for digital signal processing which later on becomes basic building block of new upcoming technologies.

Learning Outcomes:

The students will have knowledge to work in Time as well as frequency domain systems. They also can design high speed systems with the help of FFT/IFFT.

UNIT I (12 Hrs.)

Introduction to DSP, Time and Frequency domain description of different types of signals & systems, discrete time sequence systems, Linearity, unit sample response, Convolution, Time invariant system, Stability criteria for discrete time systems.

UNIT II (12 Hrs.)

Adaptive Filters: Adaptive signal processing-FIR adaptive filters – steepest descent adaptive filter – LMS algorithm – convergence of LMS algorithms – Application: noise cancellation – channel equalization – adaptive recursive filters – recursive least squares.

UNIT III (12 Hrs.)

Multirate Signal Processing: Multirate signal processing- Decimation by a factor D – Interpolation by a factor I – Filter Design and implementation for sampling rate conversion: Direct form FIR filter structures – Polyphase filter structure.

UNIT IV (12 Hrs.)

Wavelet Transforms and their Application: Wavelet Transform- Fourier Transform: Its power and Limitations – Short Time Fourier Transform – The Gabor Transform - Discrete Time Fourier Transform and filter banks – Continuous Wavelet Transform – Wavelet Transform Ideal Case – Perfect Reconstruction Filter Banks and wavelets – Recursive multi-resolution decomposition–Haar Wavelet – Daubechies Wavelet

Recommended Books:

1. John G. Proakis, Dimitris G. Manobakis, ‘Digital Signal Processing, Principles, Algorithms and Applications’, 3rd Edn., PHI, **2000**.

2. Monson H. Hayes, ‘Statistical Digital Signal Processing and Modelling’, Wiley, **2002**.
3. Emmanuel C. Ifeachor and Barrie W. Jervis, ‘Digital Signal Processing: A Practical Approach’, Pearson Education, **2008.**
4. Robert J. Schilling and Sandra L. Harris, ‘Fundamentals of Digital Signal Processing’, Cengage Learning, **2005**.

.

RESEARCH LAB.-2

Subject Code: MECE1-207 **L T P C**
4 0 0 2

Students will be make familiar with maximum available softwares like optisystem, optsim, Matlab, Virtual instrumentation, Network simulator, FHSS etc.so that student can opt any one as per his/her interest for thesis work. Students will be advised to go through maximum research papers and conclude a particular domain to work further.

DIGITAL IMAGE PROCESSING

Subject Code: MECE1-264 **L T P C** **Duration: 40 Hrs.**
4 0 0 4

Learning Objectives

This course will provide students fundamentals of Digital Image Processing and its applications. This course incorporates the concepts of image enhancement, image restoration, segmentation and image compression. Students will be able to perform image manipulations and analysis in many different fields like object recognition, medical image processing, representation of images etc.

Learning Outcomes

The student will have skills to deal with different operations on image processing. Different applications will be open for the students to work with.

UNIT I (12 Hrs.)

Digital Image Fundamentals: Digital Image Processing: Definition, Fundamental Steps in Digital Image Processing, Components of an Image Processing System, Elements of visual perception – Image sampling and Quantization, Basic relationship between pixels – Basic geometric transformations - Introduction to Fourier Transform and DFT – Properties of 2D Fourier Transform – FFT – Separable Image Transforms -Walsh – Hadamard – Discrete Cosine Transform, Haar.

UNIT II (09 Hrs.)

Image Enhancement Techniques: Spatial Domain methods: Basic grey level transformation, Histogram Equalization, Image Subtraction, Image averaging, Spatial filtering: Smoothing, sharpening filters – Laplacian filters, Frequency domain filters: Smoothing – Sharpening filters, Homomorphic filtering.

UNIT III (08 Hrs.)

Image Restoration: Model of Image Degradation/restoration process, Noise models, Inverse filtering, least mean square filtering, Blind image restoration, Singular value decomposition.

UNIT IV (11 Hrs.)

Image Compression and Segmentation: Lossless compression: Variable length coding, LZW coding, bit plane coding, Predictive coding-DPCM, Lossy Compression: Transform coding, Wavelet coding, Basics of Image compression standards: JPEG, MPEG, Edge detection, Thresholding, Region Based segmentation.

Recommended Books

1. R.C. Gonzalez and R.E. Woods, 'Digital Image Processing', Pearson Education, **2002**.
2. G.A. Baxes, 'Digital Image Processing', Indian Edn., John Wiley, **1994.**
3. R.J. Schalkoff, 'Digital Image Processing and Computer Vision', John Wiley, **1989**.
4. Sid Ahmed, 'Image Processing', McGraw Hill, **1994**.
5. William K. Pratt, 'Digital Image Processing', John Willey, **2001**.
6. Millman Sonka, Vaclav Hlavac, Roger Boyle, 'Image Processing Analysis and Machine Vision', Broos/colic, Thompson Learning, **1999**.
7. A.K. Jain, 'Fundamentals of Digital Image Processing', PHI, **2002**.
8. Chanda Dutta Magundar, 'Digital Image Processing and Applications', Prentice Hall of India, **2000**.

SATELLITE COMMUNICATION

Subject Code: MECE1-265 **L T P C** **Duration: 48 Hrs.**
4 0 0 4

Learning Objectives

This course provides an introduction to the fundamentals of orbital mechanics and launchers, link budgets, modulation, coding, multiple access techniques, propagation effects, and earth terminals. This course provides an understanding how analog and digital technologies are used for satellite communications networks.

Learning Outcomes

The students will gain teaching skills in this area. They will gain skills for performance improvement for different available satellites by calculating power Budgets

UNIT I (12 Hrs.)

Introduction: Origin of Satellite Communication, Current state of Satellite Communication, Advantages of Satellite Communication, Active & Passive satellite, Orbital aspects of Satellite Communication, System Performance. Communication Satellite Link Design - Introduction, general link design equation, system noise temperature, C/N & G/T ratio, atmospheric & econospheric effects on linkdesign, complete link design, interference effects on complete link design, earth station
parameters.

UNIT II (12 Hrs.)

Satellite Analog & Digital Communication Baseband analog (voice) signal, FDMA techniques, S/N ration, SCPC & CSSB systems, digital baseband signals & modulation techniques.

Multiple Access Techniques TDMA frame structure, burst structure, frame efficiency, superframe, frame acquisition & synchronization, TDMA vs FDMA, burst time plan, beam hopping, satellite switched, Erlang call congestion formula, demand assignment ctrl, DA-FDMA system, DATDMA.

UNIT III (12 Hrs.)

Laser & Satellite Communication Link analysis, optical satellite link Tx & Rx, Satellite, beam acquisition, tracking & pointing, cable channel frequency, head end equation, distribution of signal, n/w specifications and architecture, optical fibre CATV system.

UNIT IV (12 Hrs.)

Satellite Applications Satellite TV, telephone services via satellite, data Communication services, satellites for earth observation, weather forecast, military appliances, scientific studies.

Recommended Books

1. Timothy Pratt, 'Satellite Communication', Addison Wesley, **2010**.

2. D.C. Aggarwal, ‘Satellite Communication’, Willey Sons, **2010**.

INFORMATION SECURITY

Subject Code: MECE1-266 **L T P C** **Duration: 48 Hrs.**
4 0 0 4

UNIT-I

INTRODUCTION (12 Hrs.)

Introduction to various multimedia communication, Techniques, Applications, Networks, Protocols and Standards, Bandwidth and Compression issues. Source Encoding, Channel Encoding, Different types of multimedia information, Information representation. Encoding and decoding techniques

UNIT-II

COMPRESSION TECHNIQUES (12 Hrs.)

Text compression techniques, Image compression techniques, Audio and Video Compression, Standards for Multimedia Compression, Huffman, Run length, Variable length, Lossy/ Lossless compression.

Various files formats for multimedia and their applications, BMP, TIFF, JPEG, DFX, AVI, MPEG.

UNIT-III

NETWORK SECURITY (12 Hrs.)

Network and computer security issues. Security attacks, Security Services and Security Mechanisms. Network security models.

Cryptology: Introduction, Terminology, Cryptography and its objectives, Cryptanalysis, Classifications of cryptography; Basic concept of symmetric and asymmetric cryptography. Stream Ciphers versus Block Ciphers.

UNIT-IV

SYMMETRIC & ASYMMETRIC KEY CRYPTOGRAPHY (12 Hrs.)

Substitution and Transposition techniques. Block cipher principles. Study of DES Algorithm, its internal structure, f-function and its key schedule. Security of DES. Triple DES, IDEA, AES Algorithm.

Principles of public key cryptosystems. RSA algorithm. Distribution of public keys. Diffie-Hellman key exchange**.**

Recommended Books

1. Fred Halsall, ‘Multimedia Communication’, Prentice Hall.
2. Proakis, ‘Digital Communication’, Prentice Hall.
3. William Stallings, ‘Cryptography and Network Security’, Prentice Hall.
4. Bruce Schneier, ‘Applied Cryptography’, John Wiley & Sons.
5. W. Zeng, H. Yu and C. Lin, ‘Multimedia Security Technologies for Digital Rights Management’, Elsevier.
6. B. Furht and D. Kirovski (Eds.), ‘Multimedia Security Handbook’, CRC Press.

PARALLEL PROCESSING

Subject Code: MECE1-267 **L T P C** **Duration: 48 Hrs.**
4 0 0 4

Learning Objectives

This course will help students to achieve the following objectives:

1. Describe the principles of computer design and classify instruction set architectures.
2. Describe the operation of performance enhancements such as pipelines, dynamic scheduling, branch prediction, caches, and vector processors.
3. Describe the operation of virtual memory, modern architectures such as RISC, Super Scalar, VLIW (very large instruction word), and multi-core and multi-CPU systems.

Learning Outcomes

Students will have skills in RISC as well as CISC architectures and can design or analyses different problems associated with this domain

Unit-I (12 Hrs.)

Parallel computer models: The state of computing, Classification of parallel computers, Multiprocessors and multicomputer, Multivector and SIMD computers. Conditions of parallelism, Data and resource Dependences, Hardware and software parallelism, Program partitioning and scheduling, Grain Size and latency, Program flow mechanisms, Control flow versus data flow, Data flow Architecture, Demand driven mechanisms, Comparisons of flow mechanisms.

Unit-II (12 Hrs.)

System Interconnect Architectures: Network properties and routing, Static interconnection Networks, Dynamic interconnection Networks, Multiprocessor system Interconnects, Hierarchical bus systems, Crossbar switch and multiport memory, Multistage and combining network. Advanced processor technology, Instruction-set Architectures, CISC Scalar Processors, RISC Scalar Processors, Superscalar Processors, VLIW Architectures, Vector and Symbolic processors.

Unit-III (12 Hrs.)

Pipelining: Linear pipeline processor, nonlinear pipeline processor, Instruction pipeline Design, Mechanisms for instruction pipelining, Dynamic instruction scheduling, Branch Handling techniques, branch prediction, Arithmetic Pipeline Design, Computer arithmetic principles, Static Arithmetic pipeline, Multifunctional arithmetic pipelines.

Unit-III (12 Hrs.)

Multiprocessor Architectures: Symmetric shared memory architectures, distributed shared memory architectures, models of memory consistency, cache coherence protocols (MSI, MESI, MOESI), scalable cache coherence, overview of directory based approaches, design challenges of directory protocols, memory based directory protocols, cache based directory protocols, protocol design tradeoffs, synchronization.

Recommended Books

1. Kai Hwang, 'Advanced computer Architecture', 18th Reprint, TMH, **2003**.
2. D.A. Patterson and J.L. Hennessey, 'Computer Organization and Design', 4th Edn., Morgan Kaufmann.
3. J.P. Hayes, 'Computer Architecture and Organization', 2nd Edn., MGH, **1988**.
4. Harvey G. Cragon, 'Memory System and Pipelined Processors', Narosa Publication, **1996**.
5. V. Rajaranam & C.S.R.Murthy, 'Parallel Computer', PHI.
6. R.K. Ghose, Rajan Moona & Phalguni Gupta, 'Foundation of Parallel Processing', Narosa Publications.

NANO ELECTRONICS

Subject Code: MECE1-268 **L T P C** **Duration: 48 Hrs.**
4 0 0 4

Learning Objectives:

The main aim of this course is to introduce the students about Nano sciences. Actual chemistry involved in semiconductor physics will be discussed. How this will be helpful for Designing of different circuits.

Learning Outcomes:

Students learn skills for handling basic concepts of Nano sciences for different applications for various fields.

UNIT I (12 Hrs.)

BASICS AND SCALE OF NANOTECHNOLOGY: Introduction – Scientific revolutions – Time and length scale in structures, Definition of a nano-system, Top down and bottom up approaches – Evolution of band structures and Fermi surface – introduction to semi conducting Nanoparticles, introduction to quantum Dots, wells, wires, Dimensionality and size dependent phenomena – Fraction of surface atoms – Surface energy and surface stress, Misconceptions of Nanotechnology.

UNIT II (12 Hrs.)

The carbon age and nanotubes: New forms of carbon, Types of nanotubes, Formation of nanotubes, methods and reactants- Arcing in the presence of cobalt, Laser method, Chemical Vapour deposition method, ball milling, properties of Nanotubes Electrical properties, vibrational properties, Mechanical properties, applications of Nanotubes in electronics, hydrogen storage, materials, space elevators.

UNIT III (12 Hrs.)

Characterization Techniques in Nano-electronics:

Principle, construction and working: Electron microscopy (SEM and TEM), Infrared and Raman Spectroscopy, Photoemission and X-RD spectroscopy, AFMs, Magnetic force microscope.

UNIT IV (12 Hrs.)

Nano-scale Devices:

Introduction: Quantum Electron Devices; High Electron Mobility Transistor, Quantum Interference Transistor, Single Electron Transistor and Carbon Nanotube Transistor, DNA Computing; Structure of DNA, Basic Operation on DNA and DNA Computer.

Recommended Books

1. C.P. Polle and F.J. Owens, 'Introduction to Nanotechnology', Willey India Pvt. Ltd., **2011**.
2. Daniel Minoli, 'Nanotechnology Applications to Telecommunications and Networking', Willey India Pvt. Ltd., **2011**.

MULTIMEDIA COMMUNICATION SYSTEM

Subject Code: MECE1-269 **L T P C** **Duration: 48 Hrs.**

4 0 0 4

Learning Objectives:

The objective of this course is to get aware the students about various multimedia systems, components associated and possibilities available for this particular domain.

Learning Outcomes:

Student will acquire teaching as well as analytical knowledge to design different Multimedia oriented systems.

Unit –I (12 Hrs.)

Introduction:

Concept of Multimedia, Multimedia Applications, Hardware Software requirements, Multimedia products & its evaluation.

Unit –II (12 Hrs.)

Components of Multimedia: Text, Graphics, Audio, Video. Design & Authoring Tools, Categories of Authority Tools, Types of products.

Unit –III (12 Hrs.)

Animation: Introduction, Basic Terminology techniques, Motion Graphics 2D & 3D animation.

Unit –IV (12 Hrs.)

Introduction to MAYA (Animating Tool): Fundamentals, Modelling: NURBS, Polygon, Organic, animation, paths & boxes, deformers. Working with MEL: Basics & Programming Rendering & Special Effects: Shading & Texturing Surfaces, Lighting, Special effects.

Recommended Books:

1. David Hillman, 'Multimedia Technology & Applications', Galgotia Publications.
2. Rajneesh Agrawal, 'Multimedia Systems', Excel Books.
3. Nigel Chapman & Jenny Chapman, 'Digital Multimedia', Wiley Publications.
4. D.P. Mukherjee, 'Fundamentals of Computer Graphics and Multimedia', PHI.

ADVANCED NETWORK SYNTHESIS AND ANALYSIS

Subject Code: MECE1-270	**L T P C** **4 0 0 4**	**Duration: 48 Hrs.**

UNIT 1 (12 Hrs.)

Data Transmission

Overview of Data Communication and networking, Analog and Digital Data Transmission, Transmission Impairments, Various Transmission Media, Data Encoding.

UNIT II (12 Hrs.)

Switching and Computer Networks

Communication Networks, Circuit Switching, Message Switching, Packet Switching, X.25, Virtual circuits and Data gram's, LAN/MAN Technologies, Medium Access control protocols (CSMA/CD, Token ring, FDDI, DQDB)

UNIT III (12 Hrs.)

Network Security

Security issues, concept of firewalls, intrusion detection Systems

UNIT IV (12 Hrs.)

Advanced Network Analysis: Application analysis using the Application form (AAF) Binary-Hex-Decimal conversion, building test packets, Calculating the cost of network problems (Analysis ROI), Key network calculations: Throughput, Latency and Bandwidth, Unattended captures: Triggered starts/stops, Analysis ROI worksheet/calculation

Recommended Books:

1. Scott Empson, 'CCNA Portable Command Guide', 2nd Edn.,
2. Laura Chappell, 'Network Analysis'.

MICRO & NANO ELECTRO MECHANICAL SYSTEM (MEMS & NEMS)

Subject Code: MECE1-271	**L T P C** **4 0 0 4**	**Duration: 48 Hrs.**

Learning Objectives

The course aims to give the students a basic knowledge about state-of-the-art MEMS including technology, device architecture, design and modelling, scalability, figures of merit and RF IC novel functionality and performance.

Learning Outcomes

Students will attain analytical and design oriented feature knowledge about NEMS and MEMS. Reliability and packaging are also considered as key issues for industrial applications.

UNIT 1 (12 Hrs.)

Introduction:

Micro Electro Mechanical System (MEMS) Origins. MEMS Impetus / Motivation. Material for MEMS. The toolbox: Processes for Micro machining.

UNIT II (12 Hrs.)

MEMS Fabrication Technologies. Fundamental MEMS Device Physics: Actuation.

UNIT III (12 Hrs.)

Fundamental MEMS Devices: The Cantilever Beam. Microwave MEMS Applications: MEM Switch

UNIT IV (12 Hrs.)

Design Considerations. The Micromachined Transmission Line. MEMS-Based Microwave Circuit and System.

Recommended Books

1. Hector J. De Los Santos, ‘Micro-electromechanical (MEM) Microwave Systems’, Artechhouse.
2. Nadim Maluf, ‘An Introduction to Micro-Electromechanical System’, Artechhouse.

RESEARCH METHODOLOGY

Subject Code – MREM0-101 **L T P C** **Duration – 45 Hrs.**

4 0 0 4

UNIT–I (11 Hrs.)

Introduction to Research: Meaning, Definition, Objective and Process

Research Design: Meaning, Types - Historical, Descriptive, Exploratory and Experimental

Research Problem: Necessity of Defined Problem, Problem Formulation, Understanding of Problem, Review of Literature

Design of Experiment: Basic Principal of Experimental Design, Randomized Block, Completely Randomized Block, Latin Square, Factorial Design.

Hypothesis: Types, Formulation of Hypothesis, Feasibility, Preparation and Presentation of Research Proposal

UNIT–II (10 Hrs.)

Sources of Data: Primary and Secondary, Validation of Data

Data Collection Methods: Questionnaire Designing, Construction

Sampling Design & Techniques – Probability Sampling and Non Probability Sampling

Scaling Techniques: Meaning & Types

Reliability: Test – Retest Reliability, Alternative Form Reliability, Internal Comparison Reliability and Scorer Reliability

Validity: Content Validity, Criterion Related Validity and Construct Validity

UNIT–III (13 Hrs.)

Data Process Operations: Editing, Sorting, Coding, Classification and Tabulation

Analysis of Data: Statistical Measure and Their Significance, Central Tendency, Dispersion, Correlation: Linear and Partial, Regression: Simple and Multiple Regression, Skewness, Time series Analysis, Index Number

Testing of Hypothesis: T-test, Z- test, Chi Square, F-test, ANOVA

UNIT – IV (11 Hrs.)

Multivariate Analysis: Factor Analysis, Discriminant Analysis, Cluster Analysis, Conjoint Analysis, Multi Dimensional Scaling

Report Writing: Essentials of Report Writing, Report Format

Statistical Software: Application of Statistical Softwares like SPSS, MS Excel, Mini Tab or MATLAB Software in Data Analysis

**Each Student has to Prepare Mini Research Project on Topic/ Area of their Choice and Make Presentation. The Report Should Consists of Applications of Tests and Techniques Mentioned in The Above UNITs*

Recommended Books

1. R.I. Levin and D.S. Rubin, ‘Statistics for Management’, 7th Edn., Pearson Education New Delhi.
2. N.K. Malhotra, ‘Marketing Research–An Applied Orientation’, 4th Edn., Pearson Education, New Delhi,
3. Donald Cooper, ‘Business Research Methods’, Tata McGraw Hill, New Delhi.
4. Sadhu Singh, ‘Research Methodology in Social Sciences’, Himalaya Publishers.
5. Darren George & Paul Mallery, ‘SPSS for Windows Step by Step’, Pearson Education, New Delhi.
6. C.R. Kothari, ‘Research Methodology Methods & Techniques’, 2nd Edn., New Age International Publishers.

PROJECT

Subject Code: MECE1-309 **L T P C**

Learning Objectives

1. To propose engineering based project in a clear and concise manner.
2. Allow students to develop problem solving, analysis, synthesis and evaluation skills.

Learning Outcomes

1. Synthesis of knowledge.
2. To demonstrate the aptitude of applying the own knowledge to solve a specific problem.
3. To mature the knowledge.
4. Able to organize, compile and record all work details in an efficient manner

Each student will be required to complete a Project and submit a Project Report on a topic on any of the areas of modern technology related to Electronics & Communication Engineering including interdisciplinary fields.

SEMINAR

Subject Code: MECE1-310 **L T P C**
0 0 4 2

Learning Objectives

1. To identify, understand and discuss current advanced research topic.
2. To gain experience in the critical assessment of the available scientific literature

3. To practice the use of various resources to locate and extract information using offline & online tools, journals

Learning Outcomes

1. An ability to utilize technical resources
2. An ability to write technical documents and give oral presentations related to the work completed.
3. To learn preparation and presentation of scientific papers in an exhaustive manner

Each student will be required to prepare a Seminar Report and present a Seminar on a topic in any of the areas of modern technology related to Electronics & Communication Engineering including interdisciplinary fields.

ANTENNA SYSTEM DESIGN

Course Code: MECE1- 372 **L T P C** **Duration: 45 Hrs.**
4 0 0 4

Learning Objectives

1. To study various types of antennas, antenna arrays and antenna parameters
2. Study of propagation of waves through different media.
3. Familiarize the students with different parameters to be considered while designing antennas.

Learning Outcomes

1. Gain understanding of different parameters used to characterize antennas.
2. Know how to analyze wire and aperture radiating elements.
3. Be able to design various antennas and arrays for many communication systems.
4. Implementation of radio wave propagation mechanisms while designing an antenna.
5. An ability to understand basic terminology associated with antennas and calculation of power radiated from an antenna and array.

UNIT-I (10 Hrs.)

Review of electromagnetic fields, Displacement current, Maxwell’s equations in free space, plane wave & uniform plane wave in free space. Electromagnetic radiations, Physical concept of radiation, Retarded potential, Radiation from a Hertizian dipole, monopole and a half wave dipole, Fields in the vicinity of an antenna and far field approximation.

UNIT-II (10 Hrs.)

Antenna Parameters: Radiation pattern, Gain, Directive gain, Directivity, Reciprocity theorem & its applications, effective aperture, radiation resistance, terminal impedance, noise temperature, elementary ideas about self & mutual impedance, front-to-back ratio, antenna beam width, antenna bandwidth, antenna beam efficiency, antenna beam area or beam solid angle, polarization, antenna temperature.

UNIT-III (13 Hrs.)

Antenna Arrays: Various forms of antenna arrays, arrays of point sources, non-isotropic but similar point sources, multiplication of patterns, arrays of n-isotropic sources of equal amplitude and spacing, Dolph-Tchebysceff arrays, continuous arrays, rectangular arrays.

UNIT-IV (12 Hrs.)

Broadband Antennas: Travelling wave antennas helical antennas, Biconical antennas Sleeve antennas, and Principles of frequency independent antennas, Spiral antennas, and Log - periodic antennas.

Aperture antennas, scanning antennas, smart antennas. Long Wire antenna, folded dipole antenna, Yagi-Uda antenna, Slot antenna, Micro Strip or Patch antennas, Antenna measurements.

Recommended Books

1. J.D. Krauss, 'Antennas', McGraw Hill Inc., New York, **1991.**
2. Balanis A. Constantine, 'Antenna Theory, Analysis and Design', Wiley, New York.
3. K.D. Prasad, 'Antenna and Wave Propagation', 3rd Edn., Satya Prakashan, New Delhi.
4. W.L. Stutzman, G.A. Thieele, 'Antenna Theory and Design', Wiley, New York.

ERROR CONTROL AND CODING

Subject Code: MECE1-373 **L T P C** **Duration: 45 Hrs.**
4 0 0 4

Learning Objectives: Students will be able to understand block codes, maximum likelihood decoding, generator matrix, parity-check matrix, error-correcting capability of a linear code and the importance of probability theory in error control & coding

Learning Outcomes

1. Describe the model and calculate the capacity of typical digital communication channels
2. Demonstrate the encoding and decoding procedures of various error control codes
3. Compare the error correction capability of different error control codes and their performances
4. Apply error control coding to achieve error detection and correction in digital transmission systems
5. Design an error detecting and correcting system for semiconductor memory system to meet given system specification.

UNIT-I (11 Hrs.)

Review of Random Process: Review of Probability Theory, Basic concepts of random processes, random variables, basicconcepts from systems theory and stochastic processes, Stationary and non stationary process, correlation function, Ergodicity and power spectral density, transformation random process by linear system, Special random process: white Gaussian noise, Wiener levy, Shot noise, Markov Process

UNIT-II (11 Hrs.)

Hypothesis Testing: Simple binary hypothesis test, Decesion Criteria, Neyman Pearson tests, Bayes Criteria Multiple hypothesis testing, Composite hypothesis testing

UNIT-III (11 Hrs.)

Detection Theory: Sequential detection Walds test Detection of known signals in white noise, Detection of known signal in colored noise, Maximum SNR Criteria, Detection of signals with unknown parameters

UNIT-IV (12 Hrs.)

Coding: Error Control coding for wireless fading channels, Channel Estimation and Adaptive channel coding, Joint Source and Channel coding. Non binary Linear Block Codes, Hard and soft decision decoding, Coding and Decoding of BCH, Reed Solomon Codes, Convolution codes: Coding and Decoding, Distance bounds, Performance bounds Turbo codes: Coding, Decoding Algorithms, Performance comparison, Interleaver design Trellis coded Modulation, TCM Decoders, TCM for AWGN and Fading Wireless Channels, Performance comparison

Recommended Books

1. C.W. Helstrom, 'Elements of Signal Detection and Estimation', Prentice Hall, NJ, **1995.**
2. H.L. Van Trees, 'Detection, Estimation, and Modulation Theory', Wiley, **1971.**
3. H. V. Poor, 'An Introduction to Signal Detection and Estimation', 2nd Edn., Springer-Verlag, New York.
4. Stephen G. Wilson, 'Digital Modulation & Coding'. Prentice Hall Inc.
5. Ranjan Bose, 'Information Theory Coding and Cryptography', TMH.

6. J.G. Proakis, ‘Digital Communication’, Pearson Education.

WIRELESS AND ADHOC NETWORKS

Subject Code: MECE1-374 **L T P C** **Duration: 45 Hrs.**
4 0 0 4

Learning Objectives: The objective of this course is to provide the concepts of sensor networks and to understand the MAC and transport protocols for adhoc networks.

Learning Outcomes:

1. To understand the adhoc networks.
2. To learn the data transmission flow in adhoc networks
3. To understand the security of sensor networks
4. To understand the applications of adhoc and sensor networks

UNIT-I (11 Hrs.)

Introduction to Ad Hoc Wireless Networks: Characteristics of MANETs, Applications of MANETs, Challenges.

Routing in MANETs: Topology-based versus Position-based approaches, Topology based routing protocols, Position based routing, Other Routing Protocols.

UNIT-II (10 Hrs.)

Data Transmission in MANETs: The Broadcast Storm, Multicasting, Geocasting, TCP over Ad Hoc Networks: TCP Protocol overview, TOP and MANETs, Solutions for TOP over Ad Hoc

UNIT-III (12 Hrs.)

Basics of Wireless Sensors and Applications: The Mica Mote, Sensing and Communication Range, Design issues, Energy consumption, Clustering of Sensors, Applications.

Data Retrieval In Sensor Networks: Classification of WSNs, MAC layer, Routing layer, High-level application layer support, Adapting to the inherent dynamic nature of WSNs.

UNIT-IV (12 Hrs.)

Security: Security in Ad hoc Wireless Networks, Key Management, Secure Routing, Cooperation in MANETs, Intrusion Detection Systems. Sensor Network Platforms and Tools: Sensor Network Hardware, Sensor Network Programming Challenges, Node-Level Software Platforms

Recommended Books

1. Car/os Corderlo Dharma R. Aggarwal, ‘Ad Hoc and Sensor Networks — Theory and Applications’, World Scientific Publications /Cambridge University Press, March **2006**
2. Feng Zhao, Leonidas Guibas, ‘Wireless Sensor Networks: An Information Processing Approach’, Elsevier Science imprint, Morgan Kauffman Publishers, **2005**, rp **2009.**
3. C. Siva Ram Murthy, B.S. Murthy, ‘Adhoc Wireless Networks — Architectures and Protocols’, Pearson Education, **2004.**
4. Fei Hu, Xiaojun Cao, ‘Wireless Sensor Networks — Principles and Practice’, CRC Press, Taylor & Francis Group, **2010.**
5. Subir Kumar Sarkar, et al., ‘Wireless Ad hoc Mobile Wireless Networks — Principles, Protocols and Applications’, Auerbach Publications, Taylor & Francis Group, **2008.**

SPEECH AND AUDIO PROCESSING

Subject Code: MECE1-375 **L T P C** **Duration: 45 Hrs.**
4 0 0 4

Learning Objectives

To introduce the fundamentals of speech & image processing and provide students the description of adaptive filters and filters in image and audio processing. Also study the filters in image& audio processing and wavelets along with its application in various fields

Learning Outcomes:

1. Qualitatively describe the mechanisms of speech production.
2. Apply programming tools (such as Matlab) to analyze speech and audio signals in time and frequency domains.
3. Analyze, compare and implement methods and systems for filtering and coding of speech and audio signals.
4. Analyze the methods and systems for enhancement of speech and audio signals in environmental noisy conditions.

UNIT-I (10 Hrs.)

Introduction: Review of basic digital signal processing fundamentals, Parametric methods for power spectrum estimation-Relationship between the auto correlation and the model parameters – The Yule – Walker method for the AR Model Parameters – The Burg Method for the AR Model parameters – unconstrained least-squares method for the AR Model parameters – sequential estimation methods for the AR Model parameters – selection of AR Model order.

UNIT-II (13 Hrs.)

Adaptive Filters: Adaptive signal processing-FIR adaptive filters – steepest descent adaptive filter – LMS algorithm – convergence of LMS algorithms – Application: noise cancellation – channel equalization – adaptive recursive filters – recursive least squares.

Multirate Signal Processing: Multirate signal processing- Decimation by a factor D – Interpolation by a factor I – Filter Design and implementation for sampling rate conversion: Direct form FIR filter structures – Polyphase filter structure.

UNIT-III (11 Hrs.)

Speech Signal Processing: Speech signal processing-Digital models for speech signal : Mechanism of speech production – model for vocal tract, radiation and excitation – complete model – time domain processing of speech signal:- Pitch period estimation – using autocorrelation function – Linear predictive Coding: Basic Principles – autocorrelation method – Durbin recursive solution.

UNIT-IV (11 Hrs.)

Wavelet Transforms and their Application: Wavelet Transform- Fourier Transform : Its power and Limitations – Short Time Fourier Transform – The Gabor Transform - Discrete Time Fourier Transform and filter banks – Continuous Wavelet Transform – Wavelet Transform Ideal Case – Perfect Reconstruction Filter Banks and wavelets – Recursive multi-resolution decomposition–Haar Wavelet – Daubechies Wavelet.

Recommended Books

1. John G. Proakis, Dimitris G. Manobakis, 'Digital Signal Processing, Principles, Algorithms and Applications' 3rd Edn., PHI, **2000.**
2. Monson H. Hayes, 'Statistical Digital Signal Processing and Modelling', Wiley, **2002**..
3. Emmanuel C. Ifeachor and Barrie W. Jervis, 'Digital Signal Processing: A Practical Approach', Pearson Education, **2008.**
4. Robert J. Schilling and Sandra L. Harris, 'Fundamentals of Digital Signal Processing', Cengage Learning, **2005.**

DISSERTATION

Subject Code: MECE1-410 **L T P C**

Learning Objectives: To learn, practice, and critique effective scientific writing and to formulate the research objectives clearly, state claims and evidence clearly, assess validity of claims, evidence, outcomes, and results.

Learning Outcomes:

1. Design and execute a meaningful research project that demonstrates spatial thinking and uses the knowledge and skills.
2. Define and analyze a problem in latest research areas.
3. Formulate and write a research proposal.
4. Able to learn effectively record data and experiments so that others can understand them.
5. Communicate the findings by means of a thesis, written in the format specified by the department/institute.

Each student will be required to complete a Dissertation and submit a written Report on the topic on any of the areas of modern technology related to Electronics & Communication Engineering including interdisciplinary fields in the Final semester of M.Tech. Course.

Papers accepted in UGC approved journals will be given 10 marks as special incentive. It will be mandatory to publish one paper in conference/journal.

M.Tech. CSE (Software Engineering) (1^{ST} SEM.)
TOTAL CONTACT HRS. = 24, TOTAL CREDITS = 22

Course		Contact Hrs.			Marks			Credits
Code	**Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
MCSE3-101	Advanced Data Structures and Algorithm	3	1	0	40	60	100	4
MREM0-101	Research Methodology	4	0	0	40	60	100	4
MCSE3-103	Soft Computing	3	1	0	40	60	100	4
Departmental Elective-I		3	1	0	40	60	100	4
MCSE3-156	Software requirements							
MCSE3-157	Software Project Estimation and Planning							
MCSE3-158	Software Engineering Concepts and Methodologies							
MCSE3-159	Object Oriented Analysis and Design							
Departmental Elective-II		3	1	0	40	60	100	4
MCSE3-160	Software project management							
MCSE3-161	Advanced Operating System							
MCSE3-162	Software Architecture and Design Patterns							
MCSE3-163	Software Maintenance and Management							
MCSE3-104	**Practical Lab.-I**	0	0	4	60	40	100	2
Total 5 Theory & 1 Lab. Courses		**16**	**4**	**4**	**260**	**340**	**600**	**22**

MRSPTU

M.Tech. CSE (Software Engineering) (2^{nd} SEM.)
TOTAL CONTACT HRS. = 24, TOTAL CREDITS = 22

Course		Contact Hrs.			Marks			Credits
Code	**Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
MCSE3-205	Agile Software Development	3	1	0	40	60	100	4
MCSE3-206	Software Testing& Validations	3	1	0	40	60	100	4
Departmental Elective-III		3	1	0	40	60	100	4
MCSE3-264	Information Retrieval							
MCSE3-265	Software Quality Management							
MCSE3-266	Unified Software Configuration Management							
MCSE3-267	Software Design and Construction							
Departmental Elective-IV		3	1	0	40	60	100	4
MCSE3-268	Secure Software Engineering							
MCSE3-269	Software Project Metrics							
MCSE3-270	Software Reliability and Metrics							
MCSE3-271	Open Source Technology							
Open Elective I		3	1	0	40	60	100	4
MCSE3-207	Practical Lab.-II	0	0	4	60	40	100	2
Total 5 Theory & 1 Lab. Courses		**15**	**5**	**4**	**260**	**340**	**600**	**22**

M.Tech. CSE (Software Engineering) (3rd SEM.)
TOTAL CONTACT HRS. = 8, TOTAL CREDITS = 21

Course		Contact Hrs.			Marks			Credits
Code	**Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
Departmental Elective-V		**3**	**1**	**0**	**40**	**60**	**100**	**4**
MCSE3-372	Component Based Development							
MCSE3-373	Object Oriented Engineering Using UML							
MCSE3-374	Software Reliability & Metrics							
MCSE3-375	Usability Engineering							
Open Elective-II		**3**	**1**	**0**	**40**	**60**	**100**	**4**
MCSE3-308	Project	**-**	**-**	**-**	**60**	**40**	**100**	**10**
MCSE3-309	Seminar	**-**	**-**	**-**	**60**	**40**	**100**	**4**
Total 2 Theory Courses		**6**	**2**	**0**	**200**	**200**	**400**	**22**

M.Tech. CSE (Software Engineering) (4th SEM.)
TOTAL CREDITS = 25

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Course		Contact Hrs.			Marks			Credits
Code	**Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
MCSE3-410	Dissertation	**0**	**0**	**0**	**60**	**40**	**100**	**24**
Total		**0**	**0**	**0**	**60**	**40**	**100**	**24**

Total Marks = 600 + 600 + 400 + 100 = 1700
Total Credits = 22 + 22 + 22 + 24 = 90

ADVANCED DATA STRUCTURES AND ALGORITHMS

Subject Code- MCSE1-101 **L T P C** **Duration: 45 Hrs.**
MCSE2-101, **3 1 0 4**
MCSE3-101,
MCSE4-101

LEARNING OBJECTIVES:

To learn the advanced concepts of data structure and algorithms and its implementation. The course has the main ingredients required for a computer science graduate and has all the necessary topics for assessment of data structures and algorithms.

LEARNING OUTCOMES:

CO1 Ability to apply and implement various data structures to algorithms and to solve problems.

CO2 Basic ability to analyze algorithms and to determine algorithm correctness and time efficiency class.

CO3 Ability to apply various traversing, finding shortest path and text pattern matching algorithm.

CO4 Know the concepts of tractable and intractable problems and the classes P, NP and NP-complete problems.

UNIT-I (12 Hrs.)

Introduction to Basics: Significance and need of various data structures and algorithms, Arrays, linked lists, Stacks, Queues, Priority queues, Heaps; Strategies for choosing the appropriate data structures.

Advanced Data Structures: Binary Search Tree**,** AVL Trees, Red-Black Trees, Splay Trees, B-trees, Fibonacci heaps, Data Structures for Disjoint Sets, Augmented Data Structures.

UNIT-II (10 Hrs.)

Algorithms Complexity and Analysis: Probabilistic Analysis, Amortized Analysis, Competitive Analysis, Internal and External Sorting algorithms: Quick Sort, Heap Sort, Merge Sort, Counting Sort, Radix Sort.

UNIT-III (12 Hrs.)

Graphs & Algorithms: Representation, Type of Graphs, Paths and Circuits: Euler Graphs, Hamiltonian Paths & Circuits; Cut-sets, Connectivity and Separability, Planar Graphs, Isomorphism, Graph Coloring, Covering and Partitioning, bridges, Depth- and breadth-first traversals, Minimum Spanning Tree: Prim’s and Kruskal’s algorithms, Shortest-path Algorithms: Dijkstra’s and Floyd’s algorithm, Topological sort, Max flow: Ford-Fulkerson algorithm, max flow – min cut.

String Matching Algorithms: Suffix arrays, Suffix trees, Brute Force, Rabin-Karp, Knuth-Morris-Pratt, Boyer-Moore algorithm.

UNIT-IV (11 Hrs.)

Approximation algorithms: Need of approximation algorithms: Introduction to P, NP, NP-Hard and NP-Complete; Deterministic, non-Deterministic Polynomial time algorithms; Knapsack, TSP, Set Cover, Open Problems.

Randomized algorithms: Introduction, Type of Randomized Algorithms, 2-SAT; Game Theoretic Techniques, Random Walks.

RECOMMENDED BOOKS:

1. E. Horowitz, S. Sahni and Dinesh Mehta, ‘Fundamentals of Data structures in C++’, Galgotia, **1999**.
2. Thomas H. Corman, Charles E. Leiserson, Ronald L. Rivest, ‘Introduction to Algorithms’, 3rd Edn., PHI, **2009**.

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3. Adam Drozdex, ‘Data Structures and Algorithms in C++’, 2nd Edn., Thomson Learning – Vikas Publishing House, **2001**.
4. G. Brassard and P. Bratley, ‘Algorithmics: Theory and Practice’, Prentice –Hall, **1988**.

RESEARCH METHODOLOGY

Subject Code: MREM0-101 **L T P C** **Duration: 45 Hrs.**
4 0 0 4

UNIT–I (11 Hrs.)

Introduction to Research: Meaning, Definition, Objective and Process
Research Design: Meaning, Types - Historical, Descriptive, Exploratory and Experimental
Research Problem: Necessity of Defined Problem, Problem Formulation, Understanding of Problem, Review of Literature
Design of Experiment: Basic Principal of Experimental Design, Randomized Block, Completely Randomized Block, Latin Square, Factorial Design.
Hypothesis: Types, Formulation of Hypothesis, Feasibility, Preparation and Presentation of Research Proposal

UNIT–II (10 Hrs.)

Sources of Data: Primary and Secondary, Validation of Data
Data Collection Methods: Questionnaire Designing, Construction
Sampling Design & Techniques – Probability Sampling and Non Probability Sampling
Scaling Techniques: Meaning & Types
Reliability: Test – Retest Reliability, Alternative Form Reliability, Internal Comparison Reliability and Scorer Reliability
Validity: Content Validity, Criterion Related Validity and Construct Validity

UNIT–III (13 Hrs.)

Data Process Operations: Editing, Sorting, Coding, Classification and Tabulation
Analysis of Data: Statistical Measure and Their Significance, Central Tendency, Dispersion, Correlation: Linear and Partial, Regression: Simple and Multiple Regression, Skewness, Time series Analysis, Index Number
Testing of Hypothesis: T-test, Z- test, Chi Square, F-test, ANOVA

UNIT – IV (11 Hrs.)

Multivariate Analysis: Factor Analysis, Discriminant Analysis, Cluster Analysis, Conjoint Analysis, Multi-Dimensional Scaling
Report Writing: Essentials of Report Writing, Report Format
Statistical Software: Application of Statistical Softwares like SPSS, MS Excel, Mini Tab or MATLAB Software in Data Analysis

**Each Student has to Prepare Mini Research Project on Topic/ Area of their Choice and Make Presentation. The Report Should Consists of Applications of Tests and Techniques Mentioned in The Above UNITs.*

RECOMMENDED BOOKS:

1. R.I. Levin and D.S. Rubin, ‘Statistics for Management’, 7th Edn., Pearson Education New Delhi.
2. N.K. Malhotra, ‘Marketing Research–An Applied Orientation’, 4th Edn., Pearson Education New Delhi.
3. Donald Cooper, ‘Business Research Methods’, Tata McGraw Hill, New Delhi.
4. Sadhu Singh, ‘Research Methodology in Social Sciences’, Himalaya Publishers.
5. Darren George & Paul Mallery, ‘SPSS for Windows Step by Step’, Pearson Education New Delhi.

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6. C.R. Kothari, 'Research Methodology Methods & Techniques', 2nd Edn., New Age International Publishers.

SOFT COMPUTING

Subject Code: MCSE1-103 **MCSE2-103,** **MCSE3-103,** **MCSE4-103**	**L T P C** **3 1 0 4**	**Duration: 45 Hrs.**

LEARNING OBJECTIVES:

The objective of this course is to teach basic neural networks, fuzzy systems, Genetic Algorithms and optimization algorithms concepts and their relations**.**

LEARNING OUTCOMES:

CO1 Able to comprehend techniques and applications of Soft Computing in real world problems.

CO2 Able to follow fuzzy logic methodology and design fuzzy systems for various applications.

CO3 Able to design feed forward Artificial Neural Networks (ANN) and implement various methods of supervised learning.

CO4 Able to design feedback Artificial Neural Networks (ANN) and implement various methods of unsupervised learning

CO5 Able to appreciate the methodology of GA and its implementation in various applications.

UNIT-I (11 Hrs.)

Soft Computing: Introduction of soft computing, soft computing vs. hard computing, various types of soft computing techniques, applications of soft computing.

Fuzzy Logic: Fuzzy set versus crisp set, basic concepts of fuzzy sets, membership functions, basic operations on fuzzy sets and its properties. Fuzzy relations versus Crisp relation,

Fuzzy Rule Base System: Fuzzy propositions, formation, decomposition & aggregation of fuzzy rules, fuzzy reasoning, Fuzzy Inference Systems (FIS) – Mamdani Fuzzy Models – Sugeno Fuzzy Models – Tsukamoto Fuzzy Models, Fuzzification and Defuzzification, fuzzy decision making & Applications of fuzzy logic.

UNIT-II (12 Hrs.)

Structure and Function of a Single Neuron: Biological neuron, artificial neuron, definition of ANN and its applications. Neural Network architecture: Single layer and multilayer feed forward networks and recurrent networks. Learning rules and equations: Perceptron, Hebb's, Delta, winner take all and out-star learning rules. Supervised Learning Network: Perceptron Networks, Adaptive Linear Neuron, Multiple Adaptive Linear Neuron, Back Propagation Network, Associative memory networks, Unsupervised Learning Networks: Competitive networks, Adaptive Resonance Theory, Kohnen Self Organizing Map.

UNIT-III (11 Hrs.)

Genetic Algorithm: Fundamentals, basic concepts, working principle, encoding, fitness function, reproduction, Genetic modeling: selection operator, cross over, mutation operator, Stopping Condition and GA flow, Constraints in GA, Applications of GA, Classification of GA.

UNIT-IV (11 Hrs.)

Hybrid Soft Computing Techniques: An Introduction, Neuro-Fuzzy Hybrid Systems, Genetic Neuro-Hybrid systems, Genetic fuzzy Hybrid and fuzzy genetic hybrid systems

RECOMMENDED BOOKS:

1. S. Rajasekaran & G.A. Vijayalakshmi Pai, 'Neural Networks, Fuzzy Logic & Genetic Algorithms, Synthesis & Applications', 1st Edn., PHI Publication, **2003**.
2. S.N. Sivanandam & S.N. Deepa, 'Principles of Soft Computing', 2nd Edn., Wiley Publications, **2008**.
3. Michael Negnevitsky, 'Artificial Intelligence', 2nd Edn., Pearson Education, New Delhi, **2008.**
4. Timothy J. Ross, 'Fuzzy Logic with Engineering Applications', 3rd Edn, Wiley, **2011.**
5. Bose, 'Neural Network Fundamental with Graph, Algorithm. & Application', TMH, **2004**.
6. Kosko, 'Neural Network & Fuzzy System', 1st Edn., PHI Publication, **2009.**
7. Klir & Yuan, 'Fuzzy Sets & Fuzzy Logic: Theory & Application', PHI, **1995**.
8. Hagen, 'Neural Network Design', 2nd Edn., Cengage Learning, **2008**.

SOFTWARE REQUIREMENTS

Subject Code: MCSE3-156 **L T P C** **Duration: 45 Hrs.**

3 1 0 4

LEARNING OBJECTIVES:

It gives knowledge about various techniques used for acquisitioning the software requirements.

LEARNING OUTCOMES:

CO1: To understand various software requirements and techniques for how to manage these requirements.

CO2: To analyze the problems that comes under designing the software requirements.

CO3: To measure the various qualities like performance, availability, safety etc.

CO4: To understand the modeling of various software requirements and building the right system.

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UNIT-I (11 Hrs.)

Introduction: Requirements Problem, Requirements management, Requirements and software life cycle-software team, Techniques for eliciting requirements, Languages and models for representing requirements.

UNIT-II (12 Hrs.)

Analyzing the Problem and Requirements in the Context of System Engineering: Business modeling, Systems engineering of software intensive systems, understanding user and stakeholders needs, features of a product or system, Interviewing, Requirements workshops, Brain storming and Idea reduction, Specifying and measuring external qualities: performance, reliability, availability, safety, security. Specifying and analyzing requirements for various types of systems: embedded systems, consumer systems, web based systems, business systems.

UNIT-III (11 Hrs.)

Requirements Modeling and Evaluation- Class diagrams, Agents, Operations, Behaviors, integrating multiple views, Goal diagrams, Risk analysis in goal diagrams- Requirements Evaluation, Requirements Specification and Documentation, Diagrammatic Notations- Use Case Example, Refining the use cases-developing the supplementary specification-Ambiguity and specificity.

UNIT-IV (11 Hrs.)

Building the Right System- From use cases to Implementation- From Use Cases to Test Cases-Tracing Requirements-Managing Change-Assessing Requirements Quality in Iterative Development-Agile Requirement methods.

RECOMMENDED BOOKS:

1. D. Leffingwell, D. Widrig, ‘Managing Software Requirements: A Use Case Approach’, 2nd Edn., Pearson Education, **2007**.
2. Karl E. Wiegers, ‘Software Requirements’, 2nd Edn.
3. Van Lamsweerde, ‘A. Requirements Engineering’, John Wiley & Sons, Ltd., UK, **2009**.
4. R.N. Taylor, et al., ‘Softaware Achitecture: Foundations, Theory and Practice’, John Wiley & Sons, Ltd. USA, **2009**.
5. Ian K. Bray, ‘An Introduction to Requirements Engineering’, Addison Wesley, **2002**.
6. Elizabeth Hull, Ken Jackson, Jeremy Dick,’ Requirements Engineering’, Springer-Verlag, **2004**.
7. Gerald Kotonya, Ian Sommerville, ‘Requirements Engineering: Processes and Techniques’, Wiley, **1998**.

SOFTWARE PROJECT ESTIMATION AND PLANNING

Subject Code: MCSE3-157	L T P C 3 1 0 4	Duration: 45 Hrs.

LEARNING OBJECTIVES:

To learn the advanced concepts of Software Engineering, Project Estimation, Project Planning and Project Management and its implementation for assessment of understanding the course by the students

LEARNING OUTCOMES:

CO1: Able to know about Introduction, history and development of software and its various process models.

CO2: Able to explain about project planning, estimation and Scheduling.

CO3: Able to study about software quality, its planning and assurance techniques.

CO4: Able to know how to manage the project, risks and case study of different software quality models

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UNIT-I (11 Hrs.)

Principles and Motivations: History; definitions; why engineered approach to software development; Software development process models from the points of view of technical development and project management: waterfall, rapid prototyping, incremental development, spiral models, Agile Software Development, Emphasis on computer-assisted environments. Selection of appropriate development process.

UNIT-II (12 Hrs.)

Project Planning and Estimation: Characteristics of a software project, Software scope and feasibility, resources, the SPM plan, Size/scope estimation, Decomposition techniques, WBS. Effort estimation: Sizing, Function point, LOC, FP vs LOC. Schedule estimation: GANTT Charts, Activity networks, PERT/CPM networks. Cost estimation: Models: COCOMO I, COCOMO II.

UNIT-III (11 Hrs.)

Software Quality and its Assurance and Planning: Concepts of software quality, software quality control and software quality assurance, evolution of SQA, major SQA activities and issues, zero defect software, SQA techniques; Management review process, technical review process, walkthrough, software inspection process, configuration audits, and document verification, Error Reporting , Trend Analysis and Corrective Action: Identification ,Analysis and Correction of defect, implementation of correction, regression testing; Categorization of defect w.r.t development phases; Error quantity, error frequency, program unit complexity, compilation frequency; Corrective action and documenting the corrective action, periodic review of actions taken, Quality control, Quality assurance, Formal Technical Reviews, The SQA Plan, ISO and CMM standards.

UNIT-IV (11 Hrs.)

Software Project Management and Case Studies: Reactive vs. proactive Risk strategies, Risk projection, Risk Refinement, Risk Monitoring, Monitoring and management, RMMM plan., Earned Value Analysis., Team structures: hierarchical, Egoless, chief programmer, mixed; Team software Process; Resource leveling, Building a team: Skill sets, CASE tools, Quality management standards, Quality standards with emphasis on ISO approach, Capability Maturity Models-CMM and CMMI, TQM Models, Bootstrap methodology, The SPICE project, ISO/IEC 15504, Six Sigma Concept for Software Quality.

RECOMMENDED BOOKS:

1. Bob Hughes and Mike Cotterell, ‘Software Project Management’, 5th Edn., Tata McGraw Hill, **2009**.
2. Roger Pressman, ‘A practitioner’s Guide to Software Engineering’, 8th Edn., Tata McGraw Hill, **2014**.
3. ‘Head First PMP: A Brain Friendly Guide to Passing the Project Management Professional Exam’, **2013**.

SOFTWARE ENGINEERING CONCEPTS AND METHODOLOGIES

Subject Code: MCSE1-158, MCSE3-158

L T P C
3 1 0 4

Duration: 45 Hrs.

MRSPTU

LEARNING OBJECTIVES:

To impart knowledge on software engineering concepts and methodologies. To develop skills that will help the students to construct software using different methodologies and advanced techniques.

LEARNING OUTCOMES:

CO1: To study project management concepts
CO2: To understand the role of formal methods and reengineering
CO3: To understand the use of advanced techniques to develop the software.
CO4: To study the special requirements and development of different types of systems

UNIT-I (11 Hrs.)

Project Management: The management spectrum, The People; stakeholders, software team, Agile teams, coordination and communication issues, the product; problem decomposition, the process; modeling the product and process, process decomposition, The W^5 HH principle, RAD model, Metrics for process and projects, software measurements. Agile Methodology-Scrum and XP.

Cleanroom Software Engineering: The cleanroom approach, Functional specification, Cleanroom design and testing.

UNIT-II (12 Hrs.)

Formal Methods: Basic concepts, mathematical preliminaries, Applying mathematical notions for formal specification, Formal specification languages, Z specification Language, Formal methods- the road ahead.

Reengineering: Business process reengineering, Software reengineering, Reverse reengineering, Restructuring, Forward reengineering, economics of reengineering.

UNIT-III (11 Hrs.)

Component-Based Software Engineering: Engineering of component -based systems, CBSE process, Domain engineering, Component-based development, Classifying and retrieving components and economics of CBSE.

Computer-Aided Software Engineering: Building Blocks for CASE, taxonomy Of CASE tools, integrated CASE environments, Integration architecture, and CASE repository

UNIT-IV (11 Hrs.)

Web Engineering: Attributes of web-based applications, the Web E process, a framework for Web E. Formulating, analyzing web-based systems, design and testing for web-based applications, Management issues.

Client/Server Software Engineering: Structure of client/server systems, Software engineering for Client/Server systems, Analysis modeling issues, Design for Client/Server systems, Testing issues

RECOMMENDED BOOKS:

1. Roger S. Pressman, 'Software Engineering a Practitioners Approach', 5th Edn., McGraw-Hill, **2014**.
2. Sommerville, 'Software Engineering', 7th Edn., Pearson**, 2005**.
3. J. Bowan, 'Formal Specification and Documentation testing - A Case Study Approach', International Thomson Computer Press, **2003**.
4. James S. Peters, Witold Pedrycz, 'Software engineering an engineering approach', Wiley India, **2011**.

OBJECT ORIENTED ANALYSIS AND DESIGN

Subject Code: MCSE3-159 **L T P C** **Duration: 45 Hrs.**

3 1 0 4

MRSPTU

LEARNING OBJECTIVES:

To give students the detailed knowledge about Objects, Classes, types of modeling and detailed system design students will also come across the comparison of different methodologies.

LEARNING OUTCOMES:

CO1 Understanding Objects and classes and concept of generalization and inheritance
CO2 Learning Dynamic modeling and various functional models
CO3 Understanding system design and Object design
CO4 Comparing various methodologies and their implementation

UNIT-I (11 Hrs.)

Introduction to Object: Object Orientation, Development, Modeling, Object Modeling technique. Objects and classes, Links and Association, Generalization and inheritance, Grouping constructs, Aggregation, Abstract Classes, Generalization as extension and restriction, multiple inheritance, Meta data, Candidate keys, Constraints.

UNIT-II (12 Hrs.)

Dynamic modeling: Events and states, Nesting, Concurrency, Advanced Dynamic Modeling concepts, Functional modeling: Functional Models, Data flow diagrams, Specifying operations, Constraints, Relation of Functional model to Object and Dynamic Models.

Design Methodology, Analysis: Object modeling, Dynamic modeling, Functional modeling, adding operations, Iterating Analysis.

UNIT-III (11 Hrs.)

System Design: Subsystems Concurrency, Allocation to processor and tasks, Management of data stores, Handling Global Resources, Handling boundary Conditions, Setting Trade-off priorities.

Object Design: Overview, Combining the three models, Designing Algorithms, Design Optimization, Implementation of Control, Adjustment of Inheritance, Design of Associations, Object Representation, Physical Packaging, and Document Design Decision.

UNIT-IV (11 Hrs.)

Comparison of methodologies: Structured Analysis/Structured Design, Jackson Structured Development. **Implementation**: Using Programming Language, Database System, outside Computer.

Programming Style: Object Oriented Style, Reusability, Extensibility, Robustness, and Programming-in-the-large.

RECOMMENDED BOOKS:

1. Rambough, 'Object Oriented Modeling and Design', Pearson Education.
2. BOOCH, 'Object Oriented Analysis and Design', Addison Wesley.
3. Rebecca Wirfs-Brock, 'Design Object Oriented Software', PHI.

SOFTWARE PROJECT MANAGEMENT

Subject Code: MCSE3-160 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

LEARNING OBJECTIVES:

It gives an in depth knowledge of software project management and project planning. It also covers the Step Wise framework in project planning

LEARNING OUTCOMES:

CO1 Apply the basics of Software Project Management in order to manage and deliver qualified product and plan the activities within time schedules with CPM and PERT Analysis

CO2 For managing the quality of product and managing the risk involved

CO3 Managing team and measuring and tracking the planning

CO4 Configuration management and project monitoring and control

UNIT-I (11 Hrs.)

Project Planning: Characteristics of a software project, Software scope and feasibility, resources, the SPM plan.

Software Project Estimation: Size/scope estimation, Decomposition techniques, WBS. Effort estimation: Sizing, Function point, LOC, FP vs LOC. Schedule estimation: GANTT Charts, Activity networks, PERT/CPM networks. Cost estimation: Models: COCOMO I, COCOMO II.

UNIT-II (12 Hrs.)

Quality Planning: Quality control, Quality assurance, Formal Technical Reviews, The SQA Plan, ISO and CMM standards.

Risk Management: Reactive vs proactive Risk strategies, Risk projection, Risk Refinement, Risk Monitoring, Monitoring and management, RMMM plan.

UNIT-III (11 Hrs.)

Measurement and Tracking Planning: Earned Value Analysis.

Team Management: Team structures: hierarchical, Egoless, chief programmer, mixed; Team software Process; Resource levelling, Building a team: Skill sets.

UNIT-IV (11 Hrs.)

Configuration Management: Baselines, Configurable items, SCM repository, SCM process, version control change control, configuration audit**.**

Project Monitoring and Control: Audits and Reviews.

RECOMMENDED BOOKS:

1. Bob Hughes and Mike Cotterell, 'Software Project Management', 5th Edn., Tata McGraw Hill, **2009**.

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2. Roger Pressman, 'A practitioner's Guide to Software Engineering', 8th Edn., Tata McGraw Hill, **2014**.
3. 'Head First PMP: A Brain Friendly Guide to Passing the Project Management Professional Exam', **2013**.

ADVANCED OPERATING SYSTEM

Subject Code-MCSE1-161, MCSE4-162, MCSE2-161, MCSE3-161	**L T P C 3 1 0 4**	**Duration: 45 Hrs.**

LEARNING OBJECTIVES:

To learn the fundamentals of Operating Systems and gain knowledge on Distributed operating system concepts that includes architecture, Mutual exclusion algorithms, Deadlock detection algorithms and agreement protocols

LEARNING OUTCOMES:

CO1 Discuss the various synchronization, scheduling and memory management issues

CO2 Demonstrate the Mutual exclusion, Deadlock detection and agreement protocols of Distributed operating system

CO3 Discuss the various resource management techniques for distributed systems

CO4 Identify the different features of real time and mobile operating systems

UNIT-I (12 Hrs.)

Fundamentals of Operating Systems: Strategies of operating system, Structures of operating system, overview, Synchronization Mechanisms, Processes and Threads, Process Scheduling, Deadlocks: Detection, Prevention and Recovery, Models of Resources, Memory Management Techniques.

Distributed Operating Systems: Issues in Distributed Operating System, Architecture, Communication Primitives, Lamport's Logical clocks, Causal Ordering of Messages – Distributed Mutual Exclusion Algorithms – Centralized and Distributed Deadlock Detection Algorithms, Agreement Protocols.

UNIT-II (11 Hrs.)

Distributed Resource Management: Distributed File Systems – Design Issues - Distributed Shared Memory – Algorithms for Implementing Distributed Shared memory–Issues in Load Distributing – Scheduling Algorithms, Synchronous and Asynchronous Check Pointing and Recovery, Fault Tolerance, Two-Phase Commit Protocol, Non-blocking Commit Protocol, Security and Protection.

UNIT-III (11 Hrs.)

Real Time and Mobile Operating Systems: Basic Model of Real Time Systems, Characteristics, Applications of Real Time Systems, Real Time Task Scheduling, Handling Resource Sharing, Mobile Operating Systems, Micro Kernel Design, Client Server Resource Access, Processes and Threads, Memory Management, File system, Networked file system.

UNIT-IV (11 Hrs.)

CASE STUDIES: Linux System: Design Principles, Kernel Modules, Process Management Scheduling, Memory Management, Input-Output Management, File System, Interprocess Communication. iOS and Android: Architecture and SDK Framework, Media Layer, Services Layer, Core OS Layer, File System.

RECOMMENDED BOOKS:

1. Andrew S. Tanenbaum and Maarten van Steen, 'Distributed Systems: Principles and Paradigms', 2nd Edn., Prentice Hall, **2007**.

MRSPTU

2. Mukesh Singhal and Niranjan G. Shivaratri, ‘Advanced Concepts in Operating Systems – Distributed, ‘Database, and Multiprocessor Operating Systems’, Tata McGraw-Hill, **2001**.
3. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, ‘Operating System Concepts’, 7th Edn., John Wiley & Sons, **2004**.
4. Daniel P. Bovet and Marco Cesati, ‘Understanding the Linux Kernel’, 3rd Edn., O’Reilly, **2005**.
5. Rajib Mall, ‘Real-Time Systems: Theory and Practice’, Pearson Education India, **2006**.
6. Neil Smyth, ‘iPhone iOS 4 Development Essentials – Xcode’, 4th Edn., Payload Media, **2011**.

SOFTWARE ARCHITECTURE AND DESIGN PATTERNS

Subject Code: MCSE3-162 **L T P C** **Duration: 45 Hrs.**

3 1 0 4

LEARNING OBJECTIVES:

This course deals with problem of identifying the concept of architecture and intends to reach the student architecture centric software development methodology. Other topics covered are Architecture Documentation, Architecture Evaluation, Product Lines Enterprise Architecture.

LEARNING OUTCOMES:

CO1: To understand the variety of implemented bad practices related to the Business for quality enhancements.

CO2: To understand the evolution of patterns for decision making.

CO3: To understand the concept of patterns and the Catalog.

CO4: To learn about specific behavioral patterns, idioms.

UNIT-I (11 Hrs.)

Envisioning Architecture: The Architecture Business Cycle, what is Software Architecture, Architectural patterns, reference models, reference architectures, architectural structures and views. Creating an Architecture Quality Attributes, achieving qualities, Architectural styles and patterns, designing the Architecture, Documenting software architectures, Reconstructing Software Architecture.

UNIT-II (12 Hrs.)

Software Architecture: Patterns in Software Architecture, Enabling Techniques for Software Architecture, Non-functional Properties of Software Architecture.

Analysing Architectures: Architecture Evaluation, Architecture design decision making, ATAM, CBAM. Moving from one system to many Software Product Lines, Building systems from off the shelf components, Software architecture in future.

UNIT-III (11 Hrs.)

Patterns: Pattern Description, organizing catalogues, role in solving design problems, Selection and usage. Creational and Structural patterns, Abstract factory, builder, factory method, prototype, singleton, adapter, bridge, composite, decorator, façade, flyweight, proxy.

UNIT-IV (11 Hrs.)

Behavioural Patterns: Chain of responsibility, command, Interpreter, iterator, mediator, memento, observer, state, strategy, template method, visitor.

Idioms: Introduction, What Can Idioms Provide, Idioms and Style, Where Can You Find Idioms, Counted Pointer.

RECOMMENDED BOOKS:

1. Len Bass, Paul Clements & Rick Kazman, ‘Software Architecture in Practice’, 2nd Edn., Pearson Education, **2003**.

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2. Erich Gamma, 'Design Patterns', Pearson Education, **1995**.
3. Luke Hohmann, 'Beyond Software Architecture', Addison Wesley, **2003**.
4. David M. Dikel, David Kane and James R. Wilson, 'Software Architecture', Prentice Hall PTR, **2001**.
5. David Budgen, 'Software Design', 2nd Edn., Pearson Education, **2003**.
6. Eric Freeman and Elisabeth Freeman, 'Head First Design patterns, Eric Freeman & Elisabeth Freeman', O'reilly, **2007**.
7. Steven John Metsker and William C. Wake, 'Design Patterns in Java', Pearson Education, **2006**.
8. Deepak Alur, John Crupi and Dan Malks, 'J2EE Patterns', Pearson Education, **2003**.
9. Steven John metsker, 'Design Patterns in C#', Pearson Education, **2004.**
10. F. Buschmann and others, 'Pattern Oriented Software Architecture', John Wiley & Sons.

SOFTWARE MAINTENANCE AND MANAGEMENT

Subject Code: MCSE3-163 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

LEARNING OBJECTIVES:

To expertise in the SQA maintenance tools, gain knowledge of the overall project activities, To analyses the various issues in each phase of project management and people management.

LEARNING OUTCOMES:

CO1 Learn about measurement, benchmarking

CO2 Know about SQA maintenance tools and process models

CO3 Knowledge gained in usage and application of umbrella activities for project management. Execute the project development in a systematic manner using tools and techniques.

CO4 Issues are analysed in various phases of project management and people management

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UNIT-I (11 Hrs.)

Maintenance Process: Software Maintenance- Customer's Viewpoint- Economics of Maintenance- Issues in Maintenance- Software Maintenance Standard, Process, Activities and Categories – Maintenance Measurement – Service Measurement and Benchmarking – Problem Resolution Reporting – Fix Distribution.

UNIT-II (12 Hrs.)

Activities for Maintenance and process Models: Role of SQA for Support and Maintenance, SQA tools for Maintenance, Configuration Management and Maintenance, Maintenance of Mission Critical Systems, Global Maintenance Teams, Foundation of S3m Process Model, Exemplary Practices. Product, Process and Project, Definition, Product Life Cycle, Project Life Cycle Models. Format model for a process, The ISO 9001 and CMM models and their relevance to project Management-other emerging models like People CMM.

UNIT-III (11 Hrs.)

Umbrella activities in projects and in stream activities in projects: Software Project Management -Formal Technical Reviews-Software Quality Assurance, Software Configuration Management, Re-usability Management-Risk analysis and Management - Measurement and Metrics-Document Preparation and Production. Project Initiation - Project Planning- feasibility study estimation- resource allocation- execution and tracking, root cause analysis- Project Wind-Up-Concept of process/project database.

UNIT-IV (11 Hrs.)

Engineering and People Issues in Project Management: Phases (Requirements, Design, Development, Testing, maintenance, deployment) – engineering activities and management issues in each Phase-Difficulties in people management- Role of Project manager, Special considerations in project management for India and geographic distribution issues.

RECOMMENDED BOOKS:

1. Alian April and Alain Abran, 'Software Maintenance Management: Evaluation and Continuous Improvement', John Wiley & Sons Inc., **2008**.
2. Watts Humphrey, 'Managing the Software Process', Pearson Education, New Delhi, **2000**.
3. Gopalaswamy Ramesh and Ramesh Bhattiprolu, 'Software Maintenance: Effective Practices for Geographically Distributed Environments', 2nd Reprint, Tata McGraw Hill, **2009**.
4. Humphrey, Watts, Managing the software process, Addison Wesley, **1986**.
5. Pressman, Roger, 'Software Engineering: A Practitioner's Approach', McGraw Hill, **1997**.
6. Pankaj Jalote, 'Software Project Management in Practice', Pearson Education, New Delhi, **2002**.

PRACTICAL LAB.-I

Subject Code: MCSE3-104 **L T P C**
0 0 4 2

- Practical's should be related to the core subjects of the same semester.

AGILE SOFTWARE DEVELOPMENT APPROACHES

Subject Code: MCSE1-156 **L T P C** **Duration: 45 Hrs.**
MCSE2-156, **3 1 0 4**
MCSE4-156,
MCSE3-205

MRSPTU

LEARNING OBJECTIVES:

This course makes student learn the fundamental principles and practices associated with each of the agile development methods. To apply the principles and practices of agile software development on a project of interest and relevance to the student.

LEARNING OUTCOMES:

CO1: To learn the basics concepts of Agile software and their principles design

CO2: To explain different agile development method, project tools requirement, risk and measurements related with different development methods.

CO3: To understand the overview of Agile methods, strategies, requirements and testing.

CO4: Describe and explain agile measurement, configuration and risk management. Principles of Astern and tools.

UNIT-I (11 Hrs.)

Introduction: Basics and Fundamentals of Agile Process Methods, Values of Agile, Principles of Agile, stakeholders, Challenges.

Agile and its Significance: Agile development, Classification of methods, the agile manifesto and principles, Practices of XP, Scrum Practices, working and need of Scrum, advanced Scrum Applications, Scrum and the Organization.

UNIT-II (12 Hrs.)

Agile Project Management: Embrace communication and feedback, Simple practices and project tools, Empirical Vs defined and prescriptive process – Principle-based versus Rule-Based – Sustainable discipline: The human touch – Team as a complex adaptive system – Agile hype – Specific agile methods. Quality, Risk, Metrics and Measurements, the facts of change on software projects – Key motivations for iterative development – Meeting the requirements challenge iteratively – Problems with the waterfall. Research evidence – Early historical project evidence – Standards-Body evidence, Expert and thought leader evidence – A Business case for iterative development – The historical accident of waterfall validity.

UNIT-III (11 Hrs.)

Agile Methodology: Method overview – Lifecycle – Work products, Roles and Practices values – Common mistakes and misunderstandings – Sample projects – Process mixtures – Adoption strategies – Fact versus fantasy – Strengths versus “Other” history.

Agile Requirements: User Stories, Backlog Management. Agile Architecture: Feature-Driven Development. Agile Risk Management: Risk and Quality Assurance, Agile Tools.

UNIT-IV (11 Hrs.)

Agile Testing: Agile Testing Techniques, Test-Driven Development, User Acceptance Test.

Agile Review: Agile Metrics and Measurements, The Agile approach to estimating and project variables, Agile Measurement, Agile Control: the 7 control parameters. Agile approach to Risk, The Agile approach to Configuration Management, The Atern Principles, Atern Philosophy, the rationale for using Atern, Refactoring, Continuous integration, Automated Build Tools.

RECOMMENDED BOOKS:

1. Elisabeth Hendrickson, ‘Agile Testing’, Quality Tree Software Inc., **2008**.
2. Craig Larman, ‘Agile and Iterative Development – A Manager’s Guide’, 1st Edn., Pearson Education, **2004**.
3. Robert C. Martin, ‘Agile Software Development, Principles, Patterns, and Practices (Alan Apt Series)’, 2nd Edn., Pearson Education, **2003**.
4. Alistair Cockburn, ‘Agile Software Development series’, 1st Edn., Addison-Wesley Professional, **2001**.
5. Mike Cohn, ‘Succeeding with Agile: Software Development Using Scrum’, 1st Edn., Pearson, **2010**.

MRSPTU

SOFTWARE TESTING & VALIDATIONS

Subject Code: MCSE3-206 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

LEARNING OBJECTIVES:

This course is designed to enable a clear understanding and knowledge of the foundations, techniques, and tools in the area of software testing and its practice in the industry. The course will prepare students to be leaders in software testing.

LEARNING OUTCOMES:

CO1: able to apply software testing knowledge, verification & validation and engineering methods.

CO2: Have an ability to design and conduct a software test process for a quality software test project.

CO3: Have an ability understand and identify various software testing problems, and solve these problems by designing and selecting software test models, criteria, strategies, and methods.

CO4: Have an ability to use software testing methods and modern software testing tools for their testing projects.

UNIT-I (11 Hrs.)

Review of Software Engineering: Overview of software evolution, design models, development life cycle, unit and system testing, project management, maintenance, Concept of Software verification, validation and testing.

V & V and their Limitations: Theoretical Foundations: Impracticality of Testing All data; Impracticality of testing All Paths; No Absolute Proof of Correctness.

UNIT-II (12 Hrs.)

The Role of V & V in Software Evolution: Types of Products, Requirements; Specifications, Designs, Implementation, Charges, V & V Objectives, Correctness, Consistency, Necessity Sufficiency, Performance.

Software Reliability and Quality Assurance: Software reliability, validation, safety and hazards analysis; features affecting quality of software. Concepts and importance of quality assurance, Software quality assurance strategies, FTR, structured walk through techniques.

UNIT-III (11 Hrs.)

Software V & V Approaches and their Applicability: Software Technical Reviews, Software Testing : Levels of testing, Module, Integration, System, Regression, Testing techniques and their Applicability, Functional testing and Analysis Structural testing and Analysis, Error Oriented testing and Analysis, Hybrid Approaches, Integration Strategies, Transaction Flow Analysis, Stress Analysis, Failure Analysis, Concurrency Analysis, Performance Analysis Proof of Correctness, Simulation and Prototyping, Requirements Tracing.

UNIT-IV (11 Hrs.)

Software V & V Planning, Identification and Selection techniques: requirements, Specifications, Designs, Implementations, Changes, Organizations Responsibilities, Development Organization Independent Test Organization, Software Quality Assurance, Independent V &V contractor, V & V Standards, Integrating V & V Approaches, Problem Tracking Test Activities, Assessment.

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RECOMMENDED BOOKS:

1. William Perry, 'Effective Methods for Software Testing', John Wiley & Sons, **1995**.
2. Mare Roper, 'Software Testing', McGraw Hill Book Co., **1994**.
3. Cem Kaner, Jack Falk, Nguyen Quoc, 'Testing Computer Software', 2nd Edn., Van Nostrand Reinhold, **1993**.
4. Ron Patton, 'Software Testing', 2nd Edn., **2009.**
5. K.K. & Yogesh Singh, 'Software Engineering; Agricultural', New Age International, **2001**.
6. James Mc Manus I & Gordon Schulmeyer Van Nostrand Reinhold, 'Handbook of Software Quality Assurance', **1992.**
7. Ronald Owston, Van Nostrand Reinhold, 'Software System Testing and Quality Assurance', **1984**.
8. Michael Deutch Prentice Hall, 'Software Verification and Validation: Realistic Project Approach', **1982**.

INFORMATION RETRIEVAL

Subject Code: MCSE3-264 **L T P C** **Duration: 45 Hrs.**

3 1 0 4

LEARNING OBJECTIVES:

To learn the underlying technologies of modern information retrieval system.

LEARNING OUTCOMES:

CO1 Able to understand the basic concepts of modern information retrieval system.

CO2 Able to understand the search engine architecture.

CO3Able to learn the retrieval models and apply the algorithms of retrieval algorithms.

CO4 Able to evaluate the quality of retrieval system.

UNIT-I (12 Hrs.)

Introduction: The nature of unstructured and semi-structured text, Boolean queries, World Wide Web, History of Hypertext, Hypertext systems, Problems due to Uniform accessibility, types of Hypertext data, Text and multimedia data indexing, PageRank, HITS, XML and Semantic web.

UNIT-II (11 Hrs.)

Search Engine Architecture: the basic building blocks of a modern search engine system, including web crawler, basic text analysis techniques, inverted index, query processing, search result interface.

UNIT-III (11 Hrs.)

Retrieval Models: Boolean, vector space, probabilistic and language models, latent semantic indexing, ranking algorithm, Introduction to the most recent development of learning-based ranking algorithms, i.e., learning-to-rank, Relevance feedback, query expansion, link analysis and search applications.

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UNIT-IV (11 Hrs.)

Performance Evaluation: Evaluating search engines, User happiness, precision, recall, F-measure.

RECOMMENDED BOOKS:

1. Christopher D. Manning, Prabhakar Raghavan, and Hinrich Schutze, 'Introduction to Information Retrieval', 1st Edn., Cambridge University Press, **2008**.
2. Bruce Croft, Donald Metzler, and Trevor Strohman, 'Search Engines: Information Retrieval in Practice', 1st Edn., Pearson Education, **2009**.
3. Yates Ricardo and Berthier Ribeiro-Neto, 'Modern Information Retrieval', 2nd Edn., Addison-Wesley, **2011**.
4. Soumen Chakrabarti, 'Mining the Web', 1st Edn., Morgan-Kaufmann, **2002**.

SOFTWARE QULAITY MANAGEMENT

Subject Code: MCSE3-265 **L T P C** **Duration: 45 Hrs.**

3 1 0 4

LEARNING OBJECTIVES:

The objective of the course is to understand the concepts of software quality, various standards, SQA, detailed design and testing as well as various CASE tools.

LEARNING OUTCOMES:

CO1: To understand the software quality and learning the concept of SQA.

CO2: Understanding the Quality assurance and management

CO3: To learn about software design, testing, defects and error frequency.

CO4: Understanding different CASE tools and quality management standards.

UNIT-I (11 Hrs.)

Introduction to software quality, different quality attributes software quality control and software quality assurance, concept of SQA, SQA activities and SQA issues, zero defect software, Functions of software QA organization in a project.

UNIT-II (11 Hrs.)

Quality assurance and software life cycle, SQA techniques, Tailoring the Software Quality Assurance Program: Management review process, technical review process, walkthrough, software inspection process, configuration audits and document verification.

UNIT-III (12 Hrs.)

Software requirements, preliminary design, detailed design, coding and unit test, integration and testing, system testing, Identification of defect, analysis and correction of defect, implementation of correction, regression testing, Categorization of defect, Error quantity, error frequency, program unit complexity, compilation frequency

UNIT-IV (11 Hrs.)

CASE tools and their effect on Software Quality, Software Quality Metrics, Standards, certification and assessment, Quality management standards, Quality standards with emphasis on ISO approach, Capability Maturity Models-CMM and CMMI, TQM Models, Bootstrap methodology, The SPICE project, ISO/IEC 15504, Six Sigma Concept for Software Quality.

RECOMMENDED BOOKS:

1. Roger Pressman, ‘Software Engineering - A Practitioners Approach’, McGraw Hill, **2009**.
2. Ian Sommerville, ‘Software Engineering’, Addison-Wesley Publishing Company, **2006**.
3. James F. Peter, ‘Software Engineering - An Engineering Approach’, John Willey
4. Pankaj Jalote, ‘An Integrated Approach to Software Engineering’, Narosa Publishing House.

MRSPTU

UNIFIED SOFTWARE CONFIGURATION MANAGEMENT

Subject Code: MCSE3-266 **L T P C** **3 1 0 4** **Duration: 45 Hrs.**

LEARNING OBJECTIVES:

LEARNING OUTCOMES:

CO1: Understanding basic SCM concepts and the evolution of SCM tools. Provides an overview of the Unified Change Management mode including today's most effective usage models, strategies, and policy configurations

CO2 Illustrates Clear Case objects, including the repository, workspaces, and component management and how to create SCM environment.

CO3 Learn how to deal with a variety of real-world development scenario such as multiple projects, and how to coordinate parallel work both within a project and between multiple projects.

CO4 Analyze the process of integration, building and releasing of software.

UNIT-I (11 Hrs.)

Software Configuration Management: SCM best practices, SCM tools and process, Dyeing with changing project requirements.

Overview of the Unified Change Management Model: UCM, Clear Case, UCM process overview, defining the Implementation Model, The UCM baseline and Change Model.

UNIT-II (12 Hrs.)

Functional Overview of Objects: The Repository, Versioned Object Base, Workspaces, Component Management, Process, Building, Clear make, Derived Objects, Configuration records.

Establishing the Initial SCM Environment: Clear Case Architecture Basics, Defining the Implementation Model, Creating the VOBs, Baseline promotion levels Project Management in Clear Case.

UNIT-III (11 Hrs.)

Coordinating Multiple Project Teams and Other Scenarios: Organizing large Multi project development efforts, coordinating cooperating projects, Independent components, shared components, Multiple Parallel release, Using UCM without Activity-based SCM.

Development Using the UCM Model: A Developer's perspective of UCM, joining a project, making changes, delivering changes to the project, rebasing your development stream, Dealing with conflicting changes.

UNIT-IV (11 Hrs.)

Integration, Build and Release: Software Integration, Isolation and integration, Building and Base lining, Staging and release.

RECOMMMENDED BOOKS:

1. G. Booch, I. Jacobson, J. Rumbaugh, 'The Unified Software Development Process', 1st Edn., Addison Wesley, **1999**.
2. Brian A. White**, '**Software Configuration Management Strategies and Rational Clear Case', 4th Edn., Addison Wesley, **2001**.
3. Roger S. Pressman, 'Software Engineering a Practitioners Approach', 5th Edn., McGraw-Hill, **2014**.
4. James Rumbaugh, Ivar Jacobson and Grady Booch, 'The Unified Modelling Language Reference Manual', 2nd Edn., Addison Wesley, **2004**.

MRSPTU

SOFTWARE DESIGN AND CONSTRUCTION

Subject Code: MCSE3-267 **L T P C** **Duration: 45 Hrs.**

3 1 0 4

LEARNING OBJECTIVES:

This course offers a good understanding of the concepts, methods and techniques of software designing and construction and prepares students to be in a position to develop software.

LEARNING OUTCOMES:

CO1: To explain the general fundamental design fundamentals. It explains the nature of Design process, Design qualities, object Model.

CO2: To understand the structured system analysis and design.

CO3: To Know the object oriented and design.

CO4: To Explain the software Architecture and design methods.

UNIT-I (11 Hrs.)

General Design Fundamentals: The nature of Design process, Objectives, Building Models, Constructs, Design qualities, Assessing the design, Design viewpoints for software, The object Model, Classes and Objects, Complexity, Classification, Notation, Process, Pragmatics.

UNIT-II (12 Hrs.)

Structured System Analysis and Design: Structured Design, Design Principle, Problem Partitioning and Hierarchy, Abstraction, Modularity, Top-down and Bottom-up Strategies, Transformation of a DFD to a Structure Chart, Transform Analysis, Transaction Analysis, Coupling, Cohesion, Multiple types of Cohesion in a module, Data Design, Normalization, Denormalization, Procedural Design.

UNIT-III (11 Hrs.)

Object Oriented Analysis and Design: Overview of Object Oriented Analysis, Shaler/Mellor, Coad/ Yourdon, Rumbaugh, Booch UML Use case, Conceptual model, Behaviour, Class Analysis Patterns, Overview, Diagrams, Aggregation, UML, Diagrams, Collaboration, Sequence, Class, Design patterns and Frameworks, Comparison with other design methods, Managing analysis and design, Evaluation testing, Coding, Maintenance, Metrics.

UNIT-IV (11 Hrs.)

Software Design: The Architecture Concepts, Design Methods Design Patterns, Rationale for Methods, Design Processes and Strategies, Design by Template, Designing with Patterns, Stepwise Refinement, Incremental Design, Prototyping, DSDM, Structured Systems Analysis and Structured Design, JSP, JSD. Domain Name System, Email, World Wide Web (HTTP), Simple Network Management Protocol, File Transfer Protocol, Security, Multimedia applications.

RECOMMENDED BOOKS:

1. David Budgen, ‘Software Design’, 2nd Edn., Pearson Education, **2004**.
2. R.S. Pressman, ‘Software Engineering’, 5th Edn., McGraw Hill Inc., **2001**.
3. Ed Downs, Peter Clare, Jan Coe, ‘Structured System Analysis and Design Methods Application and Context’, 2nd Edn., Prentice Hall, **1992**.
4. G. Suteliffe, ‘Human Computer Interface Design’, 2nd Edn., Macmillan, **1995**.

MRSPTU

SECURE SOFTWARE ENGINEERING

Subject Code: MCSE3-268	**L T P C** **3 1 0 4**	**Duration: 45 Hrs.**

LEARNING OBJECTIVES:

To help students to know the significance, architecture and design, requirement engineering, quality, management and techniques of security for software systems

LEARNING OUTCOMES:

CO1: To know the basics of secure software engineering

CO2: To study various issues related to requirement specification, architecture and design of secure systems

CO3: To understand the relation of quality with security and its implementation

CO4: To study various problems and their management for secure systems

UNIT-I (11 Hrs.)

Security Concepts: Introduction, the need for software security, system security, difference between software and system security, software assurance, and its relation to software security.

Trust and threat for Security: Threats to software security, sources of software insecurity, Benefits of Detecting Software Security, Properties of Secure Software, Influencing the security properties of software, trust and threat model foe software security.

UNIT-II (12 Hrs.)

Security Requirements for Secure Software: Introduction, Security requirements, Requirement Gathering, Requirement specification, Identify Assets, Risk Management, Requirements elicitation and prioritization, the SQUARE process Model

Secure Software Architecture and Design: Introduction, architecture for software security, architectural risk analysis, software security knowledge for architecture and design, security principles, security guidelines.

UNIT-III (11 Hrs.)

Quality: Code analysis, Software Security testing, Security testing considerations throughput the SDLC, relation between quality and security.

UNIT-IV (11 Hrs.)

Security and Complexity: System Assembly Challenges: introduction, security failures, functional and attacker perspectives for security analysis, system complexity drivers and security.

Managing for More Secure Software: Governance and security, adopting an enterprise software security framework, how much security is enough?

RECOMMENDED BOOKS:

1. Julia H. Allen, 'Software Security Engineering', 1st Edn., Addison Wesley, **2008**.
2. Jason Grembi, 'Developing Secure Software', 1st Edn., Cengage Learning, **2009**.
3. Richard Sinn, 'Software Security', 1st Edn., Cengage Learning, **2009**.

SOFTWARE PROJECT METRICS

Subject Code: MCSE3-269 **L T P C** **Duration: 45 Hrs.**

3 1 0 4

MRSPTU

LEARNING OBJECTIVES:

To teach students software metrics and about issues related to software metrices.

To provide students with skills needed to do independent research in the project metrices.

LEARNING OUTCOMES:

CO1 To understand the basics of Software Measurement, its underlying objectivity using the quantifiable approach in order to control, manage and Improvise quality.

CO2 Measuring internal and external product attributes.

CO3 To analyse characteristics of object oriented metrics and dynamic metrics.

CO4 Be able to define metrices for component based system and measuring productivity of resources.

UNIT-I (11 Hrs.)

Basics of Measurement: Measurement in everyday life, measurement in software engineering, scope of software metrics, representational theory of measurement, measurement and models, measurement scales, meaningfulness in measurement, goal-based framework for software measurement, classifying software measures, determining what to measure, software measurement validation, empirical investigation, types of investigation, planning and conducting investigations.

Software-Metrics Data Collection and Analysis: What is good data, how to define the data, how to collect the data, how to store and extract data, analyzing software-measurement data, frequency distributions, various statistical techniques.

UNIT-II (12 Hrs.)

Measuring Internal Product Attributes: Measuring size, aspects of software size, length, functionality and complexity, measuring structure, types of structural measures, control-flow structure, modularity and information flow attributes, data structures.

Measuring External Product Attributes: Modeling software quality, measuring aspects of software quality, software reliability, basics of software reliability, software reliability problem, parametric reliability growth models, predictive accuracy, recalibration of software-reliability growth predictions, importance of operational environment, and wider aspects of software reliability.

UNIT-III (11 Hrs.)

Metrics for Object-Oriented Systems: Intent and characteristics of object-oriented metrics, various object-oriented metric suites LK suite, CK suite and MOOD metrics.

Dynamic Metrics: Runtime Software Metrics, Extent of Class Usage, Dynamic Coupling, Dynamic Cohesion, and Data Structure Metrics.

UNIT-IV (11 Hrs.)

Metrics for Component-based Systems: The intent of component-based metrics, distinguishing characteristics of component-based metrics, various component-based metrics.

Resource Measurement: Measuring productivity, teams, tools, and methods.

RECOMMENDED BOOKS:

1. Norman E-Fenton and Shari Lawrence Pfleeger, Software Metrics, 2nd Edn., International Thomson Computer Press, **1997**.
2. Norman Fenton and James Bieman, Software metrics: a rigorous and practical approach, 3rd Edn., CRC Press, **2014**.
3. Stephen H. Kan, Metric and Models in software Quality Engineering, 2nd Edn., Addison Wesley, **1995**.
4. C. Ravindranath Pandian, Software metrics: A guide to planning, analysis and application, 1st Edn., CRC Press, **2003**.

MRSPTU

SOFTWARE RELIABILITY AND METRICES

Subject Code: MCSE3-270 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

LEARNING OBJECTIVES:

This course offers a good understanding of the concepts, methods and techniques for testing software reliability and provide software metrics and prepares students to be in a position to develop error free and good quality software.

LEARNING OUTCOMES:

CO1: Able to explain the need and basic concepts of software reliability. Able to explain the different software reliability models.

CO2: Able to explain the software prediction analysis. It explains the short and long term predictions, Analyzing Predictive Accuracy, Errors and Inaccuracy.

CO3: Able to explain the software reliability testing techniques.

CO4: Able to understand the measuring internal product attributes like software size, length, functionality and complexity etc. and the measuring external product attributes measuring aspects of software quality, parametric reliability growth models etc.

UNIT-I (12 Hrs.)

Introduction: Need and Concepts of Software Reliability, Failure and Faults – Prevention, Removal, Tolerance, Forecast, Dependability Concept– Failure Behavior, Characteristics, Maintenance Policy, Reliability and Availability Modeling. Software reliability models: Historical Perspective and Implementation, classification, limitations and issues, Exponential Failure Models – Jelinski moranda model, Poisson, Musa, Exponential models, Weibull Model, Musa okumoto Model, Bayseian Model – Littlewood verral Model.

UNIT-II (11 Hrs.)

Prediction Analysis: Model Disagreement and Inaccuracy – Short & Long Term Prediction, Model Accuracy, Analyzing Predictive Accuracy – Outcomes, PLR, U & Y Plot, Errors and

Inaccuracy, Recalibration – Detecting Bias, Techniques, Power of Recalibration, Limitations in Present Techniques, Improvements.

UNIT-III (11 Hrs.)

Testing for Reliability Measurement: Software Testing – Types, White and Black Box, Operational Profiles – Difficulties, Estimating Reliability, Time/Structure based software reliability – Assumptions, Testing methods, Limits, Starvation, Coverage, Filtering, Microscopic Model of Software Risk.

UNIT-IV (11 Hrs.)

Measuring Internal and External Product Attributes: Measuring size, aspects of software size, length, functionality and complexity, measuring structure, types of structural measures, control-flow structure, modularity and information flow attributes, data structures. Modeling software quality, measuring aspects of software quality, software reliability, basics of software reliability, software reliability problem, parametric reliability growth models, predictive accuracy, importance of operational environment.

RECOMMENDED BOOKS:

1. Patric D.T.O Connor, ‘Practical Reliability Engineering’, 4th Edn., John Wesley & Sons, **2003**.
2. John D. Musa, ‘Software Reliability Engineering’, 1st Edn., Tata McGraw Hill, **1999**.
3. Michael R. Lyu, ‘Handbook of Software Reliability Engineering’, 1st Edn., IEEE Computer Society Press, **1996**.
4. Norman E-Fenton and Shari Lawrence Pfleeger, ‘Software Metrics’, 2nd Edn., International Thomson Computer Press, **1997**.
5. Norman Fenton and James Bieman, ‘Software Metrics: A Rigorous and Practical Approach’, 3rd Edn., CRC Press, **2014**.

MRSPTU

OPEN SOURCE TECHNOLOGY

Subject Code: MCSE3-271 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

LEARNING OBJECTIVES:

To give a brief introduction to the open source technology. Through interactive sessions enabling students to enhance their skills in contributing and implementing their technical knowledge.

LEARNING OUTCOMES:

CO1: Open source software history, initiatives and principles. Open standards, Licenses and FOSS.

CO2: Learn about the Open Source Operating system and its distributions like Fedora, Google chrome OS, Ubuntu.

CO3: Study of Web technologies based on open Software’s LAMP (Linux Apache MySqland PHP/Python)

CO4: To Learn HTML, XHTML, PHP and JavaScript

UNIT-I (11 Hrs.)

Introduction: Open Source Definition, Free Software vs. Open Source Software, Public Domain Software, Open Source History, Initiatives, Principle and Methodologies. Open Standards.

Open Source Development Model Licenses and Patents: What Is a License, Important FOSS Licenses (Apache, BSD, GPL, LGPL), copyrights and copy lefts, Patents Economics of FOSS: Zero Marginal Cost, Income-generation opportunities, Problems with traditional commercial software, Internationalization.

UNIT-II (12 Hrs.)

Open Source Operating Systems: Different open source operating systems. Google Chrome OS, BSD, Linux Distributions – Fedora and Ubuntu, Installation, Disk Partitioning, Boot loader. Using Linux – Shell, File system familiarity, Linux Administration – Managing users, services and software, Network Connectivity, Configurations and Security.

Open Source Web Technologies: Two Tier and Three Tier Web based Application Architecture. LAMP Terminologies, Advantages. Apache, Web server conceptual working, Web browser, HTTP, Installation and Configuration, httpd.conf file, Logging, Security, Running a website, MySQL, Database management system, ER diagram, Relational database, Installation, Configuration, Administration, Common SQL queries.

UNIT-III (11 Hrs.)

Programming on XHTML and XML: Editing XHTML, W3C XHTML validation services, designing XHTML by using XHTML tables, frames, forms and other elements. CSS and its types. XML, XML namespaces, DTD, XML schema, XML vocabularies, DOM and its methods, SOAP.

UNIT-IV (11 Hrs.)

Programming on PHP and JavaScript: JavaScript: JavaScript variables, control structures, functions, arrays and objects. Cascading Style Sheets, Client Side Scripting - Java Script, PHP: Form processing and business logic, stream processing and regular expressions, viewing client/server environment variables, connecting to database and handling of cookies. SQL, Accessing databases with PHP.

Open Source Ethics: Open source vs. closed source Open source government, Open source ethics. Social and Financial impacts of open source technology, shared software, Shared source.

Case Studies: Mozilla (Firefox), Wikipedia, Joomla, Open Office, GCC.

RECOMMENDED BOOKS:

1. B. Ware, B Lee J., 'Open Source Development with Lamp: Using Linux, Apache, MySQL, Perl, and PHP', Addison-Wesley Professional, **2002**.
2. Deitel, 'Internet and World wide web: How to program', 4th Edn., Prentice Hall, **2008**.
3. P. DuBois, 'MySQL', 5th Edn., Addison-Wesley Professional, **2013**.
4. M. Zandstra, 'Teach Yourself PHP in 24 Hours', 3rd Edn., Sams Publishing, **2003**.

PRACTICAL LAB.-II

Subject Code: MCSE3-207 **L T P C**
0 0 4 2

- Practical's should be related to the core subjects of the same semester.

COMPONENT BASED DEVELOPMENT

Subject Code: MCSE3-372 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

LEARNING OBJECTIVES:

The objective of this course is to gain the knowledge of current component models in terms of their design, management and related issues. The students will be able to assess that how these models measure up to the goals of CBD.

MRSPTU

LEARNING OUTCOMES:

CO1: Able to explain the Fundamentals of Component based Software Development, their Software Engineering Model, Success Factors and Common High Risk Mistakes.

CO2: Acquire the knowledge about various Software Engineering Practices and techniques for defining component Infrastructure.

CO3: Acquire the knowledge about management of Component based Software Systems, their various measurement metrics, processes and phases.

CO4: Acquire the knowledge about various Component Technologies and their comparisons.

UNIT-I (11 Hrs.)

Component Definition: Definition of Software Component and its Elements. Component Models and Component Services: Concepts and Principles, COTS Myths in Component-Based Software Development, Roles for Component-Based Development, Objectives of CBSE, Component based Software Engineering Processes, Component based software life cycle model, Common High Risk Mistakes in Component-Based Software Engineering, CBSE Success Factors: Integrating Architecture, Process, and Organization.

UNIT-II (12 Hrs.)

Software Engineering Practices: The Practice of Software Engineering, From Subroutines to Subsystems: Component-Based Software Development.

The Design of Software Component Infrastructures: Software Components and the UML, Component Infrastructures: Placing Software Components in Context, Business Components, Components and Connectors: Catalysis Techniques for Defining Component Infrastructures, An Open Process for Component-Based Development, Designing Models of Modularity and Integration.

UNIT-III (11 Hrs.)

The Management of Component-Based Software Systems: Measurement and Metrics for Software Components, The Practical Reuse of Software Components, Selecting the Right COTS Software: Why Requirements are Important, Software Component Project Management Processes, The Trouble with Testing Software Components, configuration Management and Component Libraries, The Evolution, Maintenance and Management of Component-Based Systems.

UNIT-IV (11 Hrs.)

Component Technologies: Overview of the CORBA Component Model, Transactional COM+: Designing Scalable Applications, The Enterprise JavaBeans Component Model, Choosing Between COM+, EJB, and CCM, Software Agents as Next Generation Software Components, Future of CBSE.

RECOMMENDED BOOKS:

1. Katharine Whitehead, 'Component-Based Development: Principles and Planning for Business Systems', Addison Wilsey, **2010.**
2. Don Box, Dorling Kingsley, 'Essential COM', 1st Edn., Addison-Wesley Professional, **2006**.

OBJECT ORIENTED ENGINEERING USING UML

Subject Code: MCSE3-373 **L T P C** **Duration: 45 Hrs.**

3 1 0 4

LEARNING OBJECTIVES: Object-Oriented Software Development is an approach/paradigm of developing software by identifying and implementing a set of objects and their interactions to meet the desired objectives. The first step towards this kind of

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software development is to learn and master the various concepts, tools and techniques that are to be used design and implementation of such systems.

LEARNING OUTCOMES:

CO1: Understanding the history and goals of UML.
CO2: Use of functional, non-functional requirements along with Use Case Modeling.
CO3: Knowledge of Modeling Classes and Dependencies.
CO4: Ability to know interfaces, components and Sequence Diagrams.

UNIT-I (11 Hrs.)

UML: History of UML, Goals of UML, nature & purpose of models, UML views & diagrams – static, design, use case, state machine, activity, interaction deployment, model management, profile; relationships in UML – association, dependency, generalization, realization; UML extensibility mechanisms – constraints, stereotypes, tagged values. Unified Process (UP): UP structure, phases of UP.

UNIT–II (12 Hrs.)

Requirements: Meta Model, Workflow, Functional and Non-functional Requirements; Requirement Attributes, Finding Requirements.

Use Case Modeling: Finding Actors and Use Cases, Use Case Scenario – main flow, branching within a flow, repletion within a flow, modeling alternative flows; relationships among actors and use cases; use case diagrams.

UNIT–III (11 Hrs.)

Analysis: Meta Model, Workflows, Finding Analysis Classes – using noun/verb analysis, CRC analysis, using RUP stereotypes - entity, boundary and control; Modeling Classes – Association (role name, multiplicity, navigability, association classes, qualified association) dependencies (usage, abstraction, permission), class generalization, generalization sets, power types; Analysis Package – nested packages, dependencies, transitivity, package generalization, architectural analysis, finding analysis packages; Concepts of Patterns & Frameworks.

Use Case Realization – interaction diagram, sequence diagram; Activity Diagrams.

UNIT–IV (11 Hrs.)

Design: Meta Model, Workflow, design classes – well-formed design classes, inheritance, templates, nested classes, design relationships, aggregation and composition, refining analysis relationships; interfaces and components – provided and required interfaces, interface realization v/s interface, components, finding interfaces, designing with interfaces; interaction diagram in design, modelling concurrency, active classes, concurrency in sequence diagram, concurrency in communication diagram; state machine - state machine diagrams, Implementation: Meta model, workflow, deployment diagram.

RECOMMENDED BOOKS:

1. Jim Arlow, Ila Neustadt, 'UML 2 and the Unified Process – Practical Object Oriented Analysis and Design', 2nd Edn., Pearson Education, **2005**.
2. Bernd Bruegge, Allen H. Dutoit, 'Object Oriented Software Engineering using UML', 3rd Edn., Pearson Education, **2009**.
3. Rumbaugh J., Jacobson I., Booch G., 'The Unifed Modeling Language Reference Manual', 2nd Edn., Pearson Education, **2005**.
4. Blaha M., Rumbaugh J., 'Object-Oriented Modeling and Design with UML', 2nd Edn., Pearson Education, **2005**.
5. Timothy C. Lethbridge, Robert Laganiere, 'Object Oriented Software Engineering', 1st Edn., Tata McGraw-Hill, **2008.**
6. Satzinger, Jackson, Burd, 'Object-Oriented Analysis & Design with the Unified Process', PKD Edn., Course Technology Inc., **2004.**

SOFTWARE RELIABILTY & METRICS

Subject Code MCSE3-374	L T P C 3 1 0 4	Duration: 45 Hrs.

LEARNING OBJECTIVES: This course is a step by step description of the software metrics. It includes introduction to foundations of measurement theory, models of software engineering measurement, software products metrics, software process metrics and measuring management

LEARNING OUTCOMES:

CO1: To appreciate and understand scientific concepts of Software and Hardware Reliability.

CO2: To apply Software Reliability Growth Models in Software Development.

CO3: To emphasize the Application of Software Reliability Models.

CO4: Knowledge of Different Software Testing Models.

UNIT-I (11 Hrs.)

Need and Concepts of Software Reliability, Failure and Faults – Prevention, Removal, Tolerance, Forecast, Dependability Concept – Failure Behavior, Characteristics, Maintenance Policy, Reliability and Availability Modeling, Reliability Evaluation

UNIT-II (12 Hrs.)

Introduction - Historical Perspective and Implementation, classification, limitations and issues, Exponential Failure Models – Jelinski-moranda model, Poisson, Musa, Exponential models, Weibull Model, Musa-okumoto Model, Bayseian Model – Littlewood verral Model, Phase Based Model.

UNIT-III (11 Hrs.)

Model Disagreement and Inaccuracy – Short & Long Term Prediction, Model Accuracy, Analyzing Predictive Accuracy – Outcomes, PLR, U & Y Plot, Errors and Inaccuracy, Recalibration – Detecting Bias, Techniques, Power of Recalibration, Limitations in Present Techniques, Improvements.

UNIT-IV (11 Hrs.)

Concepts and Development Procedures – Customer Type, User Type, System Mode, Functional and Operational Profile, Test Selection - Selecting Operations, Regression Test, Special Issues – Indirect Input Variables, Updating, Distributed system, CASE STUDY - Application of DEFINITY & FASTAR, Power Quality Resource System.

Software Metrics: Introduction to Metrics, static and dynamic metrics, Design metrics, coding metrics, testing metrics and reliability metrics

RECOMMNEDED BOOKS:

1. Patric D.T.O Connor, 'Practical Reliability Engineering', 4th Edn., John Wesley & sons, **2003**.
2. John D. Musa, 'Software Reliability Engineering', 1st Edn., Tata McGraw Hill, **1999**.
3. Michael Lyu, 'Handbook of Software Reliability Engineering', IEEE Computer Society Press, **1996**.

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USABILITY ENGINEERING

Subject Code: MCSE3-375 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

LEARNING OBJECTIVES:
To introduce the need for human-computer-interaction study or human-centered software design, usability engineering lifecycle for designing a user-friendly software, information, interaction and GUI design process for enhancing user-experience and to develop usability evaluation skills for software testing.

LEARNING OUTCOMES:
CO1: Justify the need to study human-computer-interaction or human-factors while designing software.
CO2: Discuss the process of designing user-friendly software based on usability engineering guidelines.
CO3: Apply interaction design and UI design process in enhancing user-experience of an application.
CO4: Conduct usability evaluation of user-interfaces or software applications.

UNIT-I (11 Hrs.)

HCI AND USABILITY: What is HCI design? Disciplines contributing to HCI, Psychology of everyday things, Importance of human factors in design, Need Satisfaction curve of technology, Levels of human computer interaction What is Usability? benefits and cost savings, usability slogans, attributes of system acceptability, definition of usability, usability trade-Offs , categories of users and individual user differences, generations of user interfaces, scenario-based usability engineering case study - A Virtual Science Fair.

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UNIT – II (12 Hrs.)

THE USABILITY ENGINEERING LIFECYCLE: User research and requirements analysis, know the user, user-profile questionnaire, field-study methods, contextual inquiry and analysis, hierarchical task analysis, ethnography, cultural probe, affinity diagramming, persona, scenarios of use, use cases. Iterative Design, setting usability criteria or goals, participatory design (getting users involved), guidelines and heuristic evaluation, prototyping and scenarios, examples of problem scenarios, iterative design, interface evaluation, meta methods. Usability Heuristics, simple and natural dialogue, speak the users' language, minimize user memory load, consistency, feedback, clearly marked exits, shortcuts, good error messages, prevent errors, help and documentation, heuristic evaluation.

UNIT–III (11 Hrs.)

INFORMATION DESIGN AND INTERACTION DESIGN: Information design, Information architecture concepts, stages of action in human-computer interaction, perceiving information, interpreting information, making sense of information. Interaction Design, selecting system goal, planning action sequence, executing action sequence, case study of information and interaction design User Interface Design, Goals of UID, User Interface Models, conceptual model and mock-ups of GUI, choosing prototyping alternatives - paper prototyping, rapid prototyping, storyboarding, wireframes, Cost/benefit of good interface design, Case Study.

UNIT–IV (11 Hrs.)

USABILITY EVALUATION: Developing usability specifications for evaluation - case study, criteria for user feedback techniques, formative and summative techniques of evaluation Usability Inspections (testing without users), heuristic evaluation, user-interface guideline reviews, cognitive walkthrough, model-based analysis Usability Testing (testing with users), developing usability or test specifications with case study , test goals and test plans , getting test users, choosing experimenters, ethical aspects of tests with human subjects, test tasks, stages of a test, performance measurement, thinking-aloud testing, usability laboratories, remote evaluation, Methods beyond testing, observation, user satisfaction questionnaire (rating scale), interviews, system usability scale (SUS), focus groups, logging actual use, user feedback, choosing a methods.

RECOMMENDED BOOKS:

1. J. Nielsen, ‘Usability Engineering’, 1st Edn., Elsevier, **1994**.
2. M.B. Rosson, & J.M. Carroll, ‘Usability Engineering: Scenario-Based Development of Human-Computer Interaction’, 1st Edn., Elsevier, **2001**.
3. D. Mayhew, ‘The Usability Engineering Lifecycle: A Practitioner's Handbook for User Interface Design’, 1st Edn., Morgan Kaufmann, **1999**.
4. A. Cooper et. al., ‘The Essentials of Interaction Design’,4th Edn., Wiley, **2007.**
5. B. Schneiderman, ‘Designing the User Interface’, 6th Edn., Pearson Education, **2005**.
6. A. Dix et. al., ‘Human - Computer Interaction’,3rd Edn., Prentice Hall, **1993**.
7. T. Mandel, ‘Elements of User Interface Design’, 2nd Edn., John Wiley & Sons, **2007.**
8. Rogers et. Al., ‘Interaction Design’, 3rd Edn., John Wiley & Sons, **2011**.
9. D. Norman, ‘The Design of Everyday Things’, Revised and expanded Edition, Basic Books, **2013**.
10. Donna Spencer, ‘A Practical Guide to Information Architecture’, Five Simple Steps, **2011**.
11. W. Galitz, ‘The Essential Guide to User Interface Design’, 3rd revised Edn., Wiley, **2002.**

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M.Tech. Computer Science & Engineering (1st SEM.)
TOTAL CONTACT HRS. = 24, TOTAL CREDITS = 22

LEARNING		**Contact Hrs.**			**Marks**			**Credits**
Code	**Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
MCSE1-101	Advanced Data Structures and Algorithm	**3**	**1**	**0**	**40**	**60**	**100**	**4**
MCSE1-102	Research Methodologies	**3**	**1**	**0**	**40**	**60**	**100**	**4**
MCSE1-103	Soft Computing	**3**	**1**	**0**	**40**	**60**	**100**	**4**
Departmental Elective-I		**3**	**1**	**0**	**40**	**60**	**100**	**4**
MCSE1-156	Agile Software Development							
MCSE1-157	Software Testing & Validations							
MCSE1-158	Software Engineering Concepts and Methodologies							
MCSE1-159	Business Intelligence and Applications							
Departmental Elective-II		**3**	**1**	**0**	**40**	**60**	**100**	**4**
MCSE1-160	Cryptography & Network Security							
MCSE1-161	Advanced Operating System							
MCSE1-162	Information Security							
MCSE1-163	Distributed Systems							
MCSE1-104	Practical Lab.-I	**0**	**0**	**4**	**60**	**40**	**100**	**2**
Total 5 Theory & 1 Lab. Courses		**15**	**5**	**04**	**260**	**340**	**600**	**22**

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M.Tech. Computer Science & Engineering (2nd SEM.)
TOTAL CONTACT HRS. = 24, TOTAL CREDITS = 22

LEARNING		**Contact Hrs.**			**Marks**			**Credits**
Code	**Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
MCSE1-205	Advanced Databases	**3**	**1**	**0**	**40**	**60**	**100**	**4**
MCSE1-206	Advanced Computer Network	**3**	**1**	**0**	**40**	**60**	**100**	**4**
Departmental Elective-III		**3**	**1**	**0**	**40**	**60**	**100**	**4**
MCSE1-264	Information Retrieval							
MCSE1-265	Web Mining							
MCSE1-266	Data Warehousing and Data Mining							
MCSE1-267	Enterprise Resource Planning							
Departmental Elective-IV		**3**	**1**	**0**	**40**	**60**	**100**	**4**
MCSE1-268	Web Technology							
MCSE1-269	Java							
MCSE1-270	Artificial Neural Networks							
MCSE1-271	Open Source Technology							
Open Elective-I		**3**	**1**	**0**	**40**	**60**	**100**	**4**
MCSE1-207	Practical Lab.-II	**0**	**0**	**4**	**60**	**40**	**100**	**2**
Total 5 Theory & 1 Lab. Courses		**15**	**5**	**04**	**260**	**340**	**600**	**22**

M.Tech Computer Science & Engineering (3rd SEM.)
TOTAL CONTACT HRS. = 8, TOTAL CREDITS = 22

LEARNING		Contact Hrs.			Marks			Credits
Code	**Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
Departmental Elective-V		3	1	0	40	60	100	4
MCSE1-372	Semantic Web and Social Network							
MCSE1-373	Natural Language Processing							
MCSE1-374	Big Data & Cloud Computing							
MCSE1-375	Digital Image Processing							
Open Elective-II		3	1	0	40	60	100	4
MCSE1-308	**Project**	-	-	-	60	40	100	10
MCSE1-309	**Seminar**	-	-	-	60	40	100	4
Total 2 Theory Courses		6	2	0	200	200	400	22

M.Tech Computer Science & Engineering (4th SEM.)
TOTAL CREDITS = 24

LEARNING		Contact Hrs.			Marks			Credits
Code	**Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
MCSE1-410	Dissertation	0	0	0	60	40	100	24
Total		0	0	0	60	40	100	24

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Total Marks = 600 + 600 + 400 + 100 = 1700
Total Credits = 22 + 22 + 22 + 24 = 90

ADVANCED DATA STRUCTURES AND ALGORITHMS

MCSE1-101 **MCSE2-101,** **MCSE3-101,** **MCSE4-101**	**L T P C** **3 1 0 4**	**Duration: 45 Hrs.**

LEARNING OBJECTIVES:

To learn the advanced concepts of data structure and algorithms and its implementation. The LEARNING has the main ingredients required for a computer science graduate and has all the necessary topics for assessment of data structures and algorithms.

LEARNING OUTCOMES:

CO1: Ability to apply and implement various data structures to algorithms and to solve problems.

CO2: Basic ability to analyze algorithms and to determine algorithm correctness and time efficiency class.

CO3: Ability to apply various traversing, finding shortest path and text pattern matching algorithm.

CO4: Know the concepts of tractable and intractable problems and the classes P, NP and NP-complete problems.

UNIT-I (12 Hrs.)

Introduction to Basics: Significance and need of various data structures and algorithms, Arrays, linked lists, Stacks, Queues, Priority queues, Heaps; Strategies for choosing the appropriate data structures.

Advanced Data Structures: Binary Search Tree**,** AVL Trees, Red-Black Trees, Splay Trees, B-trees, Fibonacci heaps, Data Structures for Disjoint Sets, Augmented Data Structures.

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UNIT-II (11 Hrs.)

Algorithms Complexity and Analysis: Probabilistic Analysis, Amortized Analysis, Competitive Analysis, Internal and External Sorting algorithms: Quick Sort, Heap Sort, Merge Sort, Counting Sort, Radix Sort.

UNIT-III (11 Hrs.)

Graphs & Algorithms: Representation, Type of Graphs, Paths and Circuits: Euler Graphs, Hamiltonian Paths & Circuits; Cut-sets, Connectivity and Separability, Planar Graphs, Isomorphism, Graph Coloring, Covering and Partitioning, bridges, Depth- and breadth-first traversals, Minimum Spanning Tree: Prim's and Kruskal's algorithms, Shortest-path Algorithms: Dijkstra's and Floyd's algorithm, Topological sort, Max flow: Ford-Fulkerson algorithm, max flow – min cut.

String Matching Algorithms: Suffix arrays, Suffix trees, Brute Force, Rabin-Karp, Knuth-Morris-Pratt, Boyer-Moore algorithm.

UNIT-IV (11 Hrs.)

Approximation algorithms: Need of approximation algorithms: Introduction to P, NP, NP-Hard and NP-Complete; Deterministic, non-Deterministic Polynomial time algorithms; Knapsack, TSP, Set Cover, Open Problems.

Randomized algorithms: Introduction, Type of Randomized Algorithms, 2-SAT; Game Theoretic Techniques, Random Walks.

RECOMMENDED BOOKS:

1. E. Horowitz, S. Sahni and Dinesh Mehta, 'Fundamentals of Data Structures in C++', Galgotia, **1999**.

2. Thomas H. Corman, Charles E. Leiserson, Ronald L. Rivest, 'Introduction to Algorithms', 3rd Edn., PHI, **2009**.
3. Adam Drozdex, 'Data Structures and algorithms in C++', 2nd Edn., Thomson Learning – Vikas Publishing House, **2001**.
4. G. Brassard and P. Bratley, 'Algorithmics: Theory and Practice', Prentice –Hall, **1988**.

RESEARCH METHODOLOGY

MCSE1-102 **L T P C** **Duration: 45 Hrs.**
MCSE2-102, **3 1 0 4**
MCSE3-102,
MCSE4-102
MREM0-101

LEARNING OBJECTIVES:
To define research and describe the research process and research methods.

LEARNING OUTCOMES:
CO1: Able to select and define appropriate research problem and Parameters.
CO2: Able to organize and conduct research in a more appropriate manner.
CO3: Able to understand and apply statistical me.

UNIT–I (11 Hrs.)

Introduction to Research: Meaning, Definition, OBJECTIVES and Process.
Research Design: Meaning, Types - Historical, Descriptive, Exploratory and Experimental.
Research Problem: Necessity of Defined Problem, Problem Formulation, Understanding of Problem, Review of Literature.
Design of Experiment: Basic Principal of Experimental Design, Randomized Block, Completely Randomized Block, Latin Square, Factorial Design.
Hypothesis: Types, Formulation of Hypothesis, Feasibility, Preparation and Presentation of Research Proposal.

UNIT–II (10 Hrs.)

Sources of Data: Primary and Secondary, Validation of Data.
Data Collection Methods: Questionnaire Designing, Construction.
Sampling Design & Techniques: Probability Sampling and Non Probability Sampling.
Scaling Techniques: Meaning & Types.
Reliability: Test – Retest Reliability, Alternative Form Reliability, Internal Comparison Reliability and Scorer Reliability.
Validity: Content Validity, Criterion Related Validity and Construct Validity.

UNIT–III (13 Hrs.)

Data Process Operations: Editing, Sorting, Coding, Classification and Tabulation.
Analysis of Data: Statistical Measure and Their Significance, Central Tendency, Dispersion, Correlation: Linear and Partial, Regression: Simple and Multiple Regression, Skewness, Time series Analysis, Index Number.
Testing of Hypothesis: T-test, Z- test, Chi Square, F-test, ANOVA.

UNIT – IV (11 Hrs.)

Multivariate Analysis: Factor Analysis, Discriminant Analysis, Cluster Analysis, Conjoint Analysis, Multi-Dimensional Scaling.
Report Writing: Essentials of Report Writing, Report Format.
Statistical Software: Application of Statistical Software like SPSS, MS Excel, Mini Tab or MATLAB Software in Data Analysis.

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**Each Student has to Prepare Mini Research Project on Topic/ Area of their Choice and Make Presentation. The Report Should Consists of Applications of Tests and Techniques Mentioned in The Above UNITs.*

RECOMMENDED BOOKS:

1. R.I. Levin and D.S. Rubin, 'Statistics for Management', 7th Edn., Pearson Education New Delhi.
2. N.K. Malhotra, 'Marketing Research–An Applied Orientation', 4th Edn., Pearson Education New Delhi.
3. Donald Cooper, 'Business Research Methods', Tata McGraw Hill, New Delhi.
4. Sadhu Singh, 'Research Methodology in Social Sciences', Himalaya Publishers.
5. Darren George & Paul Mallery, 'SPSS for Windows Step by Step', Pearson Education New Delhi.
6. C.R. Kothari, 'Research Methodology Methods & Techniques', 2nd Edn., New Age International Publishers.

SOFT COMPUTING

MCSE1-103, MCSE2-103, MCSE3-103, MCSE4-103	**L T P C 3 1 0 4**	**Duration: 45 Hrs.**

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LEARNING OBJECTIVES:

The OBJECTIVES of this LEARNING is to teach basic neural networks, fuzzy systems, Genetic Algorithms and optimization algorithms concepts and their relations**.**

LEARNING OUTCOMES:

CO1: Able to comprehend techniques and applications of Soft Computing in real world problems.

CO2: Able to follow fuzzy logic methodology and design fuzzy systems for various applications.

CO3: Able to design feed forward Artificial Neural Networks (ANN) and implement various methods of supervised learning.

CO4: Able to design feedback Artificial Neural Networks (ANN) and implement various methods of unsupervised learning

CO5: Able to appreciate the methodology of GA and its implementation in various applications.

UNIT-I (11 Hrs.)

Soft Computing: Introduction of soft computing, soft computing vs. hard computing, various types of soft computing techniques, applications of soft computing.

Fuzzy Logic: Fuzzy set versus crisp set, basic concepts of fuzzy sets, membership functions, basic operations on fuzzy sets and its properties. Fuzzy relations versus Crisp relation.

Fuzzy rule base system: Fuzzy propositions, formation, decomposition & aggregation of fuzzy rules, fuzzy reasoning, Fuzzy Inference Systems (FIS) – Mamdani Fuzzy Models – Sugeno Fuzzy Models – Tsukamoto Fuzzy Models, Fuzzification and Defuzzification, fuzzy decision making & Applications of fuzzy logic.

UNIT-II (12 Hrs.)

Structure and Function of a Single Neuron: Biological neuron, artificial neuron, definition of ANN and its applications. Neural Network architecture: Single layer and multilayer feed forward networks and recurrent networks. Learning rules and equations: Perceptron, Hebb's, Delta, winner take all and out-star learning rules. Supervised Learning Network: Perceptron

Networks, Adaptive Linear Neuron, Multiple Adaptive Linear Neuron, Back Propagation Network, Associative memory networks, Unsupervised Learning Networks: Competitive networks, Adaptive Resonance Theory, Kohnen Self Organizing Map.

UNIT-III (11 Hrs.)

Genetic Algorithm: Fundamentals, basic concepts, working principle, encoding, fitness function, reproduction, Genetic modeling: selection operator, cross over, mutation operator, Stopping Condition and GA flow, Constraints in GA, Applications of GA, Classification of GA.

UNIT-IV (11 Hrs.)

Hybrid Soft Computing Techniques: An Introduction, Neuro-Fuzzy Hybrid Systems, Genetic Neuro-Hybrid systems, Genetic fuzzy Hybrid and fuzzy genetic hybrid systems.

RECOMMENDED BOOKS:

1. S. Rajasekaran & G.A. Vijayalakshmi Pai, 'Neural Networks, Fuzzy Logic & Genetic Algorithms, Synthesis & applications', 1st Edn., PHI Publication, **2003**.
2. S.N. Sivanandam& S.N. Deepa, 'Principles of Soft Computing', 2nd Edn., Wiley Publications, **2008**.
3. Michael Negnevitsky, 'Artificial Intelligence', 2nd Edn., Pearson Education, New Delhi, **2008.**
4. Timothy J. Ross, 'Fuzzy Logic with Engineering Applications', 3rd Edn., Wiley, **2011.**
5. Bose, 'Neural Network fundamental with Graph, Algoithm & Application', TMH, **2004**.
6. Kosko, 'Neural Network & Fuzzy System', 1st Edn., PHI Publication, **2009.**
7. Klir & Yuan, 'Fuzzy sets & Fuzzy Logic: Theory & Application', PHI, **1995**.
8. Hagen, 'Neural Network Design', 2nd Edn., Cengage Learning, **2008**.

AGILE SOFTWARE DEVELOPMENT APPROACHES

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MCSE1-156,	**L T P C**	**Duration: 45 Hrs.**
MCSE2-156,	**3 1 0 4**	
MCSE4-156,		
MCSE3-205		

LEARNING OBJECTIVES:

This LEARNING makes student learn the fundamental principles and practices associated with each of the agile development methods. To apply the principles and practices of agile software development on a project of interest and relevance to the student.

LEARNING OUTCOMES:

CO1: To learn the basics concepts of Agile software and their principles design

CO2: To explain different agile development method, project tools requirement, risk and measurements related with different development methods.

CO3: To understand the overview of Agile methods, strategies, requirements and testing.

CO4: Describe and explain agile measurement, configuration and risk management. Principles of Astern and tools.

UNIT-I (11 Hrs.)

Introduction: Basics and Fundamentals of Agile Process Methods, Values of Agile, Principles of Agile, stakeholders, Challenges.

Agile and its Significance: Agile development, Classification of methods, the agile manifesto and principles, Practices of XP, Scrum Practices, working and need of Scrum, advanced Scrum Applications, Scrum and the Organization.

UNIT-II (12 Hrs.)

Agile Project Management: Embrace communication and feedback, Simple practices and project tools, Empirical Vs defined and prescriptive process – Principle-based versus Rule-Based – Sustainable discipline: The human touch – Team as a complex adaptive system – Agile hype – Specific agile methods. Quality, Risk, Metrics and Measurements, the facts of change on software projects – Key motivations for iterative development – Meeting the requirements challenge iteratively – Problems with the waterfall. Research evidence – Early historical project evidence – Standards-Body evidence, Expert and thought leader evidence – A Business case for iterative development – The historical accident of waterfall validity.

UNIT-III (11 Hrs.)

Agile Methodology: Method overview – Lifecycle – Work products, Roles and Practices values – Common mistakes and misunderstandings – Sample projects – Process mixtures – Adoption strategies – Fact versus fantasy – Strengths versus "Other" history.

Agile Requirements: User Stories, Backlog Management. Agile Architecture: Feature-Driven Development. Agile Risk Management: Risk and Quality Assurance, Agile Tools.

UNIT-IV (11 Hrs.)

Agile Testing: Agile Testing Techniques, Test-Driven Development, User Acceptance Test.

Agile Review: Agile Metrics and Measurements, The Agile approach to estimating and project variables, Agile Measurement, Agile Control: the 7 control parameters. Agile approach to Risk, The Agile approach to Configuration Management, The Atern Principles, Atern Philosophy, the rationale for using Atern, Refactoring, Continuous integration, Automated Build Tools.

RECOMMENDED BOOKS:

1. Elisabeth Hendrickson, 'Agile Testing', Quality Tree Software Inc., **2008**.
2. Craig Larman, 'Agile and Iterative Development – A Manager's Guide', 1st Edn., Pearson Education, **2004**.
3. Robert C. Martin, 'Agile Software Development, Principles, Patterns, and Practices (Alan Apt Series)', 2nd Edn., Pearson Education, **2003**.
4. Alistair Cockburn, 'Agile Software Development series', 1st Edn., Addison-Wesley Professional, **2001**.
5. Mike Cohn, 'Succeeding with Agile: Software Development Using Scrum', 1st Edn., Pearson, **2010**.

SOFTWARE TESTING & VALIDATION

MCSE1-157,	**L T P C**	**Duration: 45 Hrs.**
MCSE3-206	**3 1 0 4**	

LEARNING OBJECTIVES:

This LEARNING is designed to enable a clear understanding and knowledge of the foundations, techniques, and tools in the area of software testing and its practice in the industry. The LEARNING will prepare students to be leaders in software testing.

LEARNING OUTCOMES:

CO1: able to apply software testing knowledge, verification & validation and engineering methods.

CO2: Have an ability to design and conduct a software test process for a quality software test project.

CO3: Have an ability understand and identify various software testing problems, and solve these problems by designing and selecting software test models, criteria, strategies, and methods.

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CO4: Have an ability to use software testing methods and modern software testing tools for their testing projects.

UNIT-I (11 Hrs.)

Review of Software Engineering: Overview of software evolution, design models, development life cycle, unit and system testing, project management, maintenance, Concept of Software verification, validation and testing.

V & V and their Limitations: Theoretical Foundations: Impracticality of Testing All data; Impracticality of testing All Paths; No Absolute Proof of Correctness.

UNIT-II (12 Hrs.)

The Role of V & V in Software Evolution: Types of Products, Requirements; Specifications, Designs, Implementation, Charges, V & V OBJECTIVESs, Correctness, Consistency, Necessity Sufficiency, Performance.

Software Reliability and Quality Assurance: Software reliability, validation, safety and hazards analysis; features affecting quality of software. Concepts and importance of quality assurance, Software quality assurance strategies, FTR, structured walk through techniques.

UNIT-III (11 Hrs.)

Software V & V Approaches and their Applicability: Software Technical Reviews, Software Testing : Levels of testing, Module, Integration, System, Regression, Testing techniques and their Applicability, Functional testing and Analysis Structural testing and Analysis, Error Oriented testing and Analysis, Hybrid Approaches, Integration Strategies, Transaction Flow Analysis, Stress Analysis, Failure Analysis, Concurrency Analysis, Performance Analysis Proof of Correctness, Simulation and Prototyping, Requirements Tracing.

UNIT-IV (11 Hrs.)

Software V & V Planning, Identification and Selection Techniques: requirements, Specifications, Designs, Implementations, Changes, Organizations Responsibilities, Development Organization Independent Test Organization, Software Quality Assurance, Independent V &V contractor, V & V Standards, Integrating V & V Approaches, Problem Tracking Test Activities, Assessment.

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RECOMMENDED BOOKS:

1. William Perry, ‘Effective Methods for Software Testing’, John Wiley & Sons, **1995**.
2. Mare Roper, ‘Software Testing’, McGraw Hill Book Co., **1994**.
3. Cem Kaner, Jack Falk, Nguyen Quoc, ‘Testing Computer Software’, 2nd Edn., Van Nostrand Reinhold, **1993**.
4. Ron Patton, ‘Software Testing’, 2nd Edn., **2009.**
5. K.K. & Yogesh Singh, ‘Software Engineering; Agricultural’, New Age International, **2001**.
6. James Mc Manus I & Gordon Schulmeyer Van Nostrand Reinhold, Handbook of Software Quality Assurance, **1992.**
7. Ronald Owston, Van Nostrand Reinhold, ‘Software System Testing and Quality Assurance’, **1984**.
8. Michael Deutch Prentice Hall, ‘Software Verification and Validation: Realistic Project Approach’, **1982**.

SOFTWARE ENGINEERING CONCEPTS AND METHODOLOGIES

MCSE1-158, **MCSE3-158**	**L T P C** **3 1 0 4**	**Duration: 45 Hrs.**

LEARNING OBJECTIVES:

To impart knowledge on software engineering concepts and methodologies. To develop skills that will help the students to construct software using different methodologies and advanced techniques.

LEARNING OUTCOMES:

CO1: To study project management concepts.
CO2: To understand the role of formal methods and reengineering.
CO3: To understand the use of advanced techniques to develop the software.
CO4: To study the special requirements and development of different types of systems.

UNIT-I (11 Hrs.)

Project Management: The management spectrum, The People; stakeholders, software team, Agile teams, coordination and communication issues, The product; problem decomposition, The process; modeling the product and process, process decomposition, The W^5 HH principle, RAD model, Metrics for process and projects, software measurements. Agile Methodology- Scrum and XP.

Cleanroom Software Engineering: The cleanroom approach, Functional specification, Cleanroom design and testing.

UNIT-II (12 Hrs.)

Formal Methods: Basic concepts, mathematical preliminaries, Applying mathematical notions for formal specification, Formal specification languages, Z specification Language, Formal methods- the road ahead.

Reengineering: Business process reengineering, Software reengineering, Reverse reengineering, Restructuring, Forward reengineering, economics of reengineering.

UNIT-III (11 Hrs.)

Component-Based Software Engineering: Engineering of component -based systems, CBSE process, Domain engineering, Component-based development, Classifying and retrieving components and economics of CBSE.

Computer-Aided Software Engineering: Building Blocks for CASE, taxonomy of CASE tools, integrated CASE environments, Integration architecture, and CASE repository.

UNIT-IV (11 Hrs.)

Web Engineering: Attributes of web-based applications, the Web E process, a framework for Web E. Formulating, Analyzing Web-based systems, design and testing for web-based applications, Management issues.

Client/Server Software Engineering: Structure of client/server systems, Software engineering for Client/Server systems, Analysis modeling issues, Design for Client/Server systems, Testing issues.

RECOMMENDED BOOKS:

1. Roger S. Pressman, 'Software Engineering a Practitioners Approach', 5th Edn., McGraw Hill, **2014**.
2. Sommerville, 'Software Engineering', 7th Edn., Pearson**, 2005**.
3. J. Bowan, 'Formal Specification and Documentation Testing - A Case Study Approach', International Thomson Computer Press, **2003**.
4. James S. Peters, Witold Pedrycz, 'Software Engineering an Engineering Approach', Wiley India, **2011**.

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BUSINESS INTELLIGENCE AND ITS APPLICATIONS

Subject Code: MCSE1-159	L T P C 3 1 0 4	Duration: 45 Hrs.

LEARNING OBJECTIVES:

The proposed LEARNING exposes engineering/management students to Business Intelligence domain. The Core Modules of this LEARNING includes introduction to BI terminologies and framework, basics of data integration (Extraction Transformation Loading), introduction to multi-dimensional data modeling, basics of enterprise reporting and application of the concepts using open source/Microsoft tools.

LEARNING OUTCOMES:

CO1: Differentiate between Transaction Processing and Analytical applications and describe the need for Business Intelligence.

CO2: Demonstrate understanding of technology, processes associated with Business Intelligence framework, Data Warehouse implementation methodology and project life cycle.

CO3: Given a business scenario, identify the metrics, indicators and make recommendations to achieve the business goal.

CO4: Design an enterprise dashboard that depicts the key performance indicators which helps in decision making and demonstrate application of concepts in Microsoft BI suite.

UNIT-I (11 Hrs.)

Introduction: Business Intelligence, OLTP and OLAP, BI Definitions & Concepts, Business Applications of BI, BI Framework, Role of Data Warehousing in BI, BI Infrastructure Components – BI Process, BI Technology, BI Roles & Responsibilities.

UNIT-II (12 Hrs.)

Basics of Data Integration (Extraction Transformation Loading), Concepts of data integration need and advantages of using data integration, introduction to common data integration approaches, introduction to ETL using SSIS, Introduction to data quality, data profiling concepts and applications.

UNIT-III (11 Hrs.)

Introduction to Multi-Dimensional Data Modeling, Introduction to data and dimension modeling, multidimensional data model, ER Modeling vs. multi-dimensional modeling, concepts of dimensions, facts, cubes, attribute, hierarchies, star and snowflake schema, introduction to business metrics and KPIs, creating cubes using SSAS.

UNIT-IV (11 Hrs.)

Basics of Enterprise Reporting, Introduction to enterprise reporting, concepts of dashboards, balanced scorecards, introduction to SSRS Architecture, enterprise reporting using SSRS.

RECOMMENDED BOOKS:

1. R.N. Prasad, Seema Acharya, ‘Fundamentals of Business Analytics’, **2011**.
2. David Loshin, ‘Business Intelligence’, **2003.**
3. Mike Biere, ‘Business Intelligence for the Enterprise’, 1st Edn., **2003**.
4. Larissa Terpeluk Moss, Shaku Atre, ‘Business intelligence roadmap’, 1st Edn., **2003**.
5. Cindi Howson, ‘Successful Business Intelligence: Secrets to Making Killer BI Applications’, 2nd Edn., **2013.**
6. Brain, Larson, ‘Delivering business intelligence with Microsoft SQL Server **2008’**.
7. Lynn Langit, ‘Foundations of SQL Server 2005 Business Intelligence’, 1st Edn., **2007.**
8. Stephen Few, ‘Information Dashboard Design’, **2013.**

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CRYPTOGRAPHY & NETWORK SECURITY

MCSE1-160, **MCSE4-206,** **MCSE2-206**	**L T P C** **3 1 0 4**	**Duration: 45 Hrs.**

LEARNING OBJECTIVES:

The main OBJECTIVES of this LEARNING is to make student able to understand the basic concepts, services, threats and principles in network security, various security services and mechanisms in the network protocol stack.

LEARNING OUTCOMES:

CO1: Understand security trends.
CO2: Implement various cryptographic algorithms.
CO3: Explain the hash function.
CO4: Understand the network security and system level security used.

UNIT-I (11 Hrs.)

Security Trends: Attacks and services, Classical crypto systems, Different types of ciphers, LFSR sequences, Basic Number theory, Congruence, Chinese Remainder theorem, Modular exponentiation, Fermat and Euler's theorem, Legendre and Jacobi symbols, Finite fields, continued fractions.

UNIT-II (12 Hrs.)

Simple DES: Differential crypto analysis, DES – Modes of operation, Triple DES, AES, RC4, RSA, Attacks – Primality test – factoring.

UNIT-III (11 Hrs.)

Discrete Logarithms: Computing discrete logs, Diffie-Hellman key exchange, ElGamal Public key cryptosystems, Hash functions, Secure Hash, Birthday attacks, MD5, Digital signatures, RSA, ElGamal DSA.

UNIT-IV (11 Hrs.)

Authentication Applications: Kerberos, X.509, PKI – Electronic Mail security – PGP, S/MIME – IP security – Web Security – SSL, TLS, SET. Intruders, Malicious software, viruses and related threats, Firewalls, Security Standards.

RECOMMENDED BOOKS:

1. Wade Trappe, Lawrence C Washington, 'Introduction to Cryptography with Coding Theory', 2nd Edn., Pearson, **2007**.
2. William Stallings, 'Cryptography and Network Security Principles and Practices', 4th Edn., Pearson/PHI, **2006**.
3. W. Mao, 'Modern Cryptography – Theory and Practice', 2nd Edn., Pearson Education, **2007**.
4. Charles P. Pfleeger, Shari Lawrence Pfleeger, 'Security in Computing', 3rd Edn., Prentice Hall of India, **2006**.
5. Behrouz Forouzan, 'Cryptography & Network Security', 2nd Edn., McGraw Hill, **2011.**

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ADVANCED OPERATING SYSTEM

MCSE1-161, **MCSE4-162,** **MCSE2-161,** **MCSE3-161**	**L T P C** **3 1 0 4**	**Duration: 45 Hrs.**

LEARNING OBJECTIVES:

To learn the fundamentals of Operating Systems and gain knowledge on Distributed operating system concepts that includes architecture, Mutual exclusion algorithms, Deadlock detection algorithms and agreement protocols.

LEARNING OUTCOMES:

CO1**:** Discuss the various synchronization, scheduling and memory management issues.

CO2**:** Demonstrate the Mutual exclusion, Deadlock detection and agreement protocols of Distributed operating system.

CO3**:** Discuss the various resource management techniques for distributed systems.

CO4**:** Identify the different features of real time and mobile operating systems.

UNIT-I (11 Hrs.)

Fundamentals of Operating Systems: Strategies of operating system, Structures of operating system, overview – Synchronization Mechanisms – Processes and Threads - Process Scheduling –Deadlocks: Detection, Prevention and Recovery – Models of Resources – Memory Management Techniques.

Distributed Operating Systems: Issues in Distributed Operating System – Architecture – Communication Primitives –Lamport's Logical clocks – Causal Ordering of Messages – Distributed Mutual Exclusion Algorithms – Centralized and Distributed Deadlock Detection Algorithms – Agreement Protocols.

UNIT-II (12 Hrs.)

Distributed Resource Management: Distributed File Systems – Design Issues - Distributed Shared Memory – Algorithms for Implementing Distributed Shared memory–Issues in Load Distributing – Scheduling Algorithms – Synchronous and Asynchronous Check Pointing and Recovery – Fault Tolerance – Two-Phase Commit Protocol – Non blocking Commit Protocol – Security and Protection.

UNIT-III (11 Hrs.)

Real Time and Mobile Operating Systems: Basic Model of Real Time Systems - Characteristics- Applications of Real Time Systems –Real Time Task Scheduling - Handling Resource Sharing - Mobile Operating Systems –Micro Kernel Design - Client Server Resource Access – Processes and Threads – Memory Management – File system, Networked file system.

UNIT-IV (11 Hrs.)

CASE STUDIES: Linux System: Design Principles - Kernel Modules - Process Management Scheduling –Memory Management - Input-Output Management - File System – Interprocess Communication. iOS and Android: Architecture and SDK Framework - Media Layer -Services Layer - Core OS Layer – File System.

RECOMMENDED BOOKS:

1. Andrew S. Tanenbaum and Maarten van Steen, 'Distributed Systems: Principles and Paradigms', 2nd Edn., Prentice Hall, **2007**.
2. Mukesh Singhal and Niranjan G. Shivaratri, 'Advanced Concepts in Operating Systems – Distributed Database, and Multiprocessor Operating Systems', Tata McGraw Hill, **2001**.

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3. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, 'Operating System Concepts', 7th Edn., John Wiley & Sons, **2004**.
4. Daniel P. Bovet and Marco Cesati, 'Understanding the Linux kernel', 3rd Edn., O'Reilly, **2005**.
5. Rajib Mall, 'Real-Time Systems: Theory and Practice', Pearson Education India, **2006**.
6. Neil Smyth, 'iPhone iOS 4 Development Essentials – Xcode', 4th Edn., Payload Media, **2011**.

INFORMATION SECURITY

MCSE1-162, **MCSE4-157,** **MCSE2-157**	**L T P C** **3 1 0 4**	**Duration: 45 Hrs.**

LEARNING OBJECTIVES:

It will help the students to understand the various concepts related to network security. The students will learn various techniques/algorithms that can be used to achieve security. They will also learn the security basics for wireless networks.

LEARNING OUTCOMES:

CO1: To understand the concepts of network security.
CO2: To learn the techniques for authentication and authorization.
CO3: To be able to understand the confidentiality requirement and the ways to achieve it.
CO4: To know about wireless network security.

UNIT-I (11 Hrs.)

Overview: Computer Security Concepts, Challenges, Requirements, OSI security Architecture: services, mechanism and attacks, network security model, Classical encryption techniques, latest security trends, need of security strategy.

UNIT-II (12 Hrs.)

Authentication: Message authentication, message authentication techniques: Hash, MAC, digital Signatures, User Authentication: one-way authentication, mutual authentication, Password-based authentication, token based authentication, Biometric authentication, Remote User authentication.

Authorization: Identification, authorization, Access Control: Principles, Access Rights, Discretionary Access Control, Role Based Access Control, Unix File Access Control, Role Based Access Control Internet Authentication Applications: Kerberos, X.509, PKI, Federated Identity Management.

UNIT-III (11 Hrs.)

Confidentiality: Encryption, attacks, Symmetric Encryption: DES, AES, Asymmetric Encryption: RSA, Key Distribution scenario, Email security: S/ MIME, PGP.

Wireless network security: IEEE 802.11 wireless LAN, 802.11i wireless LAN security, Wireless Application Protocol, Wireless transport layer security, WAP End to End security.

UNIT IV-(11 Hrs.)

Database Security: The Need for Database Security, Database Management Systems, Relational Databases, Database Access Control, Inference, Statistical Databases, Database Encryption, Cloud Security.

RECOMMENDED BOOKS:

1. William Stalling, Lawrie Brown, 'Computer Security: Principles and Practice', Indian Edition, Pearson, **2010**
2. Chuck Easttom, 'Computer Security Fundamentals', Pearson, **2011**
3. M. Stamp, 'Information Security: Principles and Practice', 2nd Edn., Wiley, **2011**.

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4. M. E. Whitman and H. J. Mattord, ‘Principles of Information Security’, 4th Edn., Course Technology, **2011**.
5. M. Bishop, ‘Computer Security: Art and Science’, Addison Wesley.

DISTRIBUTED SYSTEMS

MCSE1-163, **MCSE2-266**	**L T P C** **3 1 0 4**	**Duration: 45 Hrs.**

LEARNING OBJECTIVES:

To study the various types of distributed systems, Models and various its various features.

LEARNING OUTCOMES:

CO1: To give the students an introduction about the basic Distributed systems, Models and some features of operating systems.

CO2: To give the introduction of Interprocess communication and other features. Also, the details of distributed file systems.

CO3: To give the students an introduction of various services like name services, name system etc., and distributed transaction features.

CO4: To understand the Distributed multi-media and its applications.

UNIT-I (11 Hrs.)

Characterization of Distributed Systems: Introduction, System models –Architectural and fundamental models with examples.

Operating System Support: Operating System layer, Protection, processes and threads, operating system architecture.

UNIT-II (12 Hrs.)

Interprocess Communication: API for internet protocol, Marshalling, Client server communication and group communication.

Distributed Objects and Remote Invocation: communication between Distributed objects, RPC and characteristics.

Distributed File System: File service architecture, network file system, Sun network file system, Andrew file system Case Study: Unix.

UNIT-III (11 Hrs.)

Name Services: Name services and domain name system, directory and discovery services Case Study: Global Name service.

Transaction and Concurrency Control: transactions, nested transactions, Locks, optimistic concurrency control, time stamp ordering, Comparison of methods for concurrency control.

Distributed Transaction: Flat and nested distributed transactions. Atomic Commit protocol, Distributed dead locks.

UNIT-IV (11 Hrs.)

Distributed Multimedia Systems: Characteristics of multimedia, multimedia data. Quality of service management, resource management, stream adaptation. Case study; Tiger video file server.

RECOMMENDED BOOKS:

1. G. Coulouis, et al., ‘Distributed Systems: Concepts and design’, 5th Edn., Pearson Education Asia, Pearson, **2011**.
2. A.S. Tanenbaum, ‘Modern operating Systems’, 3rd Edn., Prentince Hall, **2015**.
3. Seema Shah and Sunita Mahajan, ‘Distributed Computing’, 1st Edn., Oxford University Press, **2010**.

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PRACTICAL LAB.-I

Subject Code: MCSE1-104 **L T P C** **Duration: 60 Hrs.**
0 0 4 2

- Practical's should be related to the core subjects of the same semester.

ADAVANCED DATABASES

MCSE1-205 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

LEARNING OBJECTIVES:

The OBJECTIVES of this LEARNING is to study principal of database management system, distributed databases, parallel databases and emerging database technologies. To understand the basic principles, concepts and applications of data warehousing and data mining.

LEARNING OUTCOMES:

CO1: Be able to acquire the essential concept of ER Model and object oriented Databases and Schema Designs.

CO2: Be able to understand essential concept of parallel, distributed systems with concurrency control and their recovery.

CO3: Be able to cope up with XML databases and related advance topics.

CO4: Ability to do Conceptual, Logical, and Physical design of Data Warehouses OLAP applications and OLAP deployment and Data Mining.

UNIT-I (12 Hrs.)

Extended Entity Relationship Model and Object Model: Introduction to ER model, Subclasses, Super classes, Inheritance, Specialization and Generalization, Constraints and Characteristics of Specialization and Generalization. Relationship Types.

Object−Oriented Databases: Weakness of RDBMS, Overview of Object−Oriented Concepts. Object Identity, Object Structure, and Type Constructors, Encapsulation of Operations, Methods, and Persistence, Type Hierarchies and Inheritance; Database Schema Design for OODBMS; Overview of OQL, Persistent Programming Languages; OODBMS Architecture and Storage Issues.

Object Relational and Extended Relational Databases: Database Design for an ORDBMS, Nested Relations and Collections; Storage and Access methods, Query processing and Optimization; An Overview of SQL3; Comparison of RDBMS, OODBMS, ORDBMS.

UNIT-II (11 Hrs.)

Parallel and Distributed Databases and Client−Server Architecture: Introduction to Parallel Databases, architecture for Parallel Databases, I/O Parallelism, Inter and Intra Query Parallelism. Distributed Database Concepts, Data Fragmentation, Replication, and Allocation techniques for Distributed Database Design; Query Processing in Distributed Databases; Concurrency Control and Recovery in Distributed Databases. An Overview of Client−Server Architecture.

UNIT-III (11 Hrs.)

Databases on the Web and Semi Structured Data: Web Interfaces to the Web, Overview of XML; Structure of XML Data, Document Schema, Querying XML Data; Storage of XML Data, XML Applications; The Semi Structured Data Model, Implementation Issues. Indexes for Text Data.

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Enhanced Data Models for Advanced Applications: Active Database Concepts. Temporal Database Concepts; Spatial Databases, Concepts and architecture; Deductive Databases, Mobile Databases, Geographic Information Systems.

UNIT-IV (11 Hrs.)

Introduction to Data Warehousing: Introduction to Data warehouse and OLAP, Multidimensional data model, Data Warehouse architecture, data cubes, Operations on cubes, Data preprocessing- Need for preprocessing, Analysis of Data preprocessing. Introduction to data mining, Data mining functionalities, clustering, classification - decision tree, Bayesian classifiers, association rules - apriori algorithm, Introduction to text mining.

RECOMMENDED BOOKS:

1. R. Elmasri, S.B. Navathe, 'Fundamentals of Database Systems', 6th Edn., Pearson Education, **2010**.
2. Abraham Silberschatz, Henry. F. Korth and S. Sudharsan, 'Database System Concepts', 4th Edn., Tata McGraw Hill, **2004**.
3. Raghu Ramakrishna and Johannes Gehrke, Database Management Systems, 3rd Edn., Tata McGraw Hill, **2003**.
4. Arihant Khitcha, Neeti Kapoor, 'Advance Database Management System', 4th Edn., Genius Publications, **2014**.
5. S.S. Khandare, S. Chand, 'Database Management and Oracle Programming', 2nd Edn., **2010**.

ADVANCED COMPUTER NETWORKS

Subject Code: MCSE1-206	**L T P C** **3 1 0 4**	**Duration: 45 Hrs.**

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LEARNING OBJECTIVES:

This LEARNING provides knowledge about computer network related hardware and software using a layered architecture. It is also offer good understanding of the concepts of network security, wireless, Adhoc and various emerging network technologies.

LEARNING OUTCOMES:

CO1: Able to explain the Fundamentals of Computer Networks and their layered architecture. Also acquire knowledge about ATM Layered model and LAN Emulation.

CO2: Able to explain about various Transport and Application Layer Protocols. Also acquire knowledge about various congestion control mechanisms and network management.

CO3: Able to explain Features, advantages and applications of Adhoc Networks, Adhoc versus Cellular networks, Network architecture and Technologies. Evolution with the examples of wireless communication systems other techniques of Cellular Networks like 2G, 2.5G and 3G Technologies. Also able to explain wireless local loop (WLL), Wireless and local Area Networks (WLANs).

CO4: Able to define the Fundamentals of network security, various authentication protocols and E-mail Security.

UNIT-I (11 Hrs.)

Computer Networks: Layered architecture, Asynchronous Transfer Mode- ATM layered model, switching and switching fabrics, network layer in ATM, QOS, LAN emulation.

UNIT-II (11 Hrs.)

Transport Layer: Elements of transport protocols; Internet transport protocols: TCP and UDP, TCP connection management, congestion control. Application Layer-Network application architectures: Client-server, P2P and hybrid; Application layer protocols: DNS, FTP, TFTP, TELNET, HTTP and WWW, SMTP and electronic mail; Network management and SNMP.

UNIT-III (13 Hrs.)

Adhoc and Cellular networks: Features, advantages and applications, Adhoc versus Cellular networks, Network architecture, Protocols: MAC protocols, Routing protocols, Technologies. Wireless Communication Systems- Evolution, examples of wireless communication systems, 2G Cellular networks, Evolution for 2.5G TDMA Standards, IS-95B for 2.5G CDMA. Wireless and Mobile Networks-Wireless links and network characteristics, wireless local loop (WLL), Local Multipoint Distribution System (LMDS), Wireless local Area Networks (WLANs), Bluetooth and Personal Area Networks.

UNIT-IV (10 Hrs.)

Introduction to Network Security: Cryptography, symmetric and public-key algorithms, digital signatures, communication security, and authentication protocols, E-mail security, PGP and PEM.

RECOMMENDED BOOKS:

1. B.A. Forouzan, 'Data Communication and Networking', 5th Edn., Tata McGraw-Hill, **2013**.
2. A.S. Tanenbaum, 'Computer Networks', 4th Edn., Pearson Education, **2002.**
3. William Stallings, 'Network Security and Cryptography', 6th Edn., Prentice Hall of India, **2013**.
4. Theodore S. Rappaport, 'Wireless Communication: Principles and Practices', 2nd Edn., Pearson Education, **2001**.
5. D.E. Comer and R.E. Droms, 'Computer Networks and Internets', Prentice Hall, 4th Edn., **1998**.
6. Sunil Kumar S. Manvi, Mahabaleshwar S. Kakkasageri, 'Wireless and Mobile Networks: Concepts and Protocols', 2nd Edn., Wiley India, **2016**.

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INFORMATION RETRIEVAL

Subject Code: MCSE1-264 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

LEARNING OBJECTIVES:

To learn the underlying technologies of modern information retrieval system.

LEARNING OUTCOMES:

CO1: Able to understand the basic concepts of modern information retrieval system.
CO2: Able to understand the search engine architecture.
CO3: Able to learn the retrieval models and apply the algorithms of retrieval algorithms.
CO4: Able to evaluate the quality of retrieval system.

UNIT-I (11 Hrs.)

Introduction: The nature of unstructured and semi-structured text, Boolean queries, World Wide Web, History of Hypertext, Hypertext systems, Problems due to Uniform accessibility, types of Hypertext data, Text and multimedia data indexing, PageRank, HITS, XML and Semantic web.

UNIT-II (12 Hrs.)

Search Engine Architecture: The basic building blocks of a modern search engine system, including web crawler, basic text analysis techniques, inverted index, query processing, search result interface.

UNIT-III (11 Hrs.)

Retrieval Models: Boolean, vector space, probabilistic and language models, latent semantic indexing, ranking algorithm, Introduction to the most recent development of learning-based ranking algorithms, i.e., learning-to-rank, Relevance feedback, query expansion, link analysis and search applications.

UNIT-IV (11 Hrs.)

Performance Evaluation: Evaluating search engines, User happiness, precision, recall, F-measure.

RECOMMENDED BOOKS:

1. Christopher D. Manning, Prabhakar Raghavan, and Hinrich Schutze, 'Introduction to Information Retrieval, 1st Edn., Cambridge University Press, **2008**.
2. Bruce Croft, Donald Metzler and Trevor Strohman, 'Search Engines: Information Retrieval in Practice', 1st Edn., Pearson Education, **2009**.
3. Yates Ricardo and Berthier Ribeiro-Neto, 'Modern Information Retrieval', 2nd Edn., Addison-Wesley, **2011**.
4. Soumen Chakrabarti, 'Mining the Web', 1st Edn., Morgan-Kaufmann, **2002.**

WEB MINING

Subject Code: MCSE1-265 **L T P C** **Duration: 45 Hrs.**

3 1 0 4

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LEARNING OBJECTIVES:

To strengthen real network concept while crawling web and real large scale data structure. It develops the knowledge of web search engines, and related technologies and develops the skill to apply the learned knowledge in real problems.

LEARNING OUTCOMES:

CO1: Able to explain the basics of Search Engines and their architecture. Also acquire knowledge about Crawls and feeds.

CO2: Able to explain about Ranking with indexes, inverted indexes. Also acquire knowledge about Entropy and Ambiguity, Delta Encoding, Bit-aligned codes, Byte-aligned codes.

CO3: Able to explain about evaluating Search Engines, The Evaluation Corpus, Logging, Effectiveness Metrics, Recall and Precision, Averaging and Interpolation, Efficiency Metrics, Training, Significance Tests, Setting Parameter Values.

CO4: Able to explain various Classification and Clustering Methods. Also acquire knowledge about Social Search, indexing and mechanisms.

UNIT-I (11 Hrs.)

Basic Search Engines and information Retrieval: Architecture of a Search Engine, Basic Building Blocks (Text Acquisition, Text Transformation, Index Creation, User Interaction, Ranking Evaluation). Crawls and Feeds, deciding what to search, Crawling the Web, Directory Crawling, Document Feeds, Storing the Documents, Detecting Duplicates, Removing Noise.

UNIT-II (11 Hrs.)

Ranking with Indexes: Abstract Model of Ranking, Inverted indexes, Documents, Counts, Positions, Fields and Extents, Scores, Ordering, Compression, Entropy and Ambiguity, Delta Encoding, Bit-aligned codes, Byte-aligned codes, Looking ahead.

UNIT-III (11 Hrs.)

Evaluating Search Engines: Why Evaluate? The Evaluation Corpus, Logging, Effectiveness Metrics, Recall and Precision, Averaging and Interpolation, Focusing On the Top

Documents, Using Preferences, Efficiency Metrics, Training, Testing, and Statistics, Significance Tests, Setting Parameter Values, Bottom Line.

UNIT-IV (12 Hrs.)

Classification and Clustering: Classification and Categorization, Naïve Bayes, Support Vector Machines, Evaluation, Classifier and Feature Selection, Spam, Sentiment, and Online Advertising, Clustering, Hierarchical and *K*-Means Clustering, *K* Nearest Neighbour Clustering, Social Search, What is Social Search?, User Tags and Manual Indexing, Searching With Communities, Filtering and, Recommending, Document Filtering, Collaborative Filtering, Personalization, Peer-to-Peer and Meta search, Distributed search, P2P Networks.

RECOMMENDED BOOKS:

1. Soumen Chakrabarti, Mining the Web, 1st Edn., Morgan-Kaufmann, **2002**.
2. Christopher D. Manning, Prabhakar Raghavan, and Hinrich Schutze, 'Introduction to Information Retrieval', 1st Edn., Cambridge University Press, **2008.**

DATA WAREHOUSING AND DATA MINING

Subject Code: MCSE1-266 **L T P C** **Duration: 45 Hrs.**

3 1 0 4

LEARNING OBJECTIVES:

Concept of Data mining and warehousing, applications to real life examples. The study of data warehousing and various data mining tools.

LEARNING OUTCOMES:

CO1: To introduce the basic concepts of Data Warehouse and Data Mining techniques.

CO2: To process raw data to make it suitable for various data mining algorithms.

CO3: To discover interesting patterns, analyze supervised and unsupervised models and estimate the accuracy of the algorithms.

CO4: Apply the techniques of clustering, classification, association finding, feature selection and visualization to real world data.

UNIT-I (11 Hrs.)

Data Warehousing: Introduction, ETL, Data warehouses– design guidelines for data warehouse implementation, Multidimensional Models; OLAP- introduction, Characteristics, Architecture, Multidimensional view and data cube, Data cube operations, data cube computation.

Review of the Basic Data Analytic Methods using R: Introduction to R –look at the data, Analyzing and Exploring the Data, Statistics for Model Building and Evaluation.

UNIT-II (11 Hrs.)

Data Mining: Introduction, association rules mining, Naive algorithm, Apriori algorithm, direct hashing and pruning (DHP), Dynamic Item set counting (DIC), Mining frequent pattern without candidate generation (FP, growth), performance evaluation of algorithms.

UNIT-III (11 Hrs.)

Classification: Introduction, decision tree, tree induction algorithms – split algorithm based on information theory, split algorithm based on Gini index; naïve Bayes method; estimating predictive accuracy of classification method.

UNIT-IV (12 Hrs.)

Cluster Analysis: Introduction, partitional methods, hierarchical methods, density based methods, dealing with large databases, cluster software; Search engines: Characteristics of Search engines, Search Engine Functionality, Search Engine Architecture, Ranking of web pages, The search engine history, Enterprise Search, Enterprise Search Engine Software.

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Web Data Mining: Web Terminology and Characteristics, Locality and Hierarchy in the web, Web Content Mining, Web Usage Mining, Web Structure Mining, Web mining Software.

RECOMMENDED BOOKS:

1. Carlo Vercellis, 'Business Intelligence: Data mining and Optimization for Decision Making', Wiley, **2013**.
2. J. Han, M. Kamber and J. Pei, 'Data Mining Concepts and Techniques', Morgan Kaufmann Publishers, 3rd Edn., **2011**.
3. V. Pudi, P.R. Krishana, 'Data Mining', Oxford University Press, 1st Edn., **2009**.
4. P. Adriaans, D. Zantinge, 'Data Mining', Pearson Education Press, 1st Edn.., **1996**.
5. P. Pooniah, 'Data Warehousing Fundamentals', 1st Edn., Willey interscience Publication, **2001**.

ENTERPRISE RESOURSE PLANNING

Subject Code: MCSE1-267 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

LEARNING OBJECTIVES:

It gives knowledge about the various functions performed in the organizations to accomplish their targets. This LEARNING teaches the various business modules of an organization.

LEARNING OUTCOMES:

CO1: To understand the meaning of an enterprise and its related technologies.
CO2: To understand the various strategies used for ERP Implementation.
CO3: To give overview about various business modules used in an organization.
CO4: To understand the applications of an ERP system and study various ERP packages.

UNIT-I (11 Hrs.)

ERP AND Technology: Introduction, Related Technologies, Business Intelligence, E-Commerce and E-Business, Business Process Reengineering, Data Warehousing, Data Mining, OLAP, Product life Cycle management, SCM, CRM.

UNIT-II (12 Hrs.)

ERP Implementation: Implementation Challenges, Strategies, Life Cycle, Methodologies, Package selection, Project Teams, Process Definitions, Vendors and Consultants, Data Migration, Project management.

UNIT-III (11 Hrs.)

ERP in Action & Business Modules: Operation and Maintenance, Performance, Maximizing the ERP System, Business Modules, Finance, Manufacturing, Human Resources, Plant maintenance, Materials Management, Quality management, Marketing, Sales, Distribution and service.

UNIT-IV (11 Hrs.)

ERP Application and Market: Enterprise Application Integration, ERP II, Total quality management, Future Directions, SAP AG, Oracle, PeopleSoft, JD Edwards, QAD Inc, SSA Global, Lawson Software, Epicor, Intuitive.

RECOMMENDED BOOKS:

1. Alexis Leon, 'ERP DEMYSTIFIED', 2nd Edn., Tata McGraw Hill, **2008**.
2. Mary Sumner, 'Enterprise Resource Planning', Pearson Education, **2007**.
3. Jim Mazzullo, 'SAP R/3 for Everyone', Pearson, **2007**.
4. Jose Antonio Fernandz, 'The SAP R /3 Handbook', Tata McGraw Hill, **1998**.
5. Biao Fu, 'SAP BW: A Step-by-Step Guide', 1st Edn., Pearson Education, **2003**.

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WEB TECHNOLOGY

Subject Code: MCSE1-268 **L T P C** **Duration: 45 Hrs.**

3 1 0 4

LEARNING OBJECTIVES:

To study various web technologies used today.

LEARNING OUTCOMES:

CO1: To understand the meaning of internet and World Wide Web.

CO2: To understand HTML5 and various graphics used in HTML5.

CO3: To understand the various concepts used in JavaScript.

CO4: To understand the concept of AJAX and Java, Standard Controls, techniques to design website pages.

UNIT-I (11 Hrs.)

Internet and World Wide Web: Introduction, Internet Addressing, ISP, types of Internet Connections, Introduction to WWW, WEB Browsers, WEB Servers, URLS, http, WEB applications, Tools for WEB site creation.

HTML5: Introduction to HTML5, Lists, adding graphics to HTML5 page, creating tables, linking documents, forms, frames, Cascading Style sheets.

UNIT-II (12 Hrs.)

JavaScript: Introduction to JavaScript, programming constructs: variables, operators and expressions, conditional checking, functions and dialog boxes, JavaScript DOM, creating forms, introduction to Cookies. Introduction, HTTP request, XMHttpRequest, AJAX Server Script, AJAX Database.

PHP: Introduction, syntax, statements, operators, sessions, E-mail, PHP and MySQL.

UNIT-III (11 Hrs.)

JAVA: Introduction to java objects and classes, control statements, arrays, inheritance, polymorphism, Exception handling.

Standard Controls: Display information, accepting user input, submitting form data, displaying images, using the panel control, using the hyperlink control.

UNIT-IV (11 Hrs.)

Designing Website with Master Pages: Creating master pages, Modifying master page content, and Loading master page dynamically.

List Controls: Dropdown list control, Radio button list controls, list box controls, bulleted list controls, custom list controls.

Grid View Controls: Grid view control fundamentals, using field with the grid view control, working with grid view control events extending the grid view control.

RECOMMENDED BOOKS:

1. Harvey Deitel, Paul Deitel, Tem Nieto, and Praveen Sandhu, 'XML How to Program', Pearson Education, **2001**.
2. Herbert Schildt, Fatrick nanghton, 'The complete reference Java 2.0', 3rd Edn., McGraw Hill Professional, **1999**.
3. Ivan Bayross, 'Web Enabled Commercial Application', 4th Edn., BPB Publications, **2016**.
4. Steven M. Schafer, ' HTML, CSS, JavaScript, Perl, Python and PHP', Wiley India Textbooks, **2005**.

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JAVA

Subject Code: MCSE1-269 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

LEARNING OBJECTIVES:

The students should be able to create Java programs that leverage the object-oriented features of the Java language, such as encapsulation, inheritance and polymorphism; use data types, arrays and other data collections; implement error-handling techniques using exception handling**.** Understand and acquire knowledge of Servlets and JSP.

LEARNING OUTCOMES:

CO1: Understand fundamentals of object-oriented programming in Java, including defining classes, invoking methods, using class libraries, etc.

CO2: Create Java application programs that is interfaces and APIs and learn proper program structuring.

CO3: Be able to use the Java SDK environment to create, debug and run simple Java programs.

CO4: Understand Servlets, JSP to make use of it and address a particular software problem.

UNIT-I (11 Hrs.)

Introduction to Java programming: The Java Virtual Machine, Variables and data type, Conditional and looping constructs, Arrays. Object-oriented programming with Java Classes and Objects-Fields and Methods, Constructors, Overloading methods, Garbage collection, Nested classes. Inheritance- Overriding methods, Polymorphism, Making methods and classes final, Abstract classes and methods, Interfaces.

UNIT-II (12 Hrs.)

Exception Handling: With try-throw-catch-finally constructs, The Exception class. The Object class- Cloning objects, The JDK Linked List class, Strings, String conversions. Working with types- Wrapper classes, Enumeration interface, Packages- Package access, Documentation comments. Applets- Configuring applets, Applet capabilities and restrictions, Basics of AWT and Swing- Layout Managers, Event Handling, The Action Listener interface, Panels, Classes for various controls, such as label, choice, list, Checkbox, etc., Dialogs and frames, using menus, Using the adapter classes, Graphics.

UNIT-III (11 Hrs.)

Threads: Synchronization. The I/O Package-InputStream and OutputStream classes, Reader and Writer classes.Database connectivity with JDBC-Java security, Types of Drivers, Two-Tier Client/Server Model, Three-Tier Client/Server Model, Basic Steps of JDBC, Creating and Executing SQL Statement, The Result Set Object, Working with Database MetaData, Interface.

UNIT-IV (11 Hrs.)

Servlets: Servlet Interaction & Advanced Servlets, Life cycle of Servlet, Java Servlet Development Kit, Javax.servlet package, Reading Servlet Parameters, Reading Initialization Parameters, The javax.servlet.http Package, Handling HTTP. JavaServer Pages-JSP Technologies, Understanding the Client-Server Model, Understanding Web server software, Configuring the JSP Server, Handling JSP Errors.

RECOMMENDED BOOKS:

1. Bruce Eckel, ‘Thinking in Java’, 4th Edn., Prentice Hall, **2006**.
2. Herbert Schildt, Fatrick Nanghton, ‘The Complete Reference Java 2.0’, 3rd Edn., McGraw Hill Professional, **1999**.
3. Iver Harton, ‘Beginning in Java 2.0’, 7th Edn., Wrax Publications, **2011**.

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4. Paul Dietal, Harvey Dietal, 'Java How to Program', 9th Edn., Prentice Hall, **2011**.
5. Hortsmann, C.S. Cornell, 'Core Java Vol.-1 Fundamentals', 10th Edn., Pearson, **2016.**
6. Marty Hall, Larry Brown, 'Core Servlets & Java Server Pages Volume-1', 2nd Edn., Prentice, **2003**.

ARTIFICIAL NEURAL NETWORKS

Subject Code: MCSE1-270 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

LEARNING OBJECTIVES:
To understand the basics, architecture and applications of neural networks.
LEARNING OUTCOMES:
CO1: To give students an introduction to the basics and architecture of artificial Neural Network.
CO2: To understand the single layer ANN and its various learning algorithms.
CO3: To study in detail the concept of multi-Layer ANN and the various backpropagation algorithms.
CO4: To survey the applications of ANN in various fields such as pattern recognition.

UNIT-I (11 Hrs.)

Introduction and ANN Structure: Biological neurons and artificial neurons, Model of an ANN, Activation functions used in ANNs, Typical classes of network architectures.

Mathematical Foundations and Learning mechanisms: Re-visiting vector and matrix algebra, State-space concepts, Concepts of optimization, Error-correction learning, Memory-based learning, Hebbian learning, Competitive learning.

UNIT-II (12 Hrs.)

Single layer perceptrons: Structure and learning of perceptrons, Pattern classifier - introduction and Bayes' classifiers, Perceptron as a pattern classifier, Perceptron convergence, Limitations of a perceptrons.

Feedforward ANN: Structures of Multi-layer feedforward networks, Back propagation algorithm, Back propagation - training and convergence, Functional approximation with back propagation, Practical and design issues of back propagation learning.

UNIT-III (11 Hrs.)

Radial Basis Function Networks: Pattern separability and interpolation, Regularization Theory, Regularization and RBF networks, RBF network design and training, Approximation properties of RBF.

Support Vector machines: Linear separability and optimal hyperplane, Determination of optimal hyperplane, Optimal hyperplane for non-separable patterns, Design of an SVM, Examples of SVM.

UNIT-IV (11 Hrs.)

Competitive Learning and Self organizing ANN: General clustering procedures, Learning Vector Quantization (LVQ), Competitive learning algorithms and architectures, Self-organizing feature maps, Properties of feature maps.

Fuzzy Neural Networks: Neuro-fuzzy systems, Background of fuzzy sets and logic, Design of fuzzy stems, Design of fuzzy ANNs.

RECOMMENDED BOOKS:

1. Simon Haykin, 'Neural Networks: A comprehensive foundation', 2nd Edn., Pearson Education Asia.
2. Satish Kumar, 'Neural Networks: A Classroom Approach', Tata McGraw Hill, **2004**.

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3. Robert J. Schalkoff, ‘Artificial Neural Networks’, McGraw Hill International Editions, **1997**.

OPEN SOURCE TECHNOLOGIES

Subject Code: MCSE1-271 **L T P C** **Duration: 45 Hrs.**

3 1 0 4

LEARNING OBJECTIVES:

To give a brief introduction to the open source technology. Through interactive sessions enabling students to enhance their skills in contributing and implementing their technical knowledge.

LEARNING OUTCOMES:

CO1: Open source software history, initiatives and principles. Open standards, Licenses and FOSS.

CO2: Learn about the Open Source Operating system and its distributions like Fedora, Google chrome OS, Ubuntu.

CO3: Study of Web technologies based on open Software’s LAMP (Linux Apache MySqland PHP/Python).

CO4: To Learn HTML, XHTML, PHP and JavaScript.

UNIT-I (11 Hrs.)

Introduction: Open Source Definition, Free Software vs. Open Source Software, Public Domain Software, Open Source History, Initiatives, Principle and Methodologies. Open Standards.

Open Source Development Model Licenses and Patents: What Is a License, Important FOSS Licenses (Apache, BSD, GPL, LGPL), copyrights and copy lefts, Patents Economics of FOSS: Zero Marginal Cost, Income-generation opportunities, Problems with traditional commercial software, Internationalization.

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UNIT-II (12 Hrs.)

Open Source Operating Systems: Different open source operating systems. Google Chrome OS, BSD, Linux Distributions – Fedora and Ubuntu, Installation, Disk Partitioning, Boot loader. Using Linux – Shell, File system familiarity, Linux Administration – Managing users, services and software, Network Connectivity, Configurations and Security.

Open Source Web Technologies: Two Tier and Three Tier Web based Application Architecture. LAMP Terminologies, Advantages. Apache, Web server conceptual working, Web browser, HTTP, Installation and Configuration, httpd.conf file, Logging, Security, Running a website, MySQL, Database management system, ER diagram, Relational database, Installation, Configuration, Administration, Common SQL queries.

UNIT-III (11 Hrs.)

Programming on XHTML and XML: Editing XHTML, W3C XHTML validation services, designing XHTML by using XHTML tables, frames, forms and other elements. CSS and its types. XML, XML namespaces, DTD, XML schema, XML vocabularies, DOM and its methods, SOAP.

UNIT-IV (11 Hrs.)

Programming on PHP and Java Script: JavaScript: JavaScript variables, control structures, functions, arrays and objects. Cascading Style Sheets, Client Side Scripting - Java Script, PHP: Form processing and business logic, stream processing and regular expressions, viewing client/server environment variables, connecting to database and handling of cookies. SQL, Accessing databases with PHP.

Open Source Ethics: Open source vs. closed source Open source government, Open source ethics. Social and Financial impacts of open source technology, shared software, Shared source.

Case Studies: Mozilla (Firefox), Wikipedia, Joomla, Open Office, GCC.

RECOMMENDED BOOKS:

1. B. Ware, B. Lee J., 'Open Source Development with Lamp: Using Linux, Apache, MySQL, Perl, and PHP', Addison-Wesley Professional.
2. Deitel, 'Internet and World Wide Web, How to Program', 4th Edn., Prentice Hall, **2008.**
3. P. DuBois, MySQL, 4th Edn., Addison-Wesley Professional.
4. M. Zandstra, 'Teach Yourself PHP in 24 Hours', 2nd Edn., Sams Publishing.

PRACTICAL LAB.-II

Subject Code: MCSE1-207 **L T P C** **Duration: 60 Hrs.**
0 0 4 2

- Practical's should be related to the core subjects of the same semester.

SEMANTICS WEB AND SOCIAL NETWORKING

Subject Code: MCSE1-372 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

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LEARNING OBJECTIVES:

The OBJECTIVES of this LEARNING is to understand the need of semantic web in web services and advances the knowledge about Semantic Web Applications, Services and Social Networking.

LEARNING OUTCOMES:

CO1: Able to understand semantic web basics, architecture and technologies.

CO2: Able to understand the Knowledge Representation for the Semantic Web and Ontology Engineering.

CO3: Able to design and implement a web services application that "discovers" the data and/or other web services via the semantic web.

CO4: Able to discover the capabilities and limitations of semantic web technology for social networks.

UNIT-I (11 Hrs.)

Introduction: Introduction to the Syntactic web and Semantic Web, Evolution of the Web, the visual and syntactic web, Levels of Semantics, Metadata for web information, The semantic web architecture and technologies, Contrasting Semantic with Conventional Technologies, Semantic Modeling, Potential of semantic web solutions and challenges of adoption.

UNIT-II (12 Hrs.)

Knowledge Representation for the Semantic Web: Ontologies and their role in the semantic web, Ontologies Languages for the Semantic Web Resource Description Framework (RDF) / RDF Schema, fundamental concepts of Ontology Web Language (OWL), UML, XML/XML Schema.

Ontology Engineering: Ontology Engineering, Constructing Ontology, Ontology Development Tools, Ontology Methods, Ontology Sharing and Merging, Ontology Libraries and Ontology Mapping, Logic, Rule and Inference Engines.

UNIT-III (11Hrs.)

Semantic Web Applications, Services and Technology: Semantic Web applications and services, Semantic Search, e-learning, Semantic Bioinformatics, Knowledge Base, XML Based Web Services, Creating an OWL-S Ontology for Web Services, Semantic Search Technology, Web Search Agents and Semantic Methods.

UNIT-IV (11 Hrs.)

Social Network Analysis and Semantic Web: What is social Networks analysis, development of the social networks analysis, Electronic Sources for Network Analysis – Electronic Discussion networks, Blogs and Online Communities, Web Based Networks, Building Semantic Web Applications with social network features.

RECOMMENDED BOOKS:

1. Peter Mika, 'Social Networks and the Semantic Web', 1st Edn., Springer, **2007**.
2. Berners Lee, Godel and Turing, 'Thinking on the Web', Wiley Inter Science, **2009**.
3. Liyang Yu, 'A Developer's Guide to the Semantic Web', 1st Edn., Springer, **2011**.
4. John Hebeler, Matthew Fisher, Ryan Blace and Andrew Perez-Lopez, 'Semantic Web Programming', 1st Edn., Wiley, **2009**.

NATURAL LANGUAGE PROCESSING

Subject Code: MCSE1-373 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

LEARNING OBJECTIVES:

To describe the techniques and algorithms used in processing natural languages.

LEARNING OUTCOMES:

CO1: To understand the concept of Natural Language Processing (NLP), Challenges of NLP, NLP Applications, Understanding different levels of language analysis.

CO2: To understand concepts related to morphology and parsing in detail.

CO3: To study Need of Machine translation, Problems of Machine Translation, MT Approaches.

CO4: To study about lexical knowledge network and speech recognition.

UNIT –I (11 Hrs.)

Introduction: Natural Languages, Origin of Natural Language Processing (NLP), Challenges of NLP, Application of Natural Language, Understanding Different levels of language analysis.

Regular Expressions, Finite state automata, Morphological analysis: Inflectional and derivational morphology, Finite state morphological parsing.

UNIT-II (12 Hrs.)

Words and Word Forms: Morphology fundamentals; Morphological Diversity of Indian Languages; Morphology Paradigms; Finite State Machine Based Morphology; Automatic Morphology Learning; Shallow Parsing; Named Entities; Maximum Entropy Models; Random Fields, Scope Ambiguity and Attachment Ambiguity resolution.

Structures: Theories of Parsing, Parsing Algorithms: Top down parsing, bottom up parsing, Problems with top down and bottom up parsing, Robust and Scalable Parsing on Noisy Text as in Web documents; Hybrid of Rule Based and Probabilistic Parsing; Scope Ambiguity and Attachment Ambiguity resolution.

UNIT-III (11 Hrs.)

Machine Translation: Need of MT, Problems of Machine Translation, MT Approaches, Direct Machine Translations, Rule-Based Machine Translation, Knowledge Based MT

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System, Statistical Machine Translation, UNL Based Machine Translation, Translation involving Indian Languages.

UNIT-IV (11 Hrs.)

Meaning: Lexical Knowledge Networks, WorldNet Theory; Indian Language Word Nets and Multilingual Dictionaries; Semantic Roles; Word Sense Disambiguation; WSD and Multilinguality; Metaphors.

Speech Recognition: Issues in Speech Recognition, The Sound Structure of Language, Speech Recognition, Signal processing and analysis method, Articulation and acoustics, Phonology and phonetic transcription, Word Boundary Detection; Argmax based computations; HMM and Speech Recognition.

RECOMMENDED BOOKS:

1. J. Allen, ‘Natural Language Understanding’, 2nd Edn., Benjamin/Cunnings, **1987**.
2. Siddiqui and Tiwary U.S., ‘Natural Language Processing and Information Retrieval’, 1st Edn., Oxford University Press, **2008**.
3. K. Jensen, G.E. Heidorn, S.D. Richardson, ‘Natural Language Processing: The PLNLP Approach’, Springer, **2013**.
4. P. Roach, ‘Phonetics’, Oxford University Press, **2012**.

BIG DATA & CLOUD COMPUTING

Subject Code: MCSE1-374 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

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LEARNING OBJECTIVES:

This LEARNING will help you in learning Big data with Cloud technology to understand what is cloud storage, Big data in the cloud, characteristics of cloud computing, cloud computing services and cloud hosting, cloud data storage and deployment models, cloud computing companies and cloud service providers, cloud infrastructure, advantages of cloud computing and issues with cloud computing.

LEARNING OUTCOMES:

CO1: Ability to learn basics of Big data, Hadoop and Map Reduce.

CO2: Able to learn the basics of Hive, HQL, HBase schema design, PIG and NoSQL.

CO3: Understand various basic concepts related to cloud computing technologies, architecture and concept of different cloud models: IaaS, PaaS, SaaS. Cloud virtualization, cloud storage, data management and data visualization.

CO4: Understand different cloud programming platforms & tools and familiar with application development and deployment using cloud platforms.

UNIT I (11 Hrs.)

Introduction – Introduction to Big Data and its importance, 5v’s of Big Data, Security Challenges, Need for Big data analytics, Big data applications. Apache Hadoop Architecture, Hadoop YARN, Comparison of Traditional system & Hadoop Ecosystem, Installation steps of Hadoop (1.x), Moving Data in and out of Hadoop, need for Record Reader and Record writer, understanding inputs and outputs file format of Map Reduce.

UNIT-II (12 Hrs.)

Introduction to Hive, Hive Architecture and Installation, HQL vs. SQL, HBase concepts-Schema Design, Table Design, Introduction to PIG, NoSQL.

UNIT-III (11 Hrs.)

Cloud Computing Fundamental: Cloud Computing definition, Deployment models. Cloud as a Service. Benefits and challenges of cloud computing, public vs private clouds, role of virtualization in enabling the cloud; Benefits and challenges to Cloud architecture.

UNIT-IV (11 Hrs.)

Cloud Applications, Cloud Services Management: Reliability, availability and security of services deployed from the cloud. Performance and scalability of services, tools and technologies used to manage cloud services deployment, computing infrastructures available for implementing cloud based services. Case Study of EC2.

RECOMMENDED BOOKS:

1. Chris Eaton, Dirk deroos et al., 'Understanding Big Data', 1st Edn., McGraw Hill, **2015**.
2. Tom White, 'HADOOP: The definitive Guide', 4th Edn., O Reilly, **2015**.
3. Gautam Shroff, 'Enterprise Cloud Computing Technology Architecture Applications', 1st Edn., Cambridge University Press, **2010**.
4. Toby Velte, Anthony Velte, Robert Elsenpeter, 'Cloud Computing, A Practical Approach', 1st Edn., Mcgraw Hill Education, **2009**.

DIGITAL IMAGE PROCESSING

Subject Code: MCSE1-375 **L T P C** **3 1 0 4** **Duration: 45 Hrs.**

LEARNING OBJECTIVES:

Visual information plays an important role in many aspects of our life. Much of this information is represented by digital images. Digital image processing is ubiquitous, with applications including television, tomography, photography, printing, robot perception, and remote sensing. This is an introductory LEARNING to the fundamentals of digital image processing. It emphasizes general principles of image processing, rather than specific applications.

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LEARNING OUTCOMES:

CO1: To introduce the digital images, processing with digital images, application areas of the field, fundamentals step to process images, image acquisition and digitization and understand image processing system.

CO2: To learn basic image transforms, image enhancement in spatial as well as frequency domain, to make them aware about various filters used for enhancement. Aim is to introduce histograms in image processing.

CO3: To study the image restoration of degraded images and processing of colour images and Introduction to wavelets.

CO4: To understand the image compression in order to save bandwidth and storage, image segmentation techniques, representation of image and basics of morphological processing operations.

UNIT-I (11 Hrs.)

Introduction: Digital Images and their Representation, Digital image processing, Application areas of digital image processing. Fundamental Steps in Image Processing, Elements of a Digital Image Processing System.

Digital Image Fundamentals: Elements of Visual Perception, A Simple Image Model, Image acquisition, Sampling and Quantization, Some Basic Relationships between Pixels, Mathematical Preliminaries, 2D Linear Space Invariant Systems,2D Convolution and Correlation.

UNIT-II (12 Hrs.)

Image Enhancement: Some Simple Intensity Transformations, Image Subtraction, Image Averaging, Spatial Domain Methods, Smoothing Filters, Sharpening Filters, Frequency Domain Methods, Lowpass Filtering, Highpass Filtering, Generation of Spatial Masks from Frequency Domain Specifications, Histogram Processing: Streaching, Equalization and Specification.

Image Transforms: 2D Orthogonal and Unitary Transforms, Properties and Examples. Introduction to the Fourier Transform, The Discrete Fourier Transform, 2D DFT, FFT, DCT, Hadamard Transform, Haar Transform, KL Transform.

UNIT-III (11 Hrs.)

Image Restoration: Degradations Model, Degradation Model for continuous and discrete functions, Algebraic Approach to Restoration: Unconstrained Restoration, Constrained Restoration, Inverse Filtering, weiner filters, Restoration in the Spatial Domain, Geometric Transformation.

Color Image processing and wavelets: Color Image Processing Fundamentals, Color Models: RGB, CMY, CMYK, HSI, Relationship between different Models.

UNIT-IV (11 Hrs.)

Image Compression: Fundamentals: Coding Redundancy, Interpixel Redundancy, Psychovisual Redundancy, Fidelity Criteria. Image Compression Models, Loss Less Variable Length, Huffman, Arithmetic Coding, Bit Plane Coding, Loss Less Predictive Coding, Lossy Transform (DCT) Based Coding, Sub Band Coding.

Image Segmentation: Edge Detection, Line Detection, Curve Detection, Edge Linking and Boundary Extraction, Image Representation: Boundary Representation, Region Representation and Segmentation, Morphological Processing: Dilation, Erosion, Opening and Closing, Hit and Miss Algorithms.

RECOMMENDED BOOKS:

1. Rafael. C. Gonzalez & Richard E. Woods. 'Digital Image Processing', 2nd Edn., Pearson Education, **2006.**
2. W.K. Pratt. 'Digital Image Processing',3rd Edn., John Wiley & Sons, Inc., **2006.**
3. M. Sonka et.al, 'Image Processing, Analysis and Machine Vision', 2nd Edn., Thomson, Learning, India Edition, **2007**.
4. Kenneth R. Castleman, 'Digital Image Processing', 2nd Edn., Pearson Education, **1996**.
5. S. Jayaraman, S. Esakkirajan, T. Veerakumar, 'Digital Image Processing', 1st Edn., McGraw Hill Education, **2009**.
6. Anil Jain. K., 'Fundamentals of Digital Image Processing', 4th Edn., Prentice Hall of India, **1989**.

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M.Tech. CSE (Computer Networks & Information Security) (1st SEM.)

TOTAL CONTACT HRS. = 24, TOTAL CREDITS = 22

LEARNING		Contact Hrs.			Marks			Credits
Code	**Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
MCSE2-101	Advanced Data Structures and Algorithm	3	1	0	40	60	100	4
MCSE2-102	Research Methodologies	3	1	0	40	60	100	4
MCSE2-103	Soft Computing	3	1	0	40	60	100	4
Departmental Elective-I		3	1	0	40	60	100	4
MCSE2-156	Agile Software Development							
MCSE2-157	Information Security							
MCSE2-158	Cloud Computing							
MCSE2-159	Internet Technology							
Departmental Elective-II		3	1	0	40	60	100	4
MCSE2-160	Advanced Computer Networks							
MCSE2-161	Advanced Operating System							
MCSE2-162	Wireless sensor network							
MCSE2-163	Mobile networking							
MCSE2-104	Practical Lab.-I	0	0	4	60	40	100	2
Total 5 Theory & 1 Lab. LEARNINGs		**15**	**5**	**4**	**260**	**340**	**600**	**22**

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M. Tech. CSE (Computer Networks & Information Security) (2nd SEM.)

TOTAL CONTACT HRS. = 24, TOTAL CREDITS = 22

LEARNING		Contact Hrs.			Marks			Credits
Code	**Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
MCSE2-205	Graph Theory	3	1	0	40	60	100	4
MCSE2-206	Cryptography & Network Security	3	1	0	40	60	100	4
Departmental Elective-III		3	1	0	40	60	100	4
MCSE2-264	Information Retrieval							
MCSE2-265	Ethical hacking							
MCSE2-266	Distributed Systems							
MCSE2-267	Grid Computing							
Departmental Elective-IV		3	1	0	40	60	100	4
MCSE2-268	Network Programming							
MCSE2-269	Linux Programming							
MCSE2-270	Network Performance Evaluation							
MCSE2-271	Open Source Technology							
Open Elective-I		3	1	0	40	60	100	4
MCSE1-207	Practical Lab.-II	0	0	4	60	40	100	2
Total 5 Theory & 1 Lab. LEARNINGs		**15**	**5**	**04**	**260**	**340**	**600**	**22**

M. Tech. CSE (Computer Networks & Information Security) (3rd SEM.)

TOTAL CONTACT HRS. = 8, TOTAL CREDITS = 22

LEARNING		Contact Hrs.			Marks			Credits
Code	**Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
Departmental Elective-V		3	1	0	40	60	100	4
MCSE1-372	Semantic Web and Social Network							
MCSE1-373	Natural Language Processing							
MCSE1-374	Big Data & Cloud Computing							
MCSE1-375	Digital Image Processing							
Open Elective-II		3	1	0	40	60	100	4
Project		-	-	-	60	40	100	10
Seminar		-	-	-	60	40	100	4
Total 2 Theory LEARNINGs		6	2	0	200	200	400	22

M.Tech Computer Science & Engineering (4th SEMESTER)

TOTAL CONTACT HRS. = 0, TOTAL CREDITS = 24

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LEARNING		Contact Hrs.			Marks			Credits
Code	**Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
MCSE1-207	Dissertation	0	0	0	60	40	100	24
Total		0	0	0	60	40	100	24

Total Marks = 600 + 600 + 400 + 100 = 1700

Total Credits = 22 + 22 + 22 + 24 = 90

ADVANCED DATA STRUCTURES AND ALGORITHMS

MCSE1-101, MCSE2-101, MCSE3-101, MCSE4-101	**L T P C 3 1 0 4**	**Duration: 45 Hrs.**

LEARNING OBJECTIVESS:

To learn the advanced concepts of data structure and algorithms and its implementation. The LEARNING has the main ingredients required for a computer science graduate and has all the necessary topics for assessment of data structures and algorithms.

LEARNING OUTCOMESS:

CO1: Ability to apply and implement various data structures to algorithms and to solve problems.

CO2: Basic ability to analyze algorithms and to determine algorithm correctness and time efficiency class.

CO3: Ability to apply various traversing, finding shortest path and text pattern matching algorithm.

CO4: Know the concepts of tractable and intractable problems and the classes P, NP and NP-complete problems.

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UNIT-I (12 Hrs.)

Introduction to Basics: Significance and need of various data structures and algorithms, Arrays, linked lists, Stacks, Queues, Priority queues, Heaps; Strategies for choosing the appropriate data structures.

Advanced Data Structures: Binary Search Tree**,** AVL Trees, Red-Black Trees, Splay Trees, B-trees, Fibonacci heaps, Data Structures for Disjoint Sets, Augmented Data Structures.

UNIT-II (10 Hrs.)

Algorithms Complexity and Analysis: Probabilistic Analysis, Amortized Analysis, Competitive Analysis, Internal and External Sorting algorithms: Quick Sort, Heap Sort, Merge Sort, Counting Sort, Radix Sort.

UNIT-III (13 Hrs.)

Graphs & Algorithms: Representation, Type of Graphs, Paths and Circuits: Euler Graphs, Hamiltonian Paths & Circuits; Cut-sets, Connectivity and Separability, Planar Graphs, Isomorphism, Graph Coloring, Covering and Partitioning, bridges, Depth- and breadth-first traversals, Minimum Spanning Tree: Prim’s and Kruskal’s algorithms, Shortest-path Algorithms: Dijkstra’s and Floyd’s algorithm, Topological sort, Max flow: Ford-Fulkerson algorithm, max flow – min cut.

String Matching Algorithms: Suffix arrays, Suffix trees, Brute Force, Rabin-Karp, Knuth-Morris-Pratt, Boyer-Moore algorithm.

UNIT-IV (10 Hrs.)

Approximation Algorithms: Need of approximation algorithms: Introduction to P, NP, NP-Hard and NP-Complete; Deterministic, non-Deterministic Polynomial time algorithms; Knapsack, TSP, Set Cover, Open Problems.

Randomized Algorithms: Introduction, Type of Randomized Algorithms, 2-SAT; Game Theoretic Techniques, Random Walks.

RECOMMENDED BOOKS:

1. E. Horowitz, S. Sahni and Dinesh Mehta, ‘Fundamentals of Data Structures in C++’, Galgotia, **1999**.

2. Thomas H. Corman, Charles E. Leiserson, Ronald L. Rivest, 'Introduction to Algorithms', 3rd Edn., PHI, **2009**.
3. Adam Drozdex, 'Data Structures and Algorithms in C++', 2nd Edn., Thomson Learning – Vikas Publishing House, **2001**.
4. G. Brassard and P. Bratley, 'Algorithmics: Theory and Practice', Prentice –Hall, **1988**.

RESEARCH METHODOLOGY

MCSE1-102 **MCSE2-102,** **MCSE3-102,** **MCSE4-102** **MREM0-101**	**L T P C** **3 1 0 4**	**Duration: 45 Hrs.**

LEARNING OBJECTIVESS:
To define research and describe the research process and research methods.

LEARNING OUTCOMESS:
CO1: Able to select and define appropriate research problem and Parameters.
CO2: Able to organize and conduct research in a more appropriate manner.
CO3: Able to understand and apply statistical methods to formulate hypotheses.
CO4: Able to prepare a project proposal and write a research report.

UNIT–I (11 Hrs.)

Introduction to Research: Meaning, Definition, OBJECTIVES and Process.
Research Design: Meaning, Types - Historical, Descriptive, Exploratory and Experimental.
Research Problem: Necessity of Defined Problem, Problem Formulation, Understanding of Problem, Review of Literature.
Design of Experiment: Basic Principal of Experimental Design, Randomized Block, Completely Randomized Block, Latin Square, Factorial Design.
Hypothesis: Types, Formulation of Hypothesis, Feasibility, Preparation and Presentation of Research Proposal.

UNIT–II (10 Hrs.)

Sources of Data: Primary and Secondary, Validation of Data.
Data Collection Methods: Questionnaire Designing, Construction.
Sampling Design & Techniques: Probability Sampling and Non Probability Sampling
Scaling Techniques: Meaning & Types.
Reliability: Test – Retest Reliability, Alternative Form Reliability, Internal Comparison Reliability and Scorer Reliability.
Validity: Content Validity, Criterion Related Validity and Construct Validity.

UNIT–III (13 Hrs.)

Data Process Operations: Editing, Sorting, Coding, Classification and Tabulation.
Analysis of Data: Statistical Measure and Their Significance, Central Tendency, Dispersion, **Correlation:** Linear and Partial, Regression: Simple and Multiple Regression, Skewness, Time series Analysis, Index Number.
Testing of Hypothesis: T-test, Z- test, Chi Square, F-test, ANOVA.

UNIT – IV (11 Hrs.)

Multivariate Analysis: Factor Analysis, Discriminant Analysis, Cluster Analysis, Conjoint Analysis, Multi-Dimensional Scaling.

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Report Writing: Essentials of Report Writing, Report Format.
Statistical Software: Application of Statistical Softwares like SPSS, MS Excel, Mini Tab or MATLAB Software in Data Analysis.
**Each Student has to Prepare Mini Research Project on Topic/ Area of their Choice and Make Presentation. The Report Should Consists of Applications of Tests and Techniques Mentioned in The Above UNITs.*

RECOMMENDED BOOKS:

1. R.I. Levin and D.S. Rubin, 'Statistics for Management', 7th Edn., Pearson Education New Delhi.
2. N.K. Malhotra, 'Marketing Research–An Applied Orientation', 4th Edn., Pearson Education New Delhi.
3. Donald Cooper, 'Business Research Methods', Tata McGraw Hill, New Delhi.
4. Sadhu Singh, 'Research Methodology in Social Sciences', Himalaya Publishers.
5. Darren George & Paul Mallery, 'SPSS for Windows Step by Step', Pearson Education New Delhi.
6. C.R. Kothari, 'Research Methodology Methods & Techniques', 2nd Edn., New Age International Publishers.

SOFT COMPUTING

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MCSE1-103, **MCSE2-103,** **MCSE3-103,** **MCSE4-103**	**L T P C** **3 1 0 4**	**Duration: 45 Hrs.**

LEARNING OBJECTIVESS:
The OBJECTIVES of this LEARNING is to teach basic neural networks, fuzzy systems, Genetic Algorithms and optimization algorithms concepts and their relations.

LEARNING OUTCOMESS:
CO1: Able to comprehend techniques and applications of Soft Computing in real world problems.
CO2: Able to follow fuzzy logic methodology and design fuzzy systems for various applications.
CO3: Able to design feed forward Artificial Neural Networks (ANN) and implement various methods of supervised learning.
CO4: Able to design feedback Artificial Neural Networks (ANN) and implement various methods of unsupervised learning.
CO5: Able to appreciate the methodology of GA and its implementation in various applications.

UNIT-I (11 Hrs.)

Soft Computing: Introduction of soft computing, soft computing vs. hard computing, various types of soft computing techniques, applications of soft computing.
Fuzzy Logic: Fuzzy set versus crisp set, basic concepts of fuzzy sets, membership functions, basic operations on fuzzy sets and its properties. Fuzzy relations versus Crisp relation.
Fuzzy Rule Base System: Fuzzy propositions, formation, decomposition & aggregation of fuzzy rules, fuzzy reasoning, Fuzzy Inference Systems (FIS), Mamdani Fuzzy Models,

Sugeno Fuzzy Models, Tsukamoto Fuzzy Models, Fuzzification and Defuzzification, fuzzy decision making & Applications of fuzzy logic.

UNIT-II (12 Hrs.)

Structure and Function of a Single Neuron: Biological neuron, artificial neuron, definition of ANN and its applications. Neural Network architecture: Single layer and multilayer feed forward networks and recurrent networks. Learning rules and equations: Perceptron, Hebb's, Delta, winner take all and out-star learning rules. Supervised Learning Network: Perceptron Networks, Adaptive Linear Neuron, Multiple Adaptive Linear Neuron, Back Propagation Network, Associative memory networks, Unsupervised Learning Networks: Competitive networks, Adaptive Resonance Theory, Kohnen Self Organizing Map.

UNIT-III (11 Hrs.)

Genetic Algorithm: Fundamentals, basic concepts, working principle, encoding, fitness function, reproduction, Genetic modeling: selection operator, cross over, mutation operator, Stopping Condition and GA flow, Constraints in GA, Applications of GA, Classification of GA.

UNIT-IV (11 Hrs.)

Hybrid Soft Computing Techniques: An Introduction, Neuro-Fuzzy Hybrid Systems, Genetic Neuro-Hybrid systems, Genetic fuzzy Hybrid and fuzzy genetic hybrid systems.

RECOMMENDED BOOKS:

1. S. Rajasekaran & G.A. Vijayalakshmi Pai, 'Neural Networks, Fuzzy Logic & Genetic Algorithms, Synthesis & Applications', 1st Edn., PHI Publication, **2003**.
2. S.N. Sivanandam & S.N. Deepa, 'Principles of Soft Computing', 2nd Edn., Wiley Publications, **2008**.
3. Michael Negnevitsky, 'Artificial Intelligence', 2nd Edn., Pearson Education, New Delhi, **2008.**
4. Timothy J. Ross, 'Fuzzy Logic with Engineering Applications', 3rd Edn., Wiley, **2011.**
5. Bose, 'Neural Network fundamental with Graph, Algorithm. & Application', TMH, **2004**.
6. Kosko, 'Neural Network & Fuzzy System', 1st Edn., PHI Publication, **2009.**
7. Klir &Yuan, 'Fuzzy Sets & Fuzzy Logic: Theory & Application', PHI, **1995**.
8. Hagen, 'Neural Network Design', 2nd Edn., Cengage Learning, **2008**.

AGILE SOFTWARE DEVELOPMENT APPROACHES

MCSE1-156,	**L T P C**	**Duration: 45 Hrs.**
MCSE2-156,	**3 1 0 4**	
MCSE4-156,		
MCSE3-205		

LEARNING OBJECTIVESS:

This LEARNING makes student learn the fundamental principles and practices associated with each of the agile development methods. To apply the principles and practices of agile software development on a project of interest and relevance to the student.

LEARNING OUTCOMESS:

CO1: To learn the basics concepts of Agile software and their principles design.

CO2: To explain different agile development method, project tools requirement, risk and measurements related with different development methods.

CO3: To understand the overview of Agile methods, strategies, requirements and testing.

CO4: Describe and explain agile measurement, configuration and risk management, Principles of Astern and tools.

UNIT-I (11 Hrs.)

Introduction: Basics and Fundamentals of Agile Process Methods, Values of Agile, Principles of Agile, stakeholders, Challenges.

Agile and its Significance: Agile development, Classification of methods, the agile manifesto and principles, Practices of XP, Scrum Practices, working and need of Scrum, advanced Scrum Applications, Scrum and the Organization.

UNIT-II (12 Hrs.)

Agile Project Management: Embrace communication and feedback, Simple practices and project tools, Empirical Vs defined and prescriptive process, Principle-based versus Rule-Based.

Sustainable Discipline: The human touch, Team as a complex adaptive system, Agile hype, Specific agile methods. Quality, Risk, Metrics and Measurements, the facts of change on software projects, Key motivations for iterative development, Meeting the requirements challenge iteratively, Problems with the waterfall. Research evidence, Early historical project evidence, Standards-Body evidence, Expert and thought leader evidence, A Business case for iterative development, The historical accident of waterfall validity.

UNIT-III (11 Hrs.)

Agile Methodology: Method overview Lifecycle Work products, Roles and Practices values, Common mistakes and misunderstandings Sample projects, Process mixtures, Adoption strategies, Fact versus fantasy, Strengths versus "Other" history.

Agile Requirements: User Stories, Backlog Management. Agile Architecture: Feature-Driven Development. Agile Risk Management: Risk and Quality Assurance, Agile Tools.

UNIT-IV (11 Hrs.)

Agile Testing: Agile Testing Techniques, Test-Driven Development, User Acceptance Test.

Agile Review: Agile Metrics and Measurements, The Agile approach to estimating and project variables, Agile Measurement, Agile Control: the 7 control parameters. Agile approach to Risk, The Agile approach to Configuration Management, The Atern Principles, Atern Philosophy, the rationale for using Atern, Refactoring, Continuous integration, Automated Build Tools.

RECOMMENDED BOOKS:

1. Elisabeth Hendrickson, 'Agile Testing', Quality Tree Software Inc., **2008**.
2. Craig Larman, 'Agile and Iterative Development – A Manager's Guide', 1st Edn., Pearson Education, **2004**.
3. Robert C. Martin, 'Agile Software Development, Principles, Patterns, and Practices (Alan Apt Series)', 2nd Edn., Pearson Education, **2003**.
4. Alistair Cockburn, 'Agile Software Development series', 1st Edn., Addison-Wesley Professional, **2001**.
5. Mike Cohn, 'Succeeding with Agile: Software Development Using Scrum', 1st Edn., Pearson, **2010.**

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INFORMATION SECURITY

MCSE1-162, MCSE2-157, MCSE4-157	**L T P C 3 1 0 4**	**Duration: 45 Hrs.**

LEARNING OBJECTIVESS:

It will help the students to understand the various concepts related to network security. The students will learn various techniques/algorithms that can be used to achieve security. They will also learn the security basics for wireless networks.

LEARNING OUTCOMESS:

CO1: To understand the concepts of network security

CO2: To learn the techniques for authentication and authorization

CO3: To be able to understand the confidentiality requirement and the ways to achieve it.

CO4: To know about wireless network security.

UNIT-I (11 Hrs.)

Overview: Computer Security Concepts, Challenges, Requirements, OSI security Architecture: services, mechanism and attacks, network security model, Classical encryption techniques, latest security trends, need of security strategy.

UNIT-II (12 Hrs.)

Authentication: Message authentication, message authentication techniques: Hash, MAC, digital Signatures, User Authentication: one-way authentication, mutual authentication, Password-based authentication, token based authentication, Biometric authentication, Remote User authentication.

Authorization: Identification, authorization, Access Control: Principles, Access Rights, Discretionary Access Control, Role Based Access Control, Unix File Access Control, Role Based Access Control Internet Authentication Applications: Kerberos, X.509, PKI, Federated Identity Management.

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UNIT-III (11 Hrs.)

Confidentiality: Encryption, attacks, Symmetric Encryption: DES, AES, Asymmetric Encryption: RSA, Key Distribution scenario, Email security: S/ MIME, PGP.

Wireless Network Security: IEEE 802.11 wireless LAN, 802.11i wireless LAN security, Wireless Application Protocol, Wireless transport layer security, WAP End to End security.

UNIT-IV (11 Hrs.)

Database Security: The Need for Database Security, Database Management Systems, Relational Databases, Database Access Control, Inference, Statistical Databases, Database Encryption, Cloud Security.

RECOMMENDED BOOKS:

1. William Stalling, Lawrie Brown, 'Computer Security: Principles and Practice', Pearson, Indian, **2010**.
2. Chuck Easttom, 'Computer Security Fundamentals', Pearson, **2011**.
3. M. Stamp, 'Information Security: Principles and Practice', 2nd Edn., Wiley, **2011**.
4. M. E. Whitman and H. J. Mattord, 'Principles of Information Security', 4th Edn., LEARNING Technology, **2011**.
5. M. Bishop, 'Computer Security: Art and Science', Addison Wesley, **2002**.

CLOUD COMPUTING

Subject Code: MCSE2-158 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

LEARNING OBJECTIVESS:
To learn the advanced concepts of cloud infrastructure and services and its implementation for assessment of understanding the LEARNING by the students.

LEARNING OUTCOMESS:
CO1: Defining the cloud computing, types and cloud computing service (Saas, Iaas, Paas).
CO2: To familiarize with virtualization in cloud computing, data storage and develop application for cloud computing.
CO3: Understanding the cloud computing services and deployment, management in cloud computing, implementing cloud based services and application requirements.
CO4: To know and understand the testing in cloud computing. To learn the advanced topics in cloud computing like Big data and IoT.

UNIT-I (11 Hrs.)

Introduction: Cloud Computing definition, Cloud Types- Private, Public and Hybrid cloud. Cloud Services: Software as a Service (SaaS)- Understanding the Multitenant Nature of SaaS Solutions, Understanding SOA. Platform as a Service (PaaS)-IT Evolution Leading to the Cloud, Pros and Cons of PaaS Solutions. Infrastructure as a Service (IaaS)- Understanding IaaS, Improving Performance through Load Balancing, System and Storage Redundancy, Utilizing Cloud-Based NAS Devices, Advantages, Server Types. Benefits and challenges of cloud computing.

UNIT-II (12 Hrs.)

Virtualization: Definition, Type of Virtualization, Benefits, Limitations, Virtualization and Cloud, Virtual Appliance, Load Balancing and Virtualization, Hypervisors, Machine Imaging.

Cloud based Data Storage: Introduction to Map Reduce for Simplified data processing on Large clusters, Design of data applications based on Map Reduce in Apache Hadoop, Task Partitioning, Data partitioning, Data Synchronization, Distributed File system, Data Replication.

UNIT-III (11 Hrs.)

Cloud Services: Introduction, Contrast traditional software development and development for the cloud. Technologies and the processes required when deploying web services; deploying a web service from inside and outside a cloud architecture, advantages and disadvantages, Public vs Private cloud apps.

Management of Cloud Services: Reliability, availability and security of services deployed from the cloud. Performance and scalability of services, tools and technologies used to manage cloud services deployment; Cloud Economics-Cloud Computing infrastructures available for implementing cloud based services. Economics of choosing a Cloud platform for an organization application requirement, economic constraints and business needs (e.g Amazon, Microsoft and Google,Salesforce.com, Ubuntu and Red hat).

UNIT-IV (11 Hrs.)

Open Source Cloud Computing and Testing: Open Stack, Open Nebula-underlying technologies, Cloud Monitoring-Ganglia; Physical and virtual machine memory, CPU management and abstraction techniques using a hypervisor. Software Testing in the Cloud - SMART-T- Migrating Testing to the Cloud, Hadoop Unit- Test Execution in the Cloud.

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Advance Topics: Mobile Cloud Computing, Big-Data and Internet of Things (IoT): Definition of BigData, Structured and Unstructured Data, V's of Big-Data, Hadoop, Definition of IoT, Characteristics of IoT, Combining Big-Data, IoT and Cloud Computing.

RECOMMENDED BOOKS:

1. Anthony T. Velte, Toby J. Velte, Robert Elsenpeter, 'Cloud Computing: A Practical Approach', The McGraw Hill, **2010**.
2. Kris Jamsa, 'Cloud Computing: SaaS, PaaS, IaaS, Virtualization and more', **2012**.
3. Gautam Shroff, 'Enterprise Cloud Computing Technology Architecture Applications', 1st Edn., Cambridge University Press, **2010**.
4. Dimitris N. Chorafas, 'Cloud Computing Strategies', 1st Edn., CRC Press', **2010**.
5. Kevin Jackson, Cody Bunch, 'Open Stack Cloud Computing Cookbook', 2nd Edn., Packt Publishing, **2013**.

INTERNET TECHNOLOGY

Subject Code: MCSE2-159	**L T P C** **3 1 0 4**	**Duration: 45 Hrs.**

LEARNING OBJECTIVESS:

At the end of this LEARNING students will learn the fundamentals related to protocols and services implemented in communication networks.

LEARNING OUTCOMESS:

CO1: To understand the various technologies used in modern computer network.
CO2: To learn the management of quality of service in multimedia networks.
CO3: To outline the various areas of network security.
CO4: To understand the implementation of networking protocols in mobile networks.

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UNIT-I (11 Hrs.)

Computer Networks and the Internet: Evolution of Internet, Internet services, Internet protocols and standardization, TCP/IP, Review of Network technologies, Addressing schemes, Interconnection through IP Gateways or routers, Internet and Intranet. Principles of application-layer protocols, HTTP, FTP, DHCP, TELNET, e-mail, DNS, socket programming with TCP/UDP, web servers, web page design using HTML and XML.

UNIT-II (12 Hrs.)

Multimedia Networking: Applications: streaming stored audio and video, internet telephony, RTP, scheduling and policing mechanisms, integrated services, RSVP, differentiated services: network management, the internet network management framework.

UNIT-III (11 Hrs.)

Network Security: E-mail security, privacy, SMIME, IP Security: overview, architecture, authentication, header and payload, combining security associations, key management. Web security: SSL, SET. Systems Security: intruders and viruses, firewalls: design, trusted systems.

UNIT-IV (11 Hrs.)

Mobile Internet: Mobile network layer, mobile IP, dynamic host configuration protocol, ad hoc networks, mobile transport layer, implications of TCP on mobility, indirect TCP, snooping TCP, mobile TCP, transmission, selective retransmission, transaction-oriented TCP, support for mobility, file systems, WAP protocols, WML, WML script, wireless telephony applications.

RECOMMENDED BOOKS:

1. J.F. Kurose & K.W. Ross, 'Computer Networking: A Top-Down Approach Featuring the Internet', Addison Wesley, Modules I & II, **2006**.
2. W. Stallings, 'Cryptography and Network Security Principles and Practice', Pearson Education Asia, Module III, **2005**.
3. J. Schiller, 'Mobile Communications', Addison Wesley, Module IV, **2005**.
4. H.M. Deitel, P.J. Deitel, T.R. Nieto, 'Internet and World Wide Web: How to Program', Pearson Education, **2005.**
5. R. Greenlaw, E. Hepp, 'In-line / On-line: Fundamentals of the Internet and the World Wide Web', Tata McGraw Hill, **2004**.
6. V. Sharma & R. Sharma, 'Developing e-Commerce Sites: An Integrated Approach', Addison Wesley, **1999**.
7. Singhal et. al S., 'The Wireless Application Protocol', Pearson Education Asia, **2000**.
8. M. Goncalves, 'Firewalls: A Complete Guide', Tata McGraw Hill, **2001**.
9. Douglas E. Comer, 'Computer Networks and Internets', 4th Edn., PE, **2008.**

ADVANCED COMPUTER NETWORKS

MCSE2-160,	**L T P C**	**Duration: 45 Hrs.**
MCSE1-206	**3 1 0 4**	

LEARNING OBJECTIVESS:

This LEARNING provides knowledge about computer network related hardware and software using a layered architecture. It is also offer good understanding of the concepts of network security, wireless, Adhoc and various emerging network technologies.

LEARNING OUTCOMESS:

CO1: Able to explain the Fundamentals of Computer Networks and their layered architecture. Also acquire knowledge about ATM Layered model and LAN Emulation.

CO2: Able to explain about various Transport and Application Layer Protocols. Also acquire knowledge about various congestion control mechanisms and network management.

CO3: Able to explain Features, advantages and applications of Adhoc Networks, Adhoc versus Cellular networks, Network architecture and Technologies. Evolution with the examples of wireless communication systems other techniques of Cellular Networks like 2G, 2.5G and 3G Technologies. Also able to explain wireless local loop (WLL), Wireless and local Area Networks (WLANs).

CO4: Able to define the Fundamentals of network security, various authentication protocols and E-mail Security.

UNIT-I (10 Hrs.)

Computer networks and layered architecture, Asynchronous Transfer Mode- ATM layered model, switching and switching fabrics, network layer in ATM, QOS, LAN emulation.

UNIT-II (12 Hrs.)

Transport Layer: Elements of transport protocols; Internet transport protocols: TCP and UDP, TCP connection management, congestion control.

Application Layer: Network application architectures: Client-server, P2P and hybrid. **Application Layer Protocols:** DNS, FTP, TFTP, TELNET, HTTP and WWW, SMTP and electronic mail; Network management and SNMP.

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UNIT-III (12 Hrs.)

Adhoc and Cellular networks: Features, advantages and applications, Adhoc versus Cellular networks, Network architecture, Protocols: MAC protocols, Routing protocols, Technologies.

Wireless Communication Systems: Evolution, examples of wireless communication systems, 2G Cellular networks, Evolution for 2.5G TDMA Standards, IS-95B for 2.5G CDMA.

Wireless and Mobile Networks: Wireless links and network characteristics, wireless local loop (WLL), Local Multipoint Distribution System (LMDS), Wireless local Area Networks (WLANs), Bluetooth and Personal Area Networks.

UNIT-IV (11 Hrs.)

Introduction to Network Security: Cryptography, symmetric and public-key algorithms, digital signatures, communication security, and authentication protocols, E-mail security, PGP and PEM.

RECOMMENDED BOOKS:

1. B.A. Forouzan, 'Data Communication and Networking', 5th Edn., Tata McGraw-Hill, **2013**.
2. A.S. Tanenbaum, 'Computer Networks', 4th Edn., Pearson Education, **2002.**
3. William Stallings, 'Network Security and Cryptography', 6th Edn., Prentice-Hall of India, **2013**.
4. Theodore S. Rappaport, 'Wireless Communication: Principles and Practices', 2nd Edn., Pearson Education, **2001**.
5. D.E. Comer and R.E. Droms, 'Computer Networks and Internets', Prentice-Hall, 4th Edn., **1998**.
6. Sunil Kumar S. Manvi, Mahabaleshwar S. Kakkasageri, 'Wireless and Mobile Networks: Concepts and Protocols', 2nd Edn., Wiley India, **2016**.

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ADVANCED OPERATING SYSTEM

MCSE1-161, MCSE4-162, MCSE2-161, MCSE3-161	**L T P C 3 1 0 4**	**Duration: 45 Hrs.**

LEARNING OBJECTIVESS:

To learn the fundamentals of Operating Systems and gain knowledge on Distributed operating system concepts that includes architecture, Mutual exclusion algorithms, Deadlock detection algorithms and agreement protocols.

LEARNING OUTCOMESS:

CO1: Discuss the various synchronization, scheduling and memory management issues.

CO2: Demonstrate the Mutual exclusion, Deadlock detection and agreement protocols of Distributed operating system.

CO3: Discuss the various resource management techniques for distributed systems.

CO4: Identify the different features of real time and mobile operating systems.

UNIT-I (11 Hrs.)

Fundamentals of Operating Systems: Strategies of operating system, Structures of operating system, overview, Synchronization Mechanisms, Processes and Threads, Process

Scheduling, Deadlocks: Detection, Prevention and Recovery, Models of Resources, Memory Management Techniques.

Distributed Operating Systems: Issues in Distributed Operating System, Architecture, Communication Primitives, Lamport's Logical clocks, Causal Ordering of Messages, Distributed Mutual Exclusion Algorithms, Centralized and Distributed Deadlock Detection Algorithms, Agreement Protocols.

UNIT-II (12 Hrs.)

Distributed Resource Management: Distributed File Systems, Design Issues, Distributed Shared Memory, Algorithms for Implementing Distributed Shared memory, Issues in Load Distributing, Scheduling Algorithms, Synchronous and Asynchronous Check Pointing and Recovery, Fault Tolerance, Two-Phase Commit Protocol, Non-blocking Commit Protocol, Security and Protection.

UNIT-III (11 Hrs.)

Real Time and Mobile Operating Systems: Basic Model of Real Time Systems, Characteristics, Applications of Real Time Systems, Real Time Task Scheduling, Handling Resource Sharing, Mobile Operating Systems, Micro Kernel Design, Client Server Resource Access, Processes and Threads, Memory Management, File system, Networked file system.

UNIT-IV (11 Hrs.)

CASE STUDIES: Linux System: Design Principles, Kernel Modules, Process Management Scheduling, Memory Management, Input-Output Management, File System, Interprocess Communication. iOS and Android: Architecture and SDK Framework, Media Layer, Services Layer, Core OS Layer, File System.

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RECOMMENDED BOOKS:

1. Andrew S. Tanenbaum and Maarten van Steen, 'Distributed Systems: Principles and Paradigms', 2nd Edn., Prentice Hall, **2007**.
2. Mukesh Singhal and Niranjan G. Shivaratri, 'Advanced Concepts in Operating Systems – Distributed, Database, and Multiprocessor Operating Systems', Tata McGraw Hill, **2001**.
3. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, 'Operating System Concepts', 7th Edn., John Wiley & Sons, **2004**.
4. Daniel P. Bovet and Marco Cesati, 'Understanding the Linux kernel', 3rd Edn., O'Reilly, **2005**.
5. Rajib Mall, 'Real-Time Systems: Theory and Practice', Pearson Education India, **2006**.
6. Neil Smyth, 'iPhone iOS 4 Development Essentials – Xcode', 4th Edn., Payload media, **2011**.

WIRELESS SENSOR NETWORKS

Subject Code: MCSE2-162 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

LEARNING OBJECTIVESS:

The OBJECTIVES of this LEARNING is to make the students to Understand the basic WSN technology and supporting protocols, with emphasis placed on standardization basic sensor systems and provide a survey of sensor technology.

LEARNING OUTCOMESS:

CO1: Able to explain about basic concepts of wireless sensor networks. Also acquire knowledge about architecture of sensor networks.

CO2: Acquire knowledge about MAC Protocols for Wireless Sensor Networks, and various routing protocols for networking sensors.

CO3: Able to explain about Topology Control, Clustering, Time Synchronization, Localization and Positioning, Sensor Tasking and Control.

CO4: Acquire knowledge about Sensor Node Hardware – Berkeley Motes, Programming Challenges, Node-level software platforms, Node-level Simulators, State-centric programming.

UNIT-I (11 Hrs.)

Overview of Wireless Sensor Networks: Challenges for Wireless Sensor Networks, Enabling Technologies for Wireless Sensor Networks, Single-Node Architecture - Hardware Components, Energy Consumption of Sensor Nodes, Operating Systems and Execution Environments, Network Architecture - Sensor Network Scenarios, Optimization Goals and Figures of Merit, Gateway Concepts.

UNIT-II (12 Hrs.)

Networking Sensors: Physical Layer and Transceiver Design Considerations, MAC Protocols for Wireless Sensor Networks, Low Duty Cycle Protocols And Wakeup Concepts - S-MAC , The Mediation Device Protocol, Wakeup Radio Concepts, Address and Name Management, Assignment of MAC Addresses, Routing Protocols- Energy-Efficient Routing, Geographic Routing.

UNIT-III (11 Hrs.)

Infrastructure Establishment: Topology Control, Clustering, Time Synchronization, Localization and Positioning, Sensor Tasking and Control.

UNIT-IV (11 Hrs.)

Sensor Network Platforms and Tools: Sensor Node Hardware – Berkeley Motes, Programming Challenges, Node-level software platforms, Node-level Simulators, State-centric programming.

MRSPTU

RECOMMENDED BOOKS:

1. Holger Karl, Andreas Willig, 'Protocols And Architectures for Wireless Sensor Networks', John Wiley, **2005**.
2. Feng Zhao, Leonidas J. Guibas, 'Wireless Sensor Networks- An Information Processing Approach', Elsevier, **2007**.
3. Kazem Sohraby, Daniel Minoli, Taieb Znati, 'Wireless Sensor Networks- Technology, Protocols, And Applications', John Wiley, **2007**.
4. Anna Hac, 'Wireless Sensor Network Designs', John Wiley, **2003**.

MOBILE NETWORKING

Subject Code: MCSE2-163 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

LEARNING OBJECTIVESS:

Students will familiarize themselves with mobile communication networks. They will gain insight into media access control mechanisms dedicated to wireless communication and have a thorough understanding of mechanisms based on the network and the transport layers, with a focus on ad hoc and mesh networks.

LEARNING OUTCOMESS:

CO1: to familiarize with the basics of mobile networking.

CO2: to understand the standards used in networks.

CO3: to apprehend the concept of mobility at various layers.

CO4: to evaluate the performance of mobile networks.

UNIT-I (11 Hrs.)

Introduction to Mobile and Wireless Communications: Applications, history, market vision.

Overview of Wireless Transmission: frequencies & regulations, signals, antennas, signal propagation, multiplexing, modulation, spread spectrum, cellular systems.

Medium Access Control in the Wireless Domain: SDMA, FDMA, CDMA TDMA (fixed, Aloha, CSMA, DAMA, PRMA, MACA, collision avoidance, polling).

UNIT-II (12 Hrs.)

Wireless Local Area Networks: IEEE 802.11 standard including physical layer, MAC layer and access schemes (PCF and DCF), quality of service and power management.

Wireless Metropolitan Area Networks: Wireless mesh networks, IEEE 802.16 standard including modes of operation, medium access control, quality of service and scheduling.

UNIT-III (11 Hrs.)

Mobility at Network Layer: Concepts to support mobility on various layers, Mobile IPv4, Mobile IPv6, various enhancements of Mobile IP (fast-handover, hierarchical-MIP), Mobile.

Mobility at Transport Layer: Variants of TCP (indirect TCP, snoop TCP, mobile TCP, wireless TCP).

UNIT-IV (11 Hrs.)

Ad hoc Networks: Terminology, basics and applications, characteristics of ad hoc communication, ad hoc routing paradigms and protocols (AODV, DSR, LAR, OLSR).

Performance Evaluation of Mobile Networks: Overview of performance evaluation, systematic approach / common mistakes and how to avoid them, experimental design and analysis.

Outlook: Applications for mobile networks, Wireless Sensor Networks and Participatory Sensing.

RECOMMENDED BOOKS:

1. Jochen Schiller, 'Mobile Communications', 2nd Edn, **2003.**
2. Raj Jain, 'The Art of Computer Systems Performance Analysis: Techniques for Experimental Design, Measurement, Simulation and Modeling', **1991.**
3. James F. Kurose, 'Computer Networking: A Top-Down Approach Featuring the Internet' 5th Edn., **2012**.

PRACTICAL LAB.-I

Subject Code: MCSE2-104 **L T P C**
0 0 4 2

- Practical's should be related to the core subjects of the same semester.

GRAPH THEORY

Subject Code: MCSE2-205 **L T P C** **Duration:45 Hrs.**
3 1 0 4

LEARNING OBJECTIVESS:

In computer science, graph theory is used extensively. While the LEARNING will cover all elementary concepts such as coloring, covering, planarity, connectivity and so on, it will also introduce the students to some advanced concepts.

LEARNING OUTCOMESS:

CO1: Basic Ability to learn concepts of graph theory.

CO2: Ability to learn and apply graph coloring and concepts of planar graph.
CO3: Ability to apply and implement tree structure, matching and connectivity.
CO4: Know the optimized concepts of trees and matching.

UNIT-I (10 Hrs.)

Introduction to Graph Theory: Definitions and Examples, Subgraphs, Complements, and Graph Isomorphism, Paths, Cycles, and Trails, Vertex Degrees, Counting, Directed Graphs, Euler Trails and Circuit, Planar Graphs, Hamilton Paths and Cycles, Graph Colouring, and Chromatic Polynomials.

UNIT-II (13 Hrs.)

Coloring of Graphs: Vertex Colorings and Upper Bounds, Structure of k-chromatic Graphs, Enumerative Aspects.

Planar Graphs: Embeddings and Euler's Formula, Characterization of Planar Graphs, Parameters of Planarity.

Edges and Cycles: Line Graphs and Edge-Coloring, Hamiltonian Cycles, Planarity, Coloring, and Cycles.

UNIT-III (12 Hrs.)

Trees: Definitions, Properties, and Examples, Routed Trees, Trees and Sorting, Weighted Trees and Prefix Codes, Basic Properties, Spanning Trees and Enumeration.

Matchings and Factors: Matchings and Covers, Algorithms and Applications, Matchings in General Graphs.

Connectivity and Paths: Cuts and Connectivity, k-connected Graphs, Network Flow Problems.

UNIT-IV (10 Hrs.)

Optimization and Matching: Dijkstra's Shortest Path Algorithm, Minimal Spanning Trees – The algorithms of Kruskal and Prim, Transport Networks – Max-flow, Min-cut Theorem, Matching Theory.

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RECOMMENDED BOOKS:

1. Douglas B. West, 'Introduction to Graph Theory', 2nd Edn., Pearson Education, **2000**.
2. D.S. Chandrasekharaiah, 'Graph Theory and Combinatorics', Prism, **2005**.
3. Chartrand Zhang, 'Introduction to Graph Theory', 1st Edn., TMH, **2006**.
4. Richard A. Brualdi, 'Introductory Combinatorics', 4th Edn., Pearson Education, **2004**.
5. Geir Agnarsson, Raymond Geen Law, 'Graph Theory', Pearson Education, **2007**.

CRYPTOGRAPHY & NETWORK SECURITY

Subject Code: MCSE2-206	**L T P C** **3 1 0 4**	**Duration: 45 Hrs.**

LEARNING OBJECTIVESS:

The main OBJECTIVES of this LEARNING is to make student able to understand the basic concepts, services, threats and principles in network security, various security services and mechanisms in the network protocol stack.

LEARNING OUTCOMESS:

CO1: To understand security trends.
CO2: To implement various cryptographic algorithms.
CO3: To explain the hash function.
CO4: To understand the network security and system level security used.

UNIT-I (10 Hrs.)

Security Trends: Attacks and services, Classical crypto systems, Different types of ciphers, LFSR sequences, Basic Number theory, Congruence, Chinese Remainder theorem, Modular exponentiation, Fermat and Euler's theorem, Legendre and Jacobi symbols, Finite fields, continued fractions.

UNIT-II (12 Hrs.)

Simple DES: Differential crypto analysis, DES – Modes of operation, Triple DES, AES, RC4, RSA, Attacks – Primality test – factoring.

UNIT-III (11 Hrs.)

Discrete Logarithms: Computing discrete logs, Diffie-Hellman key exchange, ElGamal Public key cryptosystems, Hash functions, Secure Hash, Birthday attacks, MD5, Digital signatures, RSA, ElGamal DSA.

UNIT-IV (12 Hrs.)

Authentication Applications: Kerberos, X.509, PKI – Electronic Mail security – PGP, S/MIME – IP security – Web Security – SSL, TLS, SET. Intruders, Malicious software, viruses and related threats, Firewalls, Security Standards.

RECOMMENDED BOOKS:

1. Wade Trappe, Lawrence C. Washington, ‘Introduction to Cryptography with Coding Theory’, 2nd Edn, Pearson, **2007**.
2. William Stallings, ‘Cryptography and Network Security Principles and Practices’, 4th Edn, Pearson/PHI, **2006**.
3. W. Mao, ‘Modern Cryptography – Theory and Practice’, 2nd Edn., Pearson Education, **2007**.
4. Charles P. Pfleeger, Shari Lawrence Pfleeger, ‘Security in Computing’, 3rd Edn., Prentice Hall of India, **2006**.
5. Behrouz Forouzan, ‘Cryptography & Network Security’, 2nd Edn., McGraw Hill, **2011.**

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INFORMATION RETRIEVAL

Subject Code: MCSE2-264	L T P C 3 1 0 4	Duration: 45 Hrs.

LEARNING OBJECTIVESS:

To learn the underlying technologies of modern information retrieval system.

LEARNING OUTCOMESS:

CO1: Able to understand the basic concepts of modern information retrieval system.

CO2: Able to understand the search engine architecture.

CO3: Able to learn the retrieval models and apply the algorithms of retrieval algorithms.

CO4: Able to evaluate the quality of retrieval system.

UNIT-I (11 Hrs.)

Introduction: The nature of unstructured and semi-structured text, Boolean queries, World Wide Web, History of Hypertext, Hypertext systems, Problems due to Uniform accessibility, types of Hypertext data, Text and multimedia data indexing, PageRank, HITS, XML and Semantic web.

UNIT-II (12 Hrs.)

Search Engine Architecture: the basic building blocks of a modern search engine system, including web crawler, basic text analysis techniques, inverted index, query processing, search result interface.

UNIT-III (11 Hrs.)

Retrieval Models: Boolean, vector space, probabilistic and language models, latent semantic indexing, ranking algorithm, Introduction to the most recent development of learning-based ranking algorithms, i.e., learning-to-rank, Relevance feedback, query expansion, link analysis and search applications.

UNIT-IV (11 Hrs.)

Performance Evaluation: Evaluating search engines, User happiness, precision, recall, F-measure.

RECOMMENDED BOOKS:

1. Christopher D. Manning, Prabhakar Raghavan, and Hinrich Schutze, 'Introduction to Information Retrieval, 1st Edn., Cambridge University Press, **2008**.
2. Bruce Croft, Donald Metzler, and Trevor Strohman, 'Search Engines: Information Retrieval in Practice', 1st Edn., Pearson Education, **2009**.
3. Yates Ricardo and Berthier Ribeiro-Neto, 'Modern Information Retrieval', 2nd Edn., Addison-Wesley, **2011**.
4. Soumen Chakrabarti, 'Mining the Web', 1st Edn., Morgan-Kaufmann, **2002.**

ETHICAL HACKING

Subject Code: MCSE2-265 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

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LEARNING OBJECTIVES:

This LEARNING helps to gain knowledge of a range of computer network security technologies, tools and services related to ethical hacking.

LEARNING OUTCOMES:

CO1: To understand various fundamentals of Ethical hacking.
CO2: To understand how to extract information about hosts and networks.
CO3: To develop knowledge of various forms of attacks.
CO4: To understand about judicious and ethical use of various tools.

UNIT-I (11 Hrs.)

Introduction: Security, Functionality and ease of use Triangle, Essential Terminology, Elements of Security, Difference between Penetration Testing and Ethical Hacking, Deliverables ethics and legality, Computer Crimes and Implications.

Reconnaissance and Scanning: Information Gathering Methodology, Locate the Network Range, Active and Passive reconnaissance, Scanning, Elaboration phase, active scanning, scanning tools NMAP, hping2. Enumeration, DNS Zone transfer. Detecting live systems on the target network, discovering services running /listening on target systems, understanding port scanning techniques, Identifying TCP and UDP services running on the target network, Understanding active and passive fingerprinting.

UNIT-II (12 Hrs.)

Trojans and Backdoors: Effect on Business, Trojan, Overt and Covert Channels, Working of Trojans, Different Types of Trojans, Different ways a Trojan can get into a system, Indications of a Trojan Attack, some famous Trojans and ports used by them.

Sniffing: Definition of sniffing, Sniffer working, Passive Sniffing, Active Sniffing, Ethreal tool, Man-in-the-Middle Attacks, Spoofing and Sniffing Attacks, ARP Poisoning and countermeasures.

Social Engineering: Social Engineering, Art of Manipulation, Human Weakness, Common Types of Social Engineering, Human Based Impersonation, Example of Social Engineering, Computer Based Social Engineering, Reverse Social Engineering, Policies and Procedures, Security Policies-checklist.

UNIT-III (11 Hrs.)

Session Hijacking: Understanding Session Hijacking, spoofing vs Hijacking, Steps in Session Hijacking, Types of Session Hijacking, TCP Concepts 3 Way and shake, Sequence numbers.

Hacking Web Servers: Types of web server vulnerabilities, Attacks against web servers, IIS Unicode exploits, Patch management techniques, Web Application Scanner, Metasploit Framework, Web server hardening methods.

UNIT-IV (11 Hrs.)

Ethical Hacking: System Hacking and Hacking Wireless Networks: Aspect of remote password guessing, Role of eavesdropping, Various methods of password cracking, Keystroke Loggers, Understanding Sniffers, Comprehending Active and Passive Sniffing, ARP Spoofing and Redirection, DNS and IP Sniffing, HTTPS Sniffing. Introduction to 802.11, Role of WEP, Cracking WEP Keys, Sniffing Traffic, Wireless DOS attacks, WLAN Scanners, WLAN Sniffers, Hacking Tools, Securing Wireless Networks.

RECOMMENDED BOOKS:

1. Kimberly Graves, ‘Certified Ethical Hacking Expert Study Guide’, Wiley Publishing Inc., **2007**.
2. Eric Core, ‘Hackers Beware’, EC-Council Press, **2003**.
3. William Stallings, ‘Network Security Essentials’, 5th Edn.,Prentice Hall, **2013**.
4. William R. Cheswick and Steven M. Bellovin, ‘Firewalls and Internet Security’, 2nd Edn., Addison-Wesley Professional, **2003**.
5. W. Stallings, ‘Cryptography and Network Security’, 5th Edn., Prentice Hall, **2010**.

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DISTRIBUTED SYSTEMS

MCSE1-163,	**L T P C**	**Duration: 45 Hrs.**
MCSE2-266	**3 1 0 4**	

LEARNING OBJECTIVES:

To study the various types of distributed systems, Models and various its various features.

LEARNING OUTCOMES:

CO1: To give the students an introduction about the basic Distributed systems, Models and some features of operating systems.

CO2: To give the introduction of Interprocess communication and other features. Also, the details of distributed file systems.

CO3: To give the students an introduction of various services like name services, name system etc., and distributed transaction features.

CO4: To understand the Distributed multi-media and its applications.

UNIT- I (11 Hrs.)

Characterization of Distributed Systems: Introduction, System models –Architectural and fundamental models with examples.

Operating System Support: Operating System layer, Protection, processes and threads, operating system architecture.

UNIT –II (12 Hrs.)

Interprocess Communication: API for internet protocol, Marshalling, Client server communication and group communication.

Distributed Objects and Remote Invocation: communication between Distributed objects, RPC and characteristics.

Distributed File System: File service architecture, network file system, Sun network file system, Andrew file system Case Study: Unix.

UNIT-III (11 Hrs.)

Name Services: Name services and domain name system, directory and discovery services Case Study: Global Name service.

Transaction and Concurrency Control: transactions, nested transactions, Locks, optimistic concurrency control, time stamp ordering, Comparison of methods for concurrency control.

Distributed Transaction: Flat and nested distributed transactions. Atomic Commit protocol, Distributed dead locks.

UNIT-IV (11 Hrs.)

Distributed Multimedia Systems: Characteristics of multimedia, multimedia data. Quality of service management, resource management, stream adaptation. Case study: Tiger video file server.

RECOMMENDED BOOKS:

1. G. Coulouis, et al., 'Distributed Systems: Concepts and Design', 5th Edn., Pearson Education Asia, Pearson, **2011**.
2. A.S. Tanenbaum, 'Modern operating Systems', 3rd Edn., Prentince Hall, **2015**.
3. Seema Shah and Sunita Mahajan, 'Distributed Computing', 1st Edn., Oxford University Press, **2010**.

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GRID COMPUTING

Subject Code: MCSE2-267 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

LEARNING OBJECTIVES:

This LEARNING offers a good understanding of the concepts, methods and techniques of grid computing and application of grid computing and understanding the technology and tool kits to facilitate the grid computing.

LEARNING OUTCOMES:

CO1: To explain basics of grid computing and applications of grid computing.

CO2: To understand the Grid Computing Anatomy and to know the Open grid services Architecture.

CO3: To Explain the Grid Development Toolkits.

CO4: To explain the Message Passing Interface (MPI) Standard.

UNIT-I (11 Hrs.)

Introduction to High Performance Computing: Early Grid Activities, Current Grid Activities, Grid Business Areas, Grid Applications. Grid Computing Organizations and Their Roles: Developing Grid Standards & Best Practice Guidelines, Developing Grid Computing Toolkits & Frameworks, Grid-Based Solutions to Solve Computing, Data, and Network Requirements, Building and Using Grid-Based Solutions Commercially.

UNIT-II (12 Hrs.)

Grid Computing Anatomy: The Grid Problem, The Grid Computing Roadmap, Grid Services Architecture and Web Services Architecture.

OGSA: Introduction, Sample Use Cases that Drive the OGSA, OGSA Platform Components, Open Grid Services Infrastructure (OGSI), OGSA Basic Services.

UNIT-III (11 Hrs.)

The Grid Development Toolkits: GlobusGT3 Toolkit: Architecture, GlobusGT3 Toolkit: Programming Model, GlobusGT3 Toolkit: Implementation, GlobusGT3 Toolkit: High-Level Services.

UNIT-IV (11 Hrs.)

Message Passing Interface (MPI) Standard: Overview, Procedures and Arguments, Data Types, Processes, Error Handling, Platform independence, Point-to-Point Communication, Collective Communication, Groups — Contexts Communicators, Process Technologies.

RECOMMENDED BOOKS:

1. Joshy Joseph, Craig Fellenstein, 'Grid Computing', 1st Edn., Pearson Education, **2004**.
2. Vladimir Silva, 'Grid Computing for Developers', 1st Edn., Dreamtech Press, **2006**.
3. Ahmar Abbas, 'Grid Computing, A Practical Guide to Technology and Applications', 2nd Edn., Firewall Media, **2006**.
4. Ian Foster, Carl Kesselman, 'The Grid 2 – Blueprint for a New Computing Infrastructure', 2nd Edn., Morgan Kaufman, **2004**.
5. Joshy Joseph, Craig Fellenstein, 'Grid Computing', 2nd Edn., Pearson Education, **2004**.
6. Fran Berman, Geoffrey Fox, Anthony J.G. Hey, 'Grid Computing: Making the Global Infrastructure a Reality', 1st Edn., John Wiley and sons, **2003**.

NETWORK PROGRAMMING

Subject Code: MCSE2-268 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

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LEARNING OBJECTIVES:

To understand interprocess and inter-system communication, socket programming in its entirety, usage of TCP/UDP / Raw sockets.

LEARNING OUTCOMES:

CO1: To write socket API based programs.
CO2: To design and implement client-server applications using TCP and UDP sockets.
CO3: To analyze network programs.
CO4: To understand how to build network applications.

UNIT-I (11 Hrs.)

Introduction: Overview of UNIX OS, Environment of a UNIX process, Process control, Process relationships Signals, Interprocess Communication, overview of TCP/IP protocols.

UNIT-II (11 Hrs.)

Elementary TCP sockets: Introduction to Socket Programming, Introduction to Sockets, Socket address Structures, Byte ordering functions, address conversion functions, Elementary TCP Sockets, socket, connect, bind, listen, accept, read, write, close functions, Iterative Server, Concurrent Server.

UNIT-III (12 Hrs.)

Application Development: TCP Echo Server, TCP Echo Client, Posix Signal handling, Server with multiple clients, boundary conditions: Server process Crashes, Server host Crashes, Server Crashes and reboots, Server Shutdown, I/O multiplexing, I/O Models, select function, shutdown function, TCP echo Server (with multiplexing), poll function, TCP echo Client (with Multiplexing).

UNIT-IV (11 Hrs.)

Socket Options, Elementary UDP Sockets: Socket options, getsocket and setsocket functions, generic socket options, IP socket options, ICMP socket options, TCP socket options, Elementary UDP sockets, UDP echo Server, UDP echo Client, Multiplexing TCP and UDP sockets, Domain name system, gethostbyname function, Ipv6 support in DNS, gethostbyadr function – getservbyname and getservbyport functions.

Advanced Sockets: Ipv4 and Ipv6 interoperability, threaded servers, thread creation and termination, TCP echo server using threads, Mutexes, condition variables, raw sockets, raw socket creation, raw socket output, raw socket input, ping program, trace route program.

RECOMMENDED BOOKS:

1. W. Richard Stevens, B. Fenner, A.M. Rudoff, 'Unix Network Programming – The Sockets Networking API', 3rd Edn., Pearson, **2004**.
2. W. Richard Stevens, S.A. Rago, 'Programming in the Unix Environment', 2nd Edn., Pearson, **2005**.

LINUX PROGRAMMING

Subject Code: MCSE2-269 **L T P C** **Duration: 45 Hrs.**

3 1 0 4

LEARNING OBJECTIVESS:

To understand and make effective use of Linux utilities and Shell scripting language (bash) to solve Problems and to implement in C some standard Linux utilities using system calls.

LEARNING OUTCOMESS:

CO1: Work confidently in Linux environment.

CO2: Work with shell script to automate different tasks as Linux administration.

CO3: To develop the skills necessary for systems programming including file system programming, process and signal management, and interprocess communication.

CO4: To develop the basic skills required to write network programs using Sockets.

UNIT-I (11 Hrs.)

Linux Utilities: File handling utilities, Security by file permissions, Process utilities, Disk utilities, Networking commands, Filters, Text processing utilities and Backup utilities, sed – scripts, operation, addresses, commands, applications, awk – execution, fields and records, scripts, operation, patterns, actions, functions, using system commands in awk. **Working with the Bourne again shell (bash):** Introduction, shell responsibilities, pipes and input Redirection, output redirection, here documents, running a shell script, the shell as a programming language, shell meta characters, file name substitution, shell variables, command substitution, shell commands, the environment, quoting, test command, control structures, arithmetic in shell, shell script examples, interrupt processing, functions, debugging shell scripts.

UNIT-II (11 Hrs.)

Files: File Concept, File System Structure, Inodes, File Attributes, File types, Library functions, the standard I/O and formatted I/O in C, stream errors, kernel support for files, System calls, file descriptors, low level file access, File structure related system calls(File APIs), file and record locking, file and directory management.

UNIT-III (11 Hrs.)

Process: Process concept, Kernel support for process, process attributes, process control - process creation, waiting for a process, process termination, zombie process, orphan process, Process APIs. Signals– Introduction to signals, Signal generation and handling, Kernel support for signals, Signal function.

Interprocess Communication: Introduction to IPC, Pipes, FIFOs, Introduction to three types of IPC-message queues, semaphores and shared memory. Message Queues- Kernel support for messages, Unix system V APIs for messages, client/server example.

UNIT-IV (12 Hrs.)

Semaphores: Kernel support for semaphores, Unix system V APIs for semaphores. Shared Memory- Kernel support for shared memory, Unix system V APIs for shared memory, semaphore and shared memory example.

Multithreaded Programming: Differences between threads and processes, Thread structure and uses, Threads and Lightweight Processes, POSIX Thread APIs, Creating Threads, Thread Attributes, Thread Synchronization with semaphores and with Mutexes, Example programs.

Sockets: Introduction to Sockets, Socket Addresses, Socket system calls for connection oriented protocol and connectionless protocol, example-client/server programs.

RECOMMENDED BOOKS:

1. T. Chan, 'Unix System Programming using C++', 1st Edn., PHI, **1997**.
2. Sumitabha Das, 'Unix Concepts and Applications', 4th Edn., TMH, **2006**.
3. N. Matthew, R. Stones, Beginning Linux Programming', 4th Edn., Wiley India, **2007**.

NETWORK PERFORMANCE AND EVALUATION

Subject Code: MCSE2-270 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

MRSPTU

LEARNING OBJECTIVES:

To strengthen students in primal principles, performance measure of different protocols for a Computer Networks and analysis of Computer Network protocols.

LEARNING OUTCOMES:

CO1: Describe and compare the basic technologies used in computer network systems.
CO2: Evaluate performance of different protocols.
CO3: Analyze the protocols used in computer networks.
CO4: Study of different protocol as a stochastic process and use of simulation tools and SHARPE tool.

UNIT-I (11 Hrs.)

Review of Computer Networks, Wireless Sensor Networks.

Performance Evaluation Parameter: Bandwidth utilization, throughput, delays, error rate, congestion, and network reliability.

UNIT-II (11 Hrs.)

Basics of Modeling and Simulation: Random variables; probability distributions; expected value, Important distributions (uniform, Geometric, exponential, Joint distributions and independence, Conditional probability and conditional expectation.

UNIT-III (12 Hrs.)

Queuing Systems: Arrival and service processes, Server disciplines, Queuing networks: Open vs. closed networks, Product-form queuing networks.

Performance Measure of Different Protocols: Stochastic processes: discrete-time and continuous-time, Markov chains, Performance analysis of ALOHA protocol, CSMA/CD, CSMA/CA. Analysis of Stop and wait protocols and Sliding window protocol.

UNIT-IV (11 Hrs.)

Network Performance of Some More Protocols: Extended queuing networks, Numerical solution of Markov chains, Open central server network example, Delay and throughput analysis of ARQ systems, FDM and TDM, Measure of response time for TCP and UDP; Markov and reliability models for Network system.

RECOMMENDED BOOKS:

1. Andrew S. Tanenbaum, 'Computer Networks', 4th Edn., Pearson Education, **2002**.
2. Youlu Zheng, Shakil Akhtar, 'Networks for Computer Scientists and Engineers', 1st Edn., Oxford University Press, **2001**.
3. Raj Jain, 'The Art of Computer Systems Performance Analysis: Techniques for Experimental Design, Measurement, Simulation, and Modeling', 1st Edn., John Wiley & Sons, **1991**.
4. Kishor S. Trivedi, 'Probability and Statistics with Reliability, Queueing, and Computer Science Applications', 2nd Edn., Wiley, **2008.**
5. Sheldon M. Ross, 'Introduction to Probability Models', 7th Edn., Academic Press, **2002.**
6. Miller, Freund, 'Probability and Statistics for Engineers', 8th Edn., PHI, **2011**.
7. Sanjay K. Bose, 'An introduction to Queuing System', 1st Edn., Kluwer Academic/ Plenum Publishers, **2002**.
8. James F. Kurose, Keith W. Ross, 'Computer Networking: A Top-Down Approach Featuring the Internet', 6th Edn., Pearson Education, **2012**.
9. William Stallings, 'Data and Computer Communications', 7th Edn., Prentice Hall of India Publication, **2003**.
10. D. Bertsekas and R. Gallager, 'Data Networks', 2nd Edn., Prentice-Hall, **1992**.

OPEN SOURCE TECHNOLOGIES

MRSPTU

Subject Code: MCSE2-271	**L T P C** **3 1 0 4**	**Duration: 45 Hrs.**

LEARNING OBJECTIVES:

To give a brief introduction to the open source technology. Through interactive sessions enabling students to enhance their skills in contributing and implementing their technical knowledge.

LEARNING OUTCOMES:

CO1: Open source software history, initiatives and principles. Open standards, Licenses and FOSS.

CO2: Learn about the Open Source Operating system and its distributions like Fedora, Google chrome OS, Ubuntu.

CO3: Study of Web technologies based on open Software's LAMP (Linux Apache MySqland PHP/Python).

CO4: To Learn HTML, XHTML, PHP and JavaScript.

UNIT-I (11 Hrs.)

Introduction: Open Source Definition, Free Software vs. Open Source Software, Public Domain Software, Open Source History, Initiatives, Principle and Methodologies. Open Standards.

Open Source Development Model Licenses and Patents: What Is a License, Important FOSS Licenses (Apache, BSD, GPL, LGPL), copyrights and copy lefts, Patents Economics of FOSS: Zero Marginal Cost, Income-generation opportunities, Problems with traditional commercial software, Internationalization.

UNIT-II (12 Hrs.)

Open Source Operating Systems: Different open source operating systems. Google Chrome OS, BSD, Linux Distributions – Fedora and Ubuntu, Installation, Disk Partitioning, Boot loader. Using Linux – Shell, File system familiarity, Linux Administration – Managing users, services and software, Network Connectivity, Configurations and Security.

Open Source Web Technologies: Two Tier and Three Tier Web based Application Architecture. LAMP Terminologies, Advantages. Apache, Web server conceptual working, Web browser, HTTP, Installation and Configuration, httpd. conf file, Logging, Security, Running a website, MySQL, Database management system, ER diagram, Relational database, Installation, Configuration, Administration, Common SQL queries.

UNIT-III (11 Hrs.)

Programming on XHTML and XML: Editing XHTML, W3C XHTML validation services, designing XHTML by using XHTML tables, frames, forms and other elements. CSS and its types. XML, XML namespaces, DTD, XML schema, XML vocabularies, DOM and its methods, SOAP.

UNIT-IV (11 Hrs.)

Programming on PHP and JavaScript: JavaScript: JavaScript variables, control structures, functions, arrays and objects. Cascading Style Sheets, Client Side Scripting - Java Script, PHP: Form processing and business logic, stream processing and regular expressions, viewing client/server environment variables, connecting to database and handling of cookies. SQL, Accessing databases with PHP.

Open Source Ethics: Open source vs. closed source Open source government, Open source ethics. Social and Financial impacts of open source technology, shared software, Shared source.

Case Studies: Mozilla (Firefox), Wikipedia, Joomla, Open Office, GCC.

RECOMMENDED BOOKS:

1. B. Ware, B. Lee J., ‘Open Source Development with Lamp: Using Linux, Apache, MySQL, Perl, and PHP’, Addison-Wesley Professional.
2. Deitel, ‘Internet and World Wide Web, How to Program’, 4th Edn., Prentice Hall, **2008.**
3. P. DuBois, ‘MySQL’, 4th Edn., Addison-Wesley Professional.
4. M. Zandstra, ‘Teach Yourself PHP in 24 Hours’, 2nd Edn., Sams Publishing.

MRSPTU

PRACTICAL LAB.-II

Subject Code: MCSE2-207 **L T P C**
0 0 4 2

- Practical’s should be related to the core subjects of the same semester.

SEMANTICS WEB AND SOCIAL NETWORKING

Subject Code: MCSE1-372 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

LEARNING OBJECTIVES:

The OBJECTIVES of this LEARNING is to understand the need of semantic web in web services and advances the knowledge about Semantic Web Applications, Services and Social Networking.

LEARNING OUTCOMES:

CO1: Able to understand semantic web basics, architecture and technologies.

CO2: Able to understand the Knowledge Representation for the Semantic Web and Ontology Engineering.

CO3: Able to design and implement a web services application that "discovers" the data and/or other web services via the semantic web.

CO4: Able to discover the capabilities and limitations of semantic web technology for social networks.

UNIT-I (11 Hrs.)

Introduction: Introduction to the Syntactic web and Semantic Web, Evolution of the Web, the visual and syntactic web, Levels of Semantics, Metadata for web information, the semantic web architecture and technologies, Contrasting Semantic with Conventional Technologies, Semantic Modeling, Potential of semantic web solutions and challenges of adoption.

UNIT-II (12 Hrs.)

Knowledge Representation for the Semantic Web: Ontologies and their role in the semantic web, Ontologies Languages for the Semantic Web Resource Description Framework(RDF) / RDF Schema, fundamental concepts of Ontology Web Language(OWL), UML, XML/XML Schema.

Ontology Engineering: Ontology Engineering, Constructing Ontology, Ontology Development Tools, Ontology Methods, Ontology Sharing and Merging, Ontology Libraries and Ontology Mapping, Logic, Rule and Inference Engines.

UNIT-III (11 Hrs.)

Semantic Web Applications, Services and Technology: Semantic Web applications and services, Semantic Search, e-learning, Semantic Bioinformatics, Knowledge Base, XML Based Web Services, Creating an OWL-S Ontology for Web Services, Semantic Search Technology, Web Search Agents and Semantic Methods.

UNIT-IV (11 Hrs.)

Social Network Analysis and semantic web: What is social Networks analysis, development of the social networks analysis, Electronic Sources for Network Analysis – Electronic Discussion networks, Blogs and Online Communities, Web Based Networks, Building Semantic Web Applications with social network features.

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RECOMMENDED BOOKS:

1. Peter Mika, 'Social Networks and the Semantic Web', 1st Edn., Springer, **2007**.
2. Berners Lee, Godel and Turing, 'Thinking on the Web', Wiley Inter Science, **2009**.
3. Liyang Yu, 'A Developer's Guide to the Semantic Web', 1st Edn., Springer, **2011**.
4. John Hebeler, Matthew Fisher, Ryan Blace and Andrew Perez-Lopez, 'Semantic Web Programming', 1st Edn., Wiley, **2009**.

NATURAL LANGUAGE PROCESSING

Subject Code: MCSE1-373	**L T P C** **3 1 0 4**	**Duration: 45 Hrs.**

LEARNING OBJECTIVES:

To describe the techniques and algorithms used in processing natural languages.

LEARNING OUTCOMES:

CO1: To understand the concept of Natural Language Processing (NLP), Challenges of NLP, NLP Applications, Understanding different levels of language analysis.

CO2: To understand concepts related to morphology and parsing in detail.

CO3: To study Need of Machine translation, Problems of Machine Translation, MT Approaches.

CO4: To study about lexical knowledge network and speech recognition.

UNIT –I (11 Hrs.)

Introduction: Natural Languages, Origin of Natural Language Processing (NLP), Challenges of NLP, Application of Natural Language, Understanding Different levels of language analysis.

Regular Expressions, Finite state automata, Morphological analysis: Inflectional and derivational morphology, Finite state morphological parsing.

UNIT-II (12 Hrs.)

Words and Word Forms: Morphology fundamentals, Morphological Diversity of Indian Languages, Morphology Paradigms; Finite State Machine Based Morphology; Automatic Morphology Learning, Shallow Parsing; Named Entities, Maximum Entropy Models; Random Fields, Scope Ambiguity and Attachment Ambiguity resolution.

Structures: Theories of Parsing, Parsing Algorithms: Top down parsing, bottom up parsing, Problems with top down and bottom up parsing, Robust and Scalable Parsing on Noisy Text as in Web documents; Hybrid of Rule Based and Probabilistic Parsing; Scope Ambiguity and Attachment Ambiguity resolution.

UNIT-III (11 Hrs.)

Machine Translation: Need of MT, Problems of Machine Translation, MT Approaches, Direct Machine Translations, Rule-Based Machine Translation, Knowledge Based MT System, Statistical Machine Translation, UNL Based Machine Translation, Translation involving Indian Languages.

UNIT-IV (11 Hrs.)

Meaning: Lexical Knowledge Networks, WorldNet Theory; Indian Language Word Nets and Multilingual Dictionaries; Semantic Roles; Word Sense Disambiguation; WSD and Multilinguality; Metaphors.

Speech Recognition: Issues in Speech Recognition, The Sound Structure of Language, Speech Recognition, Signal processing and analysis method, Articulation and acoustics, Phonology and phonetic transcription, Word Boundary Detection; Argmax based computations; HMM and Speech Recognition.

RECOMMENDED BOOKS:

1. J. Allen, 'Natural Language understanding', 2nd Edn., Benjamin/Cunnings, **1987**.
2. Siddiqui and U.S. Tiwary, 'Natural Language Processing and Information Retrieval', 1st Edn., Oxford University Press, **2008**.
3. K. Jensen, G.E. Heidorn, S.D. Richardson, 'Natural Language Processing: The PLNLP Approach', Springer, **2013**.
4. P. Roach, 'Phonetics', Oxford University Press, **2012**.

BIG DATA & CLOUD COMPUTING

Subject Code: MCSE1-374	**L T P C** **3 1 0 4**	**Duration: 45 Hrs.**

LEARNING OBJECTIVES:

This LEARNING will help you in learning Big data with Cloud technology to understand what is cloud storage, Big data in the cloud, characteristics of cloud computing, cloud computing services and cloud hosting, cloud data storage and deployment models, cloud computing companies and cloud service providers, cloud infrastructure, advantages of cloud computing and issues with cloud computing.

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LEARNING OUTCOMES:

CO1: Ability to learn basics of Big data, Hadoop and Map Reduce.

CO2: Able to learn the basics of Hive, HQL, HBase schema design, PIG and NoSQL.

CO3: Understand various basic concepts related to cloud computing technologies, architecture and concept of different cloud models: IaaS, PaaS, SaaS. Cloud virtualization, cloud storage, data management and data visualization.

CO4: Understand different cloud programming platforms & tools and familiar with application development and deployment using cloud platforms.

UNIT I (11 Hrs.)

Introduction: Introduction to Big Data and its importance, 5v's of Big Data, Security Challenges, Need for Big data analytics, Big data applications. Apache Hadoop Architecture, Hadoop YARN, Comparison of Traditional system & Hadoop Ecosystem, Installation steps of Hadoop (1.x), Moving Data in and out of Hadoop, need for Record Reader and Record writer, understanding inputs and outputs file format of Map Reduce.

UNIT-II (12 Hrs.)

Introduction to Hive: Hive Architecture and Installation, HQL vs SQL, HBase concepts-Schema Design, Table Design, Introduction to PIG, NoSQL.

UNIT-III (11 Hrs.)

Cloud Computing Fundamental: Cloud Computing definition, Deployment models. Cloud as a Service. Benefits and challenges of cloud computing, public vs private clouds, role of virtualization in enabling the cloud; Benefits and challenges to Cloud architecture.

UNIT-IV (11 Hrs.)

Cloud Applications, Cloud Services Management: Reliability, availability and security of services deployed from the cloud. Performance and scalability of services, tools and technologies used to manage cloud services deployment, computing infrastructures available for implementing cloud based services. Case Study of EC2.

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RECOMMENDED BOOKS:

1. Chris Eaton, Dirk deroos et al., 'Understanding Big data', 1st Edn., McGraw Hill, **2015**.
2. Tom White, 'HADOOP: The definitive Guide', 4th Edn., O Reilly, **2015**.
3. Gautam Shroff, 'Enterprise Cloud Computing Technology Architecture Applications', 1st Edn., Cambridge University Press, **2010**.
4. Toby Velte, Anthony Velte, Robert Elsenpeter, 'Cloud Computing, A Practical Approach', 1st Edn., McGraw Hill Education, **2009**.

DIGITAL IMAGE PROCESSING

Subject Code: MCSE1-375 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

LEARNING OBJECTIVES:

Visual information plays an important role in many aspects of our life. Much of this information is represented by digital images. Digital image processing is ubiquitous, with applications including television, tomography, photography, printing, robot perception, and remote sensing. This is an introductory LEARNING to the fundamentals of digital image processing. It emphasizes general principles of image processing, rather than specific applications.

LEARNING OUTCOMES:

CO1: To introduce the digital images, processing with digital images, application areas of the field, fundamentals step to process images, image acquisition and digitization and understand image processing system.

CO2: To learn basic image transforms, image enhancement in spatial as well as frequency domain, to make them aware about various filters used for enhancement. Aim is to introduce histograms in image processing.

CO3: To study the image restoration of degraded images and processing of colour images and Introduction to wavelets.

CO4: To understand the image compression in order to save bandwidth and storage, image segmentation techniques, representation of image and basics of morphological processing operations.

UNIT-I (11 Hrs.)

Introduction: Digital Images and their Representation, Digital image processing, Application areas of digital image processing. Fundamental Steps in Image Processing, Elements of a Digital Image Processing System.

Digital Image Fundamentals: Elements of Visual Perception, A Simple Image Model, Image acquisition, Sampling and Quantization, Some Basic Relationships between Pixels, Mathematical Preliminaries, 2D Linear Space Invariant Systems,2D Convolution and Correlation.

UNIT-II (12 Hrs.)

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Image Enhancement: Some Simple Intensity Transformations, Image Subtraction, Image Averaging, Spatial Domain Methods, Smoothing Filters, Sharpening Filters, Frequency Domain Methods, Lowpass Filtering, Highpass Filtering, Generation of Spatial Masks from Frequency Domain Specifications, Histogram Processing: Streaching, Equalization and Specification.

Image Transforms: 2D Orthogonal and Unitary Transforms, Properties and Examples. Introduction to the Fourier Transform, The Discrete Fourier Transform, 2D DFT, FFT, DCT, Hadamard Transform, Haar Transform, KL Transform.

UNIT-III (11 Hrs.)

Image Restoration: Degradations Model, Degradation Model for continuous and discrete functions, Algebraic Approach to Restoration: Unconstrained Restoration, Constrained Restoration, Inverse Filtering, weiner filters, Restoration in the Spatial Domain, Geometric Transformation.

Color Image processing and wavelets: Color Image Processing Fundamentals, Color Models: RGB, CMY, CMYK, HSI, Relationship between different Models.

UNIT-IV (11 Hrs.)

Image Compression: Fundamentals: Coding Redundancy, Interpixel Redundancy, Psychovisual Redundancy, Fidelity Criteria. Image Compression Models, Loss Less Variable Length, Huffman, Arithmetic Coding, Bit Plane Coding, Loss Less Predictive Coding, Lossy Transform (DCT) Based Coding, Sub Band Coding.

Image Segmentation: Edge Detection, Line Detection, Curve Detection, Edge Linking and Boundary Extraction, Image Representation: Boundary Representation, Region Representation and Segmentation, Morphological Processing: Dilation, Erosion, Opening and Closing, Hit and Miss Algorithms.

RECOMMENDED BOOKS:

1. Rafael. C. Gonzalez & Richard E. Woods. 'Digital Image Processing', 2nd Edn., Pearson Education, **2006.**

2. W.K. Pratt. ‘Digital Image Processing’,3rd Edn., John Wiley & Sons, Inc., **2006.**
3. M. Sonka et.al, ‘Image Processing, Analysis and Machine Vision’, 2nd Edn., Thomson, Learning, India Edition, **2007**.
4. Kenneth R. Castleman, ‘Digital Image Processing’, 2nd Edn., Pearson Education, **1996**.
5. S. Jayaraman, S. Esakkirajan, T. Veerakumar, ‘Digital Image Processing’, 1st Edn., McGraw Hill Education, **2009**.
6. K. Anil Jain, ‘Fundamentals of Digital Image Processing’, 4th Edn., Prentice Hall of India, **1989**.

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MRSPTU M.TECH. ELECTRICAL ENGINEERING (POWER SYSTEM) STUDY SCHEME 2016 BATCH ONWARDS

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M.TECH. (Power System) 1ST SEMESTER
TOTAL CONTACT HRS. = 22 TOTAL CREDITS= 21

COURSE		Contact Hrs.			Marks			Credits
Code	**Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
MELE3-101	Power System operation and control	4	--	--	40	60	100	4
MELE3-102	Power Electronic Devices & Controllers	4	--	--	40	60	100	4
MELE3-103	Advanced Power System Analysis & Design	4	--	--	40	60	100	4
MELE3-104	Power System Software Lab.	--	--	2	60	40	100	1
Departmental Elective-I (Choose any one)		4	--	--	40	60	100	4
MELE3-156	EHVAC Transmission System							
MELE3-157	Fast Transients in Power System							
MELE3-158	Non Conventional Energy Resources							
MELE3-159	Applied Instrumentation & Measurements							
Departmental Elective-II (Choose any one)		4	--	--	40	60	100	4
MELE3-160	HVDC Transmission System							
MELE3-161	Power System Communication							
MELE3-162	Smart Grid Technologies							
MELE3-163	Discrete Time Control System							
Total		**20**	**0**	**2**	**260**	**340**	**600**	**21**

M.TECH. (Power System) 2ND SEMESTER
TOTAL CONTACT HRS. = 22 TOTAL CREDITS= 21

COURSE		Contact Hrs.			Marks			Credits
Code	**Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
MELE3-205	Power System Planning	4	--	--	40	60	100	4
MELE3-206	Advanced Power System Protection	4	--	--	40	60	100	4
MELE3-207	Power System Dynamics & Stability	4	--	--	40	60	100	4
MELE3-208	Simulation Lab	--	--	2	60	40	100	1
Departmental Elective-III (Choose any one)		4	--	--	40	60	100	4
MELE3-264	Power System Reliability							

MELE3-265	Customized Power Devices							
MELE3-266	Advanced Electrical Machines							
MELE3-267	Artificial Intelligent Techniques							
Open Elective-I		4	--	--	40	60	100	4
Total		20	0	2	260	340	600	21

M.TECH. (Power System) 3RD SEMESTER
TOTAL CONTACT HRS. = 24 TOTAL CREDITS= 24

COURSE		**Contact Hrs.**			**Marks**			**Credits**
Code	**Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
Departmental Elective-IV (Choose any one)		4	--	-	40	60	100	4
MELE3-368	Energy Management and Energy Auditing							
MELE3-369	Distribution System Operation & Analysis							
MELE3-370	Digital Signal Processing & Applications							
MELE3-371	Engineering Optimization							
Departmental Elective-V (Choose any one)		4	--	--	40	60	100	4
MELE3-372	Power System Harmonics							
MELE3-373	System Modeling & Optimization							
MELE3-374	Embedded Systems							
MELE3-375	Wind Energy and Small Hydro Energy Station							
MELE3-309	Project	-	--	8	60	40	100	10
MELE3-310	Seminar	-	--	4	100	_	100	4
MELE3-311	Research Lab.	-	-	4	60	40	100	2
Total		8	--	16	300	200	500	24

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M.TECH. (Power System) 4TH SEMESTER
TOTAL CREDITS= 24

COURSE		**Contact Hrs.**			**Marks**			**Credits**
Code	**Name**	**L**	**T**	**P**	**Internal**	**External**	**Total**	
MELE3-412	Dissertation	_	_	_	60	40	100	24

POWER SYSTEM OPERATION AND CONTROL

Subject Code: MELE3-101 **L T P C** **Duration: 40 Hrs.**
4 0 0 4

UNIT-1

1. INTRODUCTION (10 Hrs.)

Characteristics of power generation units (thermal, nuclear, hydro, pumped hydro), variation in thermal unit characteristics with multiple valves, Economic dispatch with and without line losses, lambda iteration method, gradient method, Economic dispatch without line losses, economic dispatch with line losses, lambda iteration method, gradient method, Newton's method, base point and participation factors.

UNIT-1I

2. TRANSMISSION LOSSES (5 Hrs.)

Coordination equations, incremental losses, penalty factors, B matrix loss formula (without derivation), methods of calculating penalty factors.

3. UNIT COMMITMENT (5 Hrs.)

Constraints in unit commitment, priority list method, Dynamic programming method and Lagrange relaxation methods.

UNIT-1II

4. HYDRO THERMAL CO-ORDINATION (5 Hrs.)

Introduction to long range and short range hydro scheduling, Types of short range scheduling problem, Scheduling energy. The short term hydro-thermal scheduling problems and its solution by Lambda-Gamma iteration method and gradient method

5. GENERATION WITH LIMITED ENERGY SUPPLY (5 Hrs.)

Take or pay fuel supply contract, composite generation production cost function, gradient search techniques.

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UNIT-1V

6. OPTIMAL POWER FLOW FORMULATION (5 Hrs.)

Gradient and Newton method, linear programming methods.

7. AUTOMATIC GENERATION CONTROL (5 Hrs.)

Load frequency control, single area system, multi-area system, tie line control, automatic voltage control.

RECOMMENDED BOOKS:

1. D.P. Kothari and J.S. Dhillon, 'Power System Optimization', Prentice-Hall of India Pvt. Ltd. New Delhi.
2. G.L.K. Kirchmayer, 'Economic Operation of Power Systems', John Willey & Sons, N.Y.
3. A.J. Wood, B.F. Wollenberg, 'Power Generation Operation and Control'.
4. D.P. Kothari and I.J. Nagrath, 'Modern Power System Analysis', Tata McGraw Hill Publishing Company Ltd., New Delhi.

POWER ELECTRONIC DEVICES AND CONTROLLERS

Subject Code: MELE3-101	L T P C 4 0 0 4	Duration: 40 Hrs.

UNIT-1

1. REVIEW OF SEMICONDUCTOR DEVICES (5 Hrs.)

Conduction Process in semiconductors, p-n Junction, Charge control description, Avalanche breakdown, Power diodes, Thyristors, Gate Turn Off thyristor (GTO), VI characteristics, Dynamic characteristics, ratings, protection.

2. POWER MOSFET AND IGBT (5 Hrs.)

Basic structure, I-V Characteristic, Physics of device operation, switching characteristics, operating limitation and safe operating area.

UNIT-1I

3. EMERGING DEVICES AND CIRCUITS (10 Hrs.)

Power junction Field effect transistor (FET), Integrated Gate-Commutated Thyristor (IGCT), Field Control Thyristor, Metal oxide semiconductor (MOS) Control Thyristor etc. Power ICs, New semiconductor materials.

UNIT-III

4. SNUBBER CIRCUITS (10 Hrs.)

Types of Snubber circuits, needs of Snubber circuit with diode, thyristor and transistors, Turn-off Snubber, over voltage snubber, turn on snubber, Snubber for bridge circuit configurations, GTO Snubber circuit.

UNIT-1V

5. GATE AND BASIC DRIVE CIRCUITS (10 Hrs.)

Design Consideration, De-coupled drive circuits, electrically isolated drive circuits, cascade connected drive circuits, Power device protection in drive circuits, circuit layout considerations.

RECOMMENDED BOOKS:

1. Mohan, Undeland and Robbins, ‘Power electronics: Converters, Applications and Design’, John Wiley and Sons.
2. M.H. Rashid, ‘Power Electronics Handbook’, Elsevier Press (Academic Press Series).
3. D. Finney, ‘The Power Thyristor and its Applications’, McGraw Hill, New York.
4. C.W. Lander, ‘Power Electronics’, McGraw Hill Book Co., U.K.
5. M.H. Rashid, ‘Power Electronics - Circuits, Devices and Applications’, PHI, India.

ADVANCED POWER SYSTEM ANALYSIS AND DESIGN

Subject Code: MELE3-101	L T P C 4 0 0 4	Duration: 40 Hrs.

UNIT-1

1. Load Flow (10 Hrs.)

Network modeling – Conditioning of Y Matrix – Load Flow-Newton Raphson method- Decoupled – Fast decoupled Load flow -three-phase load flow.

UNIT-1I

2. DC Power Flow (10 Hrs.)

Single phase and three phase -AC-DC load flow - DC system model – Sequential Solution Techniques – Extension to Multiple and Multi terminal DC systems – DC convergence tolerance – Test System and results.

UNIT-I1I

3. Fault Studies (5 Hrs.)

Analysis of balanced and unbalanced three phase faults – fault calculations – Short circuit faults – open circuit faults.

4. System Optimization (5 Hrs.)

Strategy for two generator systems – generalized strategies – effect of transmission losses - Sensitivity of the objective function- Formulation of optimal power flow-solution by Gradient Method-Newton's method.

UNIT-IV

5. State Estimation (10 Hrs.)

Method of least squares – statistics – errors – estimates – test for bad data – structure and formation of Hessian matrix – power system state estimation.

RECOMMENDED BOOKS:

1. J.J. Grainger and W.D. Stevenson, 'Power System Analysis', Tata McGraw hill, New Delhi, **2003**.
2. J. Arrillaga and C.P. Arnold, 'Computer Analysis of Power Systems', John Wiley and Sons, New York, **1997**.
3. M.A. Pai, 'Computer Techniques in Power System Analysis', Tata McGraw hill, New Delhi, **2006**.

POWER SYSTEM SOFTWARE LAB.

Subject Code: MELE3-104 **L T P C**
0 0 2 1

Development of algorithms & flowcharts and digital simulation of the following using ETAP/MATLAB Software package:

1. Z-bus and Y-bus formulation
2. Load flow studies
3. Fault analysis
4. Transient stability studies
5. Economic load dispatch

EHVAC TRANSMISSION SYSTEM

Subject Code: MELE3-156 **L T P C** **Duration: 40 Hrs.**
4 0 0 4

UNIT-1

1. INTRODUCTION (10 Hrs.)

Introduction to EHV AC Transmission, Tower Configurations, types of self-supporting Lattice towers, Flexible and Semi Flexible towers, Thermal Rating of Lines, Temperature rise of conductors and current carrying capacity of lines and cables, properties of bundled conductor, Average value of line parameters, power handling capacity and line loss, selection of cable for EHV AC transmission, Electrical characteristics and cable insulating materials. Types of circuit breakers for EHV AC system.

UNIT-2

2. VOLTAGE GRADIENT OF CONDUCTORS (10 Hrs.)

Field of line charges and their properties, surface voltage gradient on conductors, maximum surface voltage gradient. Corona e effects, Corona formulas based on voltages and voltage gradients, Corona currents, Power loss, Audible Noise and Radio interference, Limits of audible noise, AN measurement, day night equivalent noise level.

UNIT-3

3. ELECTROSTATIC FIELD OF EHV LINES (10 Hrs.)

Capacitance of long objects under transmission lines, electrostatic field of 3 phase single circuit and double circuit AC lines, Biological effects of electrostatic fields.

UNIT-4

4. LIGHTNING AND LIGHTNING PROTECTION (10 Hrs.)

Over voltage factors, type of surge arresters, rating and classification of surge arresters based on applications, insulation withstand characteristics of long air gaps. Design of EHV Lines based on Stability limits.

RECOMMENDED BOOKS:

1. R.D. Begamudre, 'EHV AC Transmission', 2nd Edn., Wiley Eastern Ltd.
2. 'Transmission Line Reference Book: 345 KV and above EPRI', Palo Alto USA.
3. 'Electrical Transmission and Distribution Reference Book', Oxford Book Company, Calcutta.
4. S. Rao, 'EHV –AC and HV DC Transmission Engineering Practice', Khanna Publishers.
5. Related IEEE/IEE Publications.

FAST TRANSIENTS IN POWER SYSTEM

Subject Code: MELE3-157 **L T P C** **Duration: 42 Hrs.**
4 0 0 4

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UNIT-1

1. ORIGIN AND NATURE OF TRANSIENTS AND SURGES (10 hrs.)

Surge parameters of plant. Equivalent circuit representations. Lumped and distributed circuit transients.

UNIT-2

2. LINE ENERGIZATION AND DE-ENERGIZATION TRANSIENTS (10 Hrs.)

Earth and earth wire effects. Current chopping in circuit breakers. Short line fault condition and its relation to circuit breaker duty. Trapped charge effects. Effect of source and source representation in short line fault studies. Control of transients.

UNIT-3

3. LIGHTNING PHENOMENON (10 Hrs.)

Influence of tower footing resistance and earth resistance. Traveling waves in distributed parameter multi-conductor lines, parameters as a function of frequency. Simulation of surge diverters in transient analysis. Influence of pole opening and pole re-closing.

UNIT-4

4. INSULATION CO-ORDINATION (6 Hrs.)

Over voltage limiting devices, dielectric properties, breakdown of gaseous insulation, tracking and erosion of insulation, high current arcs, and metallic contacts.

5. COMMUNICATION LINKS (6 Hrs.)

PLCC, Microwave, Telephone line, Satellite, Fibre optic. Requirements of' various communication equipment used in power systems. Computer networking in power systems.

RECOMMENDED BOOKS:

1. V.A. Vanikov, 'Transients in Power System', Mir Publications, Moscow.
2. L.V. Bewley, 'Traveling Waves on Transmission Lines', Dover Publications Inc., New York.
3. Ravindera Arora and Mosch Wolfgang, 'High Voltage Insulation Engineering', New Age International Publishers Limited.
4. A. Greenwood, 'Electrical Transients in Power Systems', John Wiley & Sons.
5. Stallings William, 'Data and Computer Communication', PHI, **1994**.

6. Gowar John, 'Optical Communications Systems', PHI, **1993**.
7. R.E. Collin, 'Foundations of Microwave Engineering'.
8. Theodore S. Rappaport, 'Wireless Communication, Principles and Practice', IEEE Press; PTR, **1996.**

NON-CONVENTIONAL ENERGY RESOURCES

Subject Code: MELE3-158 **L T P C** **Duration: 45 Hrs.**
4 0 0 4

UNIT-1

1. Introduction to Energy Sources (10 Hrs.)

World Energy Futures, Conventional Energy Sources, Non-Conventional Energy Sources, Prospects of Renewable Energy Sources.

UNIT-2

2. Solar Energy (10 Hrs.)

Introduction to Solar Radiation and its measurement, Introduction to Solar Energy Collectors and Storage. Applications of Solar Energy: Solar, Thermal Electric Conversion Systems, Solar Electric Power Generation, Solar Photo-Voltaic, Solar Cell Principle, Semiconductor Junctions, Conversion efficiency and power output, Basic Photovoltaic System for Power Generation.

UNIT-3

3. Wind Energy (10 Hrs.)

Introduction to wind energy Conversion, the nature of the wind, Power in the wind. Wind data and energy estimation, Site Selection Considerations, Basic Components of a Wind Energy Conversion System, Classification of WEC Systems, Schemes for Electric Generation using Synchronous Generator and Induction Generator, Wind energy Storage.

UNIT-4

4. Direct Energy Conversion Processes (10 Hrs.)

Magneto Hydro Dynamic Power Generation: Principles of MHD power generation, Open Cycle Systems, Closed Cycle Systems, Voltage and power output, Materials for MHD generators. Basic principles of thermo-electric power-generation, Seebeck, Peltier, Thomson effects, Thermo-Electric power generator, Analysis, materials. Thermionic emission and work function, Basic thermionic generation. Classification of Fuel Cells, Types, Advantages, Electrodes, Polarization. The basic Nuclear Function and Reactions Plasma Confinement, Thermo Nuclear Function Reactions.

5. Energy from Biomass (5 Hrs.)

Biomass conversion technologies, photosynthesis, Bio-gas generation, types of bio-gas plants. Biomass as a Source of Energy: Method for obtaining energy from Bio-mass, Biological Conversion of Solar Energy.

RECOMMENDED BOOKS:

1. G.D. Rai, 'Non-Conventional Sources of Energy', Khanna Publishers.
2. David Boyles, 'Bio Energy', Elis Horwood Ltd.
3. N.K. Bansal and M. Kleemann, M. Heliss, 'Renewable Energy Sources and Conversion Technology', Tata McGraw Hill, **1990**.
4. R.A. Coombie, 'Direct Energy Conversion', Pitman.
5. O.P. Vimal and P.D. Tyagi, 'Bio Energy Spectrum', Bio Energy and Wasteland Development Organization.
6. Related IEEE/IEE Publications.

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APPLIED INSTRUMENTATION & MEASUREMENTS

Subject Code: MELE3-159 **L T P C** **Duration: 45 Hrs.**
4 0 0 4

UNIT-1

1. Transducers (10 Hrs.)

Classification of Transducers including analog and digital transducers, Selection of Transducers, Static and Dynamic response of transducer System. Measurement of length & thickness, linear Displacement, Angular Displacement, force, weight, torque, Moisture, Level, Flow, pH & Thermal Conductivity, Measurement of Frequency, Proportional, Geiger Muller & Scintillation Counters.

UNIT-2

2. Telemetry (10 Hrs.)

Basic Principles, Proximity & remote Action Telemetry systems, Multiplexing; Time Division and frequency division.

UNIT-3

3. Display Device (10 Marks)

Digital Voltmeters, Dual Slope DVMS, Digital encoders, Analog and Digital encoders, Analog and Digital Data Acquisition System, A/D Converter. Fibre Optic Technology for data transmission, Supervisory Control and Data Acquisition Systems (SCADA), Q-meter. Electrical noise in control signals, its remedial measures.

UNIT-4

4. Virtual Instrumentation (10 Marks)

Introduction to Virtual Instrumentation, conventional vs. Virtual instrumentation, advantages and basic representations. Introduction to Lab view. Applications of virtual instrumentation in various fields like Industrial applications, defense, Medical.

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BOOKS RECOMMENDED:

1. W.D. Cooper & A.D. Helfrick,'Electronic Instrumentation and Measurement Techniques', PHI.
2. B.C. Nakra and K.K. Chaudhary, 'Instrumentation Measurement Analysis', Tata McGraw-Hill.
3. Hermann, K.P. Neubert, 'Instrument Transducers'.
4. Mansfleld, 'Electrical Transducers for Industrial Measurement'.
5. Mani Sharma, Rangan, 'Instrumentation Systems'.
6. Borden & Thgnel, 'Principles & Methods of Telemetry'.
7. Foster, 'Telemetry Method'.
8. Sanjay Gupta &Joseph John, 'Virtual Instrumentation Using Lab VIEW', TMG; Tata Mc-Graw Hills, **2005**.
9. Robert H. Bishop, 'Learning with Lab VIEW 7 Express', Pearson Education, **2005**.
10. Related IEEE/IEE Publications.

HVDC TRANSMISSION SYSTEM

Subject Code: MELE3-159 **L T P C** **Duration: 45 Hrs.**
4 0 0 4

UNIT-1

1. Introduction (10 Hrs.)

Merits & Demerits of H.V.D.C. transmission over E.H.V. A.C. transmission, types of HVDC links.

UNIT-2

2. Converter Configurations (10 Hrs.)

Connection, rectifier & inverter waveforms, complete analysis of 3-phase (6 pulses) bridge converter, equations of voltage & current on AC& DC side. Equivalent Circuit of HVDC link, Basic means of control of HVDC link, CIA, CEA & CC, control characteristics, combined characteristics of a converter.

UNIT-3

3. Reactive Power compensation: (10 Hrs.)

Fundamentals of Harmonics and Harmonic filters, Stability aspect of synchronous & asynchronous link.

UNIT-4

4. Hybrid HVDC System (10 Hrs.)

Introduction to multi-terminal HVDC systems, Protective system in HVDC substations.

BOOKS RECOMMENDED:

1. K.R. Padiyar, 'HDVC Power Transmission System', Wiley Eastern Ltd., **1990.**
2. E.W. Kimbark, 'Direct Current Transmission', Vol 1, Wiley Interscience, **1971**.
3. J. Arrillage, 'H.V.D.C. Transmission', Peter Peregrines, **1983**.
4. J. Arrillage, 'HVDC et.al Computer Modelling of Electrical Power System', John Wiley, **1993**.
5. S. Rao, 'EHV-AC and Transmission Engineering Practice', Khanna Publishers, **1990**.
6. Related IEEE/IEE Publications.

POWER SYSTEM COMMUNICATION

Subject Code: MELE3-161 **L T P C** **Duration: 40 Hrs.**

4 0 0 4

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UNIT I

1. Introduction (10 Hrs.)

Communication links required in telemetry, tele-control and tele protection.

UNIT 2

2. Analog and digital communication (10 Hrs.)

SPEd and banding requirements, Noise in power systems.

UNIT 3

3. Communication Links (10 Hrs.)

PLCC, Microwave, Telephone line, Satellite, Fiber optic, Requirements of' various communication equipment used in power systems

UNIT 4

4. Computer Networking (10 Hrs.)

Computer networking in power systems

RECOMMENDED BOOKS:

1. William Stallings, 'Data and Computer Communication', PHI, **1994**.
2. John Gowar, 'Optical Communications Systems', PHI, **1993**.
3. R.E. Collin, 'Foundations of Microwave Engineering'.
4. Theodore S. Rappaport, 'Wireless Communication, Principles and Practice', IEEE Press, PTR, **1996.**
5. K. Feher, 'Wireless Digital Communications', PHI, **1995**.
6. Related IEEE /IEE Publications.
7. Tanenbaum, 'Computer Network'.

SMART GRID TECHNOLOGIES

Subject Code: MELE3-162 **L T P C** **Duration: 40 Hrs.**
4 0 0 4

UNIT I

1. Introduction to Smart Grid (10 Hrs.)

Evolution of Electric Grid, Concept of Smart Grid, Definitions, Need of Smart Grid, Functions of Smart Grid, Opportunities & Barriers of Smart Grid, Difference between conventional & smart grid, Concept of Resilient & Self-Healing Grid, Present development & International policies in Smart Grid. Case study of Smart Grid. CDM opportunities in Smart Grid

UNIT 2

2. Smart Grid Technologies (10 Hrs.)

Part 1: Introduction to Smart Meters, Real Time Pricing, Smart Appliances, Automatic Meter Reading (AMR), Outage Management System (OMS), Plug in Hybrid Electric Vehicles (PHEV), Vehicle to Grid, Smart Sensors, Home & Building Automation, Phase Shifting Transformers.

Part 2: Smart Substations, Substation Automation, Feeder Automation. Geographic Information System(GIS), Intelligent Electronic Devices (IED) & their application for monitoring & protection, Smart storage like Battery, SMES, Pumped Hydro, Compressed Air Energy Storage, Wide Area Measurement System (WAMS), Phase Measurement Unit (PMU).

UNIT 3

3. Micro grids and Distributed Energy Resources (10 Hrs.)

Concept of micro grid, need & applications of micro grid, formation of micro grid, Issues of interconnection, protection & control of micro grid. Plastic & Organic solar cells, Thin film solar cells, Variable speed wind generators, fuel cells, micro turbines, Captive power plants, Integration of renewable energy sources

UNIT 4

4. Power Quality Management in Smart Grid (10 Hrs.)

Power Quality & EMC in Smart Grid, Power Quality issues of Grid connected Renewable Energy Sources, Power Quality Conditioners for Smart Grid, Web based Power Quality monitoring, Power Quality Audit.

5. Information and Communication Technology for Smart Grid: Advanced Metering Infrastructure (AMI), Home Area Network (HAN), Neighborhood Area Network (NAN), Wide Area Network (WAN). Bluetooth, Zig-Bee, GPS, Wi-Fi, Wi-Max based communication, Wireless Mesh Network, Basics of CLOUD Computing & Cyber Security for Smart Grid. Broadband over Power line (BPL). IP based protocols.

RECOMMENDED BOOKS:

1. Ali Keyhani, Mohammad N. Marwali, Min Dai, ‘Integration of Green and Renewable Energy in Electric Power Systems’, Wiley.
2. Clark W. Gellings, ‘The Smart Grid: Enabling Energy Efficiency and Demand Response’, CRC Press Janaka Ekanayake, Nick Jenkins, Kithsiri Liyanage, Jianzhong Wu.
3. Akihiko Yokoyama, ’Smart Grid: Technology and Applications’, Wiley.
4. Jean Claude Sabonnadière, Nouredine Hadjsaïd, ‘Smart Grids’, Wiley Blackwell.

DISCRETE TIME CONTROL SYSTEMS

Subject Code: MELE3-163 **L T P C** **Duration: 40 Hrs.**
4 0 0 4

UNIT I

1. Introduction (10 Hrs.)

Configuration of the basic Digital Control Systems, types of sampling operations, Sample and Hold operations, Sampling theorem, Basic discrete time signals'-Transforms, Properties of Z-Transform, Inverse Z-Transforms, Pulse Transfer Function, Difference equations, Z-Transform method for solving the difference equations, Block diagram and signal flow graph analysis, Time response of digital control systems.

UNIT II

2. Stability Methods (10 Hrs.)

Mapping between s-plane and z-plane, stability methods: Modified Routh Criterion, Jury's method, and modified Schur-Cohn criterion. State variable representation, conversion of state variable models to transfer function and vice-versa, Eigen values and Eigen vectors, Solution of state equations, Concepts of controllability and observability.

UNIT III

3. Models of Digital Control Systems (10 Hrs.)

Digital temperature control System, Digital position control system, stepping motors and their control. Design of Digital compensator using frequency response plots.

UNIT IV

4. State Variable Analysis (10 Hrs.)

Digital Control Systems, State variable description of digital control systems, conversion of state variable models to pulse transfer function and vice versa, solution of state difference equations, controllability and observability.

RECOMMENDED BOOKS:

1. M. Gopal, 'Digital Control and State Variable Methods', Tata McGraw Hill.
2. K. Ogata, 'Discrete Time Control Systems, Pearson Education, Singapore, Thomson Press, India.
3. B.C. Kuo, 'Digital Control Systems', Prentice Hall.
4. I.J. Nagrath & M. Gopal, 'Control System Engg.', John Wiley & Sons.
5. K.K. Aggarwal, 'Control System Analysis and Design', Khanna Publishers.

POWER SYSTEM PLANNING

Subject Code: MELE3-205 **L T P C** **Duration: 48 Hrs.**
4 0 0 4

Learning Objectives:

1. To acquire skills in planning and building reliable power system.

Learning Outcomes:

1. The scope of employability in power utilities will increase.
2. The management skills required in the field of power system engineering is enhanced.

Unit-1

Introduction: power system planning, objective, stages in planning and design, the electric utility industry, growth characteristics generation, transmission and distribution systems.

Demand/energy forecasting: electricity consumption pattern, peak demand and energy forecasting by trend and economic projection methods. Review of load forecasting.

MRSPTU

Unit-2

Power System Planning: Investment planning: traditional generation expansion planning models, integrated resource planning models, production cost simulation models.

Generating System Capability Planning: probabilistic models of generating units, growth rate, rate of generation capacity, outage performance and system evaluation of loss of load and loss of energy indices, power supply availability assessment. Expansion planning, unit maintenance schedule, unit effective load carrying capability.

Transmission System Planning: automatic transmission system expansion planning, automatic transmission planning using interactive graphics.

Unit-3

Distribution System Planning and Automation: load characteristics, design of sub transmission lines and distribution, substations, design considerations of' primary and secondary distribution systems, voltage drop and power loss calculations.

Interconnected Systems: multi-area reliability analysis, power pool operation and power exchange energy contracts, quantification of economic and reliability benefits of pool operation.

Unit-4

Power system Expansion Planning: formulation of least cost optimization problem involving capital, operation and maintenance costs of candidate units of different types.

RECOMMENDED BOOKS

1. Y. Wallach, 'Power System Planning', McGraw Hill International.
2. P. Sullivan, 'Power System Planning', McGraw Hill International.
3. S. Dasari, 'Electric Power System Planning', IBT Publishers, New Delhi.
4. R. Billinton, 'Power System Reliability Calculation', MIT Press, USA.
5. Endreyni, 'Reliability Modeling in Electric Power System', John Wiley, New York.
6. J.R. McDonald, 'Modern Power System Planning', McGraw Hill International.
7. A.S. Pabla, 'Electrical Power System Planning', Macmillan, **1998**.

MRSPTU

ADVANCED POWER SYSTEM PROTECTION

Subject Code: MELE3-206	**L T P C** **4 0 0 4**	**Duration: 48 Hrs.**

Learning Objectives:

1. To facilitate the students, understand the basic concepts and recent trends in power system protection.
2. To enable the students design and work with the concepts of digital and numerical relaying.

Learning Outcomes:

On completion of the course the students would be skilled enough to work with various type of schemes used for different apparatus protection.

Unit-1

Fundamentals: Types of relays, their classifications and theory Phase and amplitude comparators. Static Comparators Computer Applications to protective relaying.

Circuit Breakers: Physical stress in circuit breakers, Vacuum circuit breakers, SF6 Circuit Breakers Direct current C.B.'s, Short circuit testing of circuit breakers. Comparison of different types of circuit breakers.

Unit-2

Transmission Line Protection: Carrier Current Protection. Applications of microwave Channels for protective relaying, Selection of suitable static relaying scheme for transmission line protection.

Performance specifications of distance relays, effect of fault resistance and effects of power swings on operation of relays and Distance relay settings.

Unit-3

Generators and Transformers Protection: CT's and PTs burden and accuracy and their connections. Protection of rotor winding. Miscellaneous protection schemes for generators and transformers, Over fluxing protection of transformers.

Unit-4

Differential Relays: Operating Characteristics, Restraining Characteristics, Analysis of Electromagnetic and differential Static relays schemes.

Bus Zone Protection: Types of bus bar faults, Protection requirements, protection schemes and modern trend in bus-bar protection.

RECOMMENDED BOOKS:

1. T.S. Madhava Rao, 'Power System Protection (Static Relays)', Tata McGraw-Hill, **1989**.
2. A.R. Van C. Warrington, 'Protective Relays', Chapman and Hall London, **1968**.
3. S.K. Basu and S. Chaudhary, 'Power System Protection', Raju Primlan Oxford and IBH Press, **1983**.
4. Ravindra Nalh M. Chander, 'Power System Protection and Switch Gear', John Wiley Eastern, **1989**.
5. Sunil S. Rao, 'Power System Protection and Switch Gear', Khanna Publishers, **1989**.
6. Related IEEE/IEE Publications.

MRSPTU

POWER SYSTEM DYNAMICS & STABILITY

Subject: MELE3-207 **L T P C** **Duration: 48 Hrs.**
4 0 0 4

Learning Objectives:

1. To know the elementary mathematical model and system response to small disturbances.
2. To impart the concepts of transient stability.
3. To impart knowledge on voltage stability.

Learning Outcomes:

After Completion of this course students will be able to

1. Solve mathematical calculations and swing equation and obtain classical model of an infinite bus system.
2. Analyse the effect of small speed changes in multi machine synchronous machines and voltage regulator governor system.
3. Understand the transient stability analysis under common disturbances including the short circuits and find clearing time to solution for swing equation by step by step method.

Unit-1

OVERVIEW: Angular Stability, Transient stability, steady state stability, dynamic stability, Small Signal, Voltage Stability.

TRANSIENT STABILITY ANALYSIS: Single Machine - Infinite Bus System, Equal Area Criterion, Multi-machine Stability, Network Reduction and Numerical Integration Methods, Methods of Improvement.

Unit-2

SMALL SIGNAL STABILITY ANALYSIS: Eigen Value and Participation Factor Analysis; Single machine -Infinite Bus and Multi-Machine Simulation; Effect of Excitation System and AVR, improvement of Damping, Power System Stabilizer and Static VAR System (SVS) supplementary controls.

Unit-3

SUB SYNCHRONOUS OSCILLATIONS: Sub Synchronous Resonance (SSR) Phenomenon, Counter measures to SSR problems.

Unit-4

VOLTAGE STABILITY: PV and QV curves, Impact of Load and Tap changer Dynamics; Static Analysis, Sensitivity and Continuation Methods; Dynamic Simulation, Introduction to Bifurcation Analysis; Proximity Indices, Methods to enhance Stability Margin.

RECOMMENDED BOOKS:

1. P. Kundur, 'Power System Stability and Control', McGraw Hill.
2. C.W. Taylor, 'Power System Voltage Stability', McGraw Hill.
3. P.M. Anderson and A.A. Foud, 'Power System Control and Stability', IEEE Press.
4. E. Kimbark, 'Power System Stability', Vol. I, II & III, IEEE Press.

SIMULATION LAB.

Subject Code: MELE3-208 **L T P C**
0 0 2 1

EXPERIMENTS

1. Introduction to MATLAB and its basic commands.
2. MATLAB program to simulate Ferranti effect.
3. MATLAB program to model transmission lines.
4. MATLAB program to solve load flow equations by Gauss-Seidel method.
5. MATLAB program to find optimum loading of generators neglecting transmission losses.
6. MATLAB program to find optimum loading of generators with penalty factors.
7. MATLAB program to solve swing equation using point-by-point method.
8. Simulink model of single area load frequency control with and without PI controller and without PI controller in Simulink.
9. Simulink model for two area load frequency control.
10. Simulink model for evaluating transient stability of single machine connected to infinite bus.
11. Gauss Seidel load flow analysis using MATLAB Software.
12. Newton Raphson method of load flow analysis using MATLAB Software.
13. Fast decoupled load flow analysis using MATLAB Software.
14. Fault analysis using MATLAB Software.
15. Economic dispatch using MATLAB Software.

POWER SYSTEM RELIABILITY

Subject Code: MELE3-264/MELE1-374 **L T P C** **Duration: 48 Hrs.**
4 0 0 4

Learning Objectives:

To develop an understanding of power system reliability evaluation by using deterministic and probabilistic techniques.

Learning Outcomes

Upon successful completion of this course, a student will be able to:

1. Understand the application of basic probability theory and distribution to power system
2. Identify the main subsystems of a power system and their constituent components
3. To produce mathematical models for generator, transmission line and load
4. Apply techniques for reliability evaluation of individual systems
5. Apply techniques for reliability evaluation of composite systems

Unit-1

MRSPTU

BASIC RELIABILITY CONCEPTS: The General reliability function, Hazard rate, MTTF, Markov processes.

STATIC GENERATING CAPACITY RELIABILITY EVALUATION: Capacity outage probability tables, loss of load probability method, Frequency and duration approach.

Unit-2

SPINNING GENERATION CAPACITY RELIABILITY EVALUATION: Spinning reserve, spinning reserve capacity evaluation, Load forecasting methods, Load forecast uncertainty, maximum capacity levels, Derated capacity levels.

Unit-3

TRANSMISSION SYSTEM RELIABILITY EVALUATION: Average interruption rate method, Frequency and duration method, Stormy and normal weather effects, The Markov process approach.

Unit-4

COMPOSITE SYSTEM RELIABILITY EVALUATION: Conditional probability approach, two–plant single load system, multi plant multi load system

RECOMMENDED BOOKS:

1. R. Billinton, 'Power System Reliability Calculation', MIT Press, USA.
2. Endreyni, 'Reliability Modelling in Electric Power System', John Wiley, New York.

CUSTOMIZED POWER DEVICES

Subject Code: MELE3-265/MELE1-265 **L T P C** **Duration: 48 Hrs.**
4 0 0 4

MRSPTU

Learning Objectives:

1. To study advances in rapid development of Power systems.

Learning Outcomes

1. Upon successful completion of this course, students will be able to select suitable advanced power system for the enhancement of power transfer capability and to control the power flow in an efficient manner.

UNIT-I

Static Power Frequency Changers

Fundamental Ideas: Historical Background, Basic Operational features and Operating Principles. Mathematical Representation (output voltage and Input Current) of Static Frequency Changers. Synthesis of the Output Voltage Waveform, Control of the Output Voltage (PWM, Amplitude Dependent Frequency Modulation, Phase Shift). Unwanted Components of Output Voltage, Analysis of the Input Current. Extra-basal Components of the Input Current. Control Circuit Principles: Implementation of Modulating Functions. End Stop Control, Control of Unity Displacement Factor Frequency Charger (UDFFC), NCC and CDFFC. Forced Commutation of Frequency Changers: Fundamental Principles of Hard and Soft Commutation, Points of Connection of Commutating Circuits. Some Basic Commutating Circuits. Application of Static Frequency Changers: Speed Control of AC Machines, Constant Frequency Power Supplies and Static VAR Generators.

UNIT-II

Compensators and Power Flow Controllers:

Static shunt compensators, Static series compensators, Static Voltage and phase angle regulators, **Principle of Operation of Controllers**: Control and characteristics, Model of IPFC for power flow and optimum power flow studies. FACTS Controller interactions –SVC–SVG interaction -co-ordination of multiple controllers using linear control techniques –Quantitative treatment of control coordination

UNIT-III

Power Quality Improvement:
Harmonic filters: passive, Active and hybrid filters –Custom power devices: Network reconfiguring Devices, Load compensation using DSTATCOM, Voltage regulation using DSTATCOM, protecting sensitive loads using DVR, UPQC –control strategies: P-Q theory, Synchronous detection method –Custom power park –Status of application of custom power devices.
Difference in role of FACTS devices in transmission and distribution networks

UNIT-IV

RECENT TRENDS:
Application of basic active filters, multilevel and multi-pulse converters and Z-source inverter in various FACTS and FACDS devices for improving the performances of transmission system net work and distribution system network, respectively.

RECOMMENDED BOOKS:

1. Y.H. Song and A.T. Johns, 'Flexible AC Transmission Systems', IEEE Press, **1999**.
2. N.G. Hingorani and L. Gyragyi, 'Understanding FACTS (Concepts and Technology of Flexible AC Transmission System)', Standard Publishers & Distributors, **2001**.
3. R.M. Mathur and R.K. Verma, 'Thyristor based FACTS controllers for Electrical Transmission Systems', IEEE Press, **2002**.

ARTIFICIAL INTELLIGENT TECHNIQUES

MELE3-267/MELE1-267 **L T P C** **4 0 0 4** **Duration: 48 Hrs.**

MRSPTU

Learning Objectives:

1. To apply artificial neural networks in various electrical and electronics engineering applications.
2. To expose students to fuzzy methods of analysing problems which involve incomplete or vague criteria rather than crisp values.
3. To investigates requirements analysis, logical design, and technical design of components for fuzzy systems development.

Learning Outcomes:

1. The students acquire the skills required to innovate and build, smart and intelligent applications in electrical and electronics engineering.
2. They will understand review of Neural Networks: models of a neuron, various activation functions, Threshold function, piecewise – linear function, stochastic model of a neuron, feedback.
3. They will be able to take up fuzzy systems approach to solve applications in engineering.

UNIT I

NEURAL NETWORKS (9 hours)
Neural Networks – biological neurons – Artificial neurons – activation function – learning rules – feed forward networks – supervised & Unsupervised learning –perceptron network- linear separability – back propagation networks Algorithms-Radial basis function networks.

UNIT II

ASSOCIATIVE MODELS AND CONTROL SCHEMES IN NN (9 hours)
Auto & hetero associative memory – bi-directional associative memory – Self organizing feature Maps-Hopfield Networks-Neural Networks for non – linear system – Schemes of Neuro control – System identification – forward model and – Inverse model – Case studies.

UNIT III

FUZZY LOGIC AND GENETIC ALGORITHM: (9 hours)

Fuzzy set - Crisp set – vagueness – uncertainty and imprecision – fuzzy set – fuzzy operation-properties – crisp versus fuzzy relations – fuzzy relations –fuzzy Cartesian product and composition – composition of fuzzy Relations-Fuzzy to crisp conversion –structure of fuzzy logic controller – database – rule base – Inference engine.
GA: Working principles – terminology – Importance of mutation – comparison with traditional methods – constraints and penalty function – GA operators – Real coded GAs.

UNIT IV

APPLICATIONS: (9 hours)
Applications of Neural network, Fuzzy system & Genetic algorithms for power systems and power electronics Systems-Designing of controllers using Simulation Software, NN tool box & Fuzzy Logic Toolbox.

RECOMMENDED BOOKS:

1. Timothy J. Ross, 'Fuzzy Logic with Engineering Applications', McGraw Hill International Edition, USA, **1997**.
2. Awrence Fausatt, 'Fundamentals of Neural Networks', Prentice Hall of India, New Delhi, **1994**.
3. Simon Haykin, 'Neural Networks – A comprehensive Foundation', Pearson Education Asia, **2002**.

DISTRIBUTION SYSTEM OPERATION AND ANALYSIS

Subject Code: MELE3-369/ MELE1-375 L T P C Duration: 48 Hrs.
4 0 0 4

MRSPTU

UNIT-I

1. System Planning: Introduction, Distribution system planning, Factors affecting system planning, present planning techniques, planning models, Introduction to optimum line network. future trends in planning, systems approach, distribution automation. Load Characteristic: Basic definitions, relation between load and loss factors, maximum diversified demand, load forecasting, Load management.

UNIT-II

2. System Design and Operation: Criteria, system developers, dispersed generation, distribution systems, economics and finance, mapping, Design of substation and feeder, Operation criteria, voltage measurements, harmonics, load variations, system losses, Introduction to energy management.

UNIT-III

3. Voltage Regulation and Automation: Quality of Service and Voltage Standards, Voltage Control, Line Drop Compensation, Distribution capacitor automation, Voltage fluctuations, SCADA and Communication with Load Dispatch Centres.

UNIT-IV

4. Distribution System Protection: Objective of distribution system protection, high impedance faults coordination of protective devices: fuse to fuse co-ordination, re-closer to re-closer coordination, re-closer to fuse coordination, re-closer to substation transformer high side fuse coordination, fuse to circuit breaker coordination, re-closer to circuit breaker coordination, lightning protection.

RECOMMENDED BOOKS:

1. Gonen, Turan, 'Electric Power Distribution System Engineering', CRC PRESS, Third Indian Reprint, **2012**.
2. A.S. Pabla, 'Electric Power Distribution', 6th Edn., TMH, **2011**.
3. 'Electric Power Distribution Handbook' Thomas Allen Short**.**

DIGITAL SIGNAL PROCESSING AND APPLICATIONS

Subject Code: MELE3-370/ MELE1-161 L T P C Duration: 48 Hrs.
4 0 0 4

UNIT-I

1. Introduction: (10 Hrs.) Limitations of analog signal processing, Advantages of digital signal processing and its applications; Some elementary discrete time sequences and systems; Basic elements of digital signal processing such as convolution, correlation and autocorrelation, Concepts of stability, causality, linearity, difference equations. DFT and its properties; Linear Periodic and Circular convolution; Linear Filtering Methods based on DFT; Fast Fourier Transform algorithm using decimation in time and decimation frequency techniques; Goertzel algorithm.

UNIT-II

2. Z Transform: (6 Hrs.) Introduction, Z-Transform, Region of convergence; Inverse Z Transform methods, properties of Z transform.

UNIT-III

3. Design of Digital Filters: (12 Hrs.) Structures of realization of discrete time system, direct form, Cascade form, parallel form and lattice structure of FIR and IIR systems, Linear Phase FIR filters; Design methods for FIR filters; IIR filter design by Impulse Invariance, Bilinear Transformation, Matched Z-Transformation, Analog and Digital Transformation in the Frequency Domain. Finite Precision Effects: Fixed point and Floating point representations, Effects of coefficient unitization, Effect of round off noise in digital filters, Limit cycles.

UNIT-IV

4. DSP Processors: (10 Hrs.) Architectures of ADSP and TMS series of processor, Digital Signal Processing Principles, Algorithms and Application.

RECOMMENDED BOOKS:

1. Alan V. Oppenheim, Ronald W. Schafer, John R. Back, 'Discrete-Time Signal Processing', Prentice Hall.
2. S. Salivahan, A. Vallavaraj, Gnanpiya, 'Digital Signal Processing', Tata McGraw Hill.
3. S.K. Mitra, 'Digital Signal Processing-A computer based Approach', Tata McGraw Hill.
4. Jervis, 'Digital Signal Processing', Pearson Education India.
5. 'Introduction to Digital Signal Processing', Johny R. Johnson 1st Edn., Prentice Hall, **2006**.

ENGINEERING OPTIMIZATION

Subject Code: MELE3-371/ MELE0-F94 L T P C Duration: 48 Hrs.
MELE1-371 4 0 0 4

Learning Objectives:

1. To learn essential optimization techniques for applying to day to day problems.
2. To study of genetic algorithms with relation to application in power system.
3. To acquire knowledge of dynamic programming.

Learning Outcomes:

1. After learning the techniques, they can apply to engineering and other problems.
2. They can get skills to optimize the variety of programming.

UNIT I

Introduction: Definition, Classification of optimization problems, Classical Optimization Techniques, Single and Multiple Optimization with and without inequality constraints.

UNIT II

MRSPTU

Linear Programming (LP) and Non Linear Programming (NLP): Simplex method of solving LP, revised simplex method, duality, Constrained Optimization, Theorems and procedure, linear programming, mathematical model, solution technique, duality. Steepest descent method, Conjugate gradient method, Newton Method, Sequential quadratic programming, Penalty function method, augmented Lagrange multiplier method.

UNIT III

Dynamic Programming (DP): Multistage decision processes, concept of sub-optimization and principle of optimality, Recursive relations, Integer Linear programming, Branch and bound algorithm.

UNIT IV

Genetic Algorithm (GA): Introduction to Genetic Algorithm, working principle, coding of variables, fitness function, GA operators; Similarities and differences between GA and traditional methods; Unconstrained and constrained optimization using genetic Algorithm, real coded GA, Advanced GA, global optimization using GA, Applications to power system.

RECOMMENDED BOOKS:

1. D.A. Pierre, 'Optimization Theory with applications', Wiley Publications.
2. H.A. Taha, 'Operations Research: An Introduction', 7th Edn., Pearson Education Edition, Asia, Delhi.
3. S.S. Rao, 'Optimization –Theory and Applications', Wiley-Eastern Limited.
4. D.P. Kothari & J.S. Dhillon, 'Power System Optimization', PHI Publishers.
5. Donald E. Kirk, 'Optimal Control Theory', Dover Publications, New York.
6. 'Optimization for Engineering Design: Algorithms and Examples', Kalyanmoy Deb, PHI Publishers.

MRSPTU

POWER SYSTEM HARMONICS

Subject Code: MELE3-372	L T P C 4 0 0 4	Duration: 48 Hrs.

UNIT-I

Harmonic Analysis: Representation of harmonics, Fourier series and Coefficients, odd-even and half wave symmetry, phase sequence, voltage and current harmonic distortion, active and reactive power, apparent power, distortion power, power factor, current and voltage crest factors, Power in passive elements: power in a pure resistance, power in a pure inductance and power in a pure capacitance, Series and parallel resonance.

UNIT-II

Harmonic Sources: Types of harmonic sources, Harmonics in transformers, normal excitation characteristics, determination of current wave shape in transformers, inrush current in transformers. Harmonic in rotating machines: m.m.f. distribution of ac windings, slot harmonics, voltage harmonics produced by synchronous machines, rotor saliency effects, voltage harmonics produced by induction motors, Distortion caused by arcing devices: Electric arc furnaces and discharge type lighting. Distortion caused by dc power supplies.

UNIT-III

Effects of Harmonic Distortion in Power Systems: Thermal losses in harmonic environment: Copper losses, iron losses, dielectric losses, Harmonic amplification in capacitor banks, Effects of harmonics in transformers. Effects of harmonics in rotating machines: induced e.m.f, chorded windings, distributed winding, winding factor. Harmonic interference with power system protection: harmonic problems during fault conditions, Effects of harmonics on consumer equipment, Interference with Communications.

UNIT-IV

Limits of Harmonic Distortion: Voltage harmonic distortion limits: IEEE limits, IEC limits EN limits and NORSOK limit. Current harmonic distortion limits: IEEE limits IEC limits and NORSOK limits, Tuned filters and damped filters Active filters: Series and parallel connection of active filters Role of power converters, transformers, rotating machines and capacitor banks in reduction of harmonics. Harmonic filter design: Series tuned filters and second order damped filters.

RECOMMENDED BOOKS:

1. J. Arrillaga and N. R. Watson, 'Power System Harmonics', Wiley.
2. George J. Wakileh, 'Power Systems Harmonics', Springer.

ELECTIVE-V: SYSTEM MODELING AND OPTIMIZATION

Subject Code: MELE3- 373 **L T P C** **Duration: 48 Hrs.**
4 0 0 4

UNIT-I

Static Model of Power System Components: Generator, single circuit & multi-circuit transmission line, regulating & phase shifting transformer, VAR compensators and Loads for balanced and unbalanced conditions. Formulation of Admittance and Impedance Matrices for balanced and unbalanced conditions, their modifications, Sparsity and Optimal ordering.

UNIT-II

Power Flow Analysis: Review of power flow problem, power flow analysis methods, power flow using Newton Raphson method, power flow for unbalanced system.

Optimal Power Flow: Significance of optimal power flow (OPF), formulation of OPF problems, solution using Gradient based methods.

UNIT-III

Short Circuit Studies: Review of symmetrical components, sequence impedances and networks for power system components, Fault analysis of balanced and unbalanced faults in small and large system, Estimation of short circuit capacity of breakers.

UNIT-IV

Power System Security: Introduction to power system contingencies, Factors affecting security, Contingency analysis, Network sensitivity using DC and AC load flow methods, correcting the generation dispatch.

RECOMMENDED BOOKS:

1. J.D. Grainger, 'Power System Analysis', Tata McGraw Hill Publishing Company.
2. C.L. Kusic, 'Computer Aided Power System Analysis', Tata McGraw Hill Publishing Company.
3. 3 M.A. Pai, 'Computer Techniques in Power System Analysis', TMH Publishing Company.
4. G.W. Stagg and A.H. Elabiad, 'Computer Methods in Power System Analysis', McGraw Hill.
5. P.M. Anderson, 'Analysis of Faulted Power System', IOWA State University Press, New York.
6. D.P. Kothari & J.S. Dhillon, 'Power System Optimization', PHI Publishers.

EMBEDDED SYSTEMS

Subject Code: MELE3-374 **L T P C** **Duration: 48 Hrs.**
4 0 0 4

UNIT-I

Digital Electronics: Microprocessors & Microcontrollers, Computer Architecture. MSP 430 Microcontroller – Functional block diagram – memory – Interrupts and Resets – Input/ Output units – Instruction set – Addressing modes – Constant generator and Emulated Instructions. MSP 430 Timers – on-chip data conversion systems – ADC and DAC – on-chip communication peripherals – SPI, I2C, UART – Programming concepts.

UNIT-II

ARM7TDMI – architecture overview - processor modes – data types – Registers – program status registers – Simple programs.

UNIT-III

Introduction to Design of Systems on a chip – Core architectures for Digital media and compilation techniques – Microsystems technology and applications – Hardware/ software co-design concepts.

UNIT-IV

Multi-core System-on-Chip (McSoC) design – Application specific McSoC design – QueueCore Architecture – Synthesis and evaluation results – Reconfigurable multi-core architectures.

RECOMMENDED BOOKS:

1. John H. Davies, 'MSP 430 Microcontroller Basics', Elsevier Ltd., **2008**.
2. William Hohl, 'ARM Assembly Language, Fundamentals and Techniques', CRC Press, **2009**.
3. Abderazek Ben Abdallah, 'Multi-core systems on-Chip: Practical Software and Hardware Design', Atlantis Press, **2010**.
4. Ricardo Reis, Marcelo Lubaszewski, Jochen A.G. Jess, 'Design of Systems on a Chip: Design and Test', Springer, **2006**.

WIND ENERGY AND SMALL HYDRO POWER STATION

Subject Code: MELE3-375/ MELE1-159 L T P C Duration: 48 Hrs.
4 0 0 4

MRSPTU

UNIT-I

1. Wind Energy (12 Hrs.)

Introduction, general theory of wind machines, basic laws and concepts of aerodynamics, Micro-siting, Description and performance of the horizontal–axis wind machines, Introduction to blade design, Description and performance of the vertical–axis wind machines, generation of electricity by wind machines and case studies.

UNIT-II

2. Hydro Power Plant (10 Hrs.)

Overview of micro mini and small hydro, site selection and civil works, Penstocks and turbines, speed and voltage regulation, investment issues.

UNIT-III

3. Tariffs (8 Hrs.)

Study of load management and tariff scheme, distribution and marketing issues related to power generation.

UNIT-IV

4. Hybrid Power System (10 Hrs.)

Wind and hydro based stand-alone / hybrid power systems, control of hybrid power systems, wind diesel hybrid systems.

RECOMMENDED BOOKS:

1. J.F. Manwell, J.G. McGowan and A.L. Rogers, 'Wind Energy Explained – Theory, Design and Application', John Wiley & Sons, Ltd., **2002**.
2. Martin O.L. Hansen, 'Aerodynamics of Wind Turbines', Earthscan, **2008**.
3. 'Wind Turbine Control Systems- Principles, Modelling and Gain Scheduling Design', Fernando D. Bianchi, Hernan De Battista and Ricardo J. Mantz, Springer, **2007**.
4. Adam Harvey, Andy Brown and Priyantha Hettiarachi, 'Micro-Hydro Design Manual: A Guide to Small-Scale Water Power Schemes', ITDG, **1993**.
5. Maria Laguna, 'Guide on How to Develop a Small Hydropower Plant', ESHA, **2004**.

6. ‘Good & Bad of Mini Hydro Power’, edited by Roman Ritter, GTZ, **2009**.

PROJECT

Subject Code: MELE3-309/ MELE1-309/ L T P C
MELE2-309

Learning Objective:

1. To propose engineering based project in a clear and concise manner.
2. Allow students to develop problem solving, analysis, synthesis and evaluation skills.

Learning Outcomes:

1. Synthesis of knowledge.
2. To demonstrate the aptitude of applying the own knowledge to solve a specific problem.
3. To mature the knowledge.
4. Able to organize, compile and record all work details in an efficient manner

Each student will be required to complete a Project and submit a Project Report on a topic on any of the areas of modern technology related to Electrical Engineering including interdisciplinary fields. The project will carry 10 credits. Its evaluation will be done as under:

Internal Marks		**External Marks**	
1. Formulation of Problem	10	Implementation	10
2. Design	10	Result & Analysis	10
3. Implementation	20	Report	10
4. Testing & Analysis	10	Viva-Voce	10
5. Report	10	----	---
Total Marks	60	**Total Marks**	40

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SEMINAR

Subject Code: MELE3-310/ MELE1-310/ L T P C
MELE2-310 0 0 4 2

Learning Objectives:

1. To identify, understand and discuss current advanced research topic.
2. To gain experience in the critical assessment of the available scientific literature
3. To practice the use of various resources to locate and extract information using offline & online tools, journals

Learning Outcomes:

1. An ability to utilize technical resources
2. An ability to write technical documents and give oral presentations related to the work completed.
3. To learn preparation and presentation of scientific papers in an exhaustive manner

Each student will be required to prepare a Seminar Report and present a Seminar on a topic in any of the areas of modern technology related to Electrical Engineering including interdisciplinary fields.

Seminar will carry 4 credits. It will be done on any topic within/outside the curriculum. Its evaluation will be done as under:

Sr. No.	**Parameters for Evaluation**	**Internal Marks**	**External Marks**

1	Depth & Coverage of Topic	40	-
2	PPT Presentation & Report	20	-
3	Presentation	20	-
4	Questions & Answers	20	-
Total		**100**	**-**

RESEARCH LAB.

Subject Code: MELE3-311/ MELE1-311/ MELE2-311 **L T P C**
0 0 4 2

Students will be made familiar with one or more available softwares like MATLAB, ETAP, GAMS, Power System Toolbox, Power world Simulator, Network Simulator, LABVIEW, etc. so that students can use any one or more of them for their dissertation. Students will be advised to go through maximum research papers and conclude a particular domain to work further.

DISSERTATION

Subject Code: MELE3-412/ MELE1-412/ MELE2-412 **L T P C**

Learning Objectives: To learn, practice, and critique effective scientific writing and to formulate the research objectives clearly, state claims and evidence clearly, assess validity of claims, evidence, outcomes, and results.

Learning Outcomes:
1. Design and execute a meaningful research project that demonstrates spatial thinking and uses the knowledge and skills.
2. Define and analyse a problem in latest research areas.
3. Formulate and write a research proposal.
4. Able to learn effectively record data and experiments so that others can understand them.
5. Communicate the findings by means of a thesis, written in the format specified by the department/institute.

Each student will be required to complete a Dissertation and submit a written Report on the topic on any of the areas of modern technology related to Electrical Engineering including interdisciplinary fields in the Final semester of M.Tech. Course.
The Dissertation will carry 24 credits and will be evaluated as under:
Dissertation will be evaluated as under:

Sr. No.	Parameters for Evaluation	Internal Marks	External Marks
1	Originality	12	08
2	Presentation	12	08
3	Contents & Volume of work	18	12
4	Discussion (Contribution of candidate)	18	12
Total		**60**	**40**

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PG OPEN ELECTIVES-I 2016 BATCH ONWARDS		
Internal	External	Total
40	60	100

NOTE: MORE COURSES MAY BE ADDED IN THIS LIST LATER ON

PG OPEN ELECTIVES-I 2016 BATCH ONWARDS		
COURSE CODE	**COURSE**	**NOT APPLICABLE FOR PROGRAMMES**
MITE0-F91	Software Project Management	M.Tech. IT, M.Tech. IT & CW, M.Sc. IT
MCSE0-F91	Soft Computing	M.Tech. CSE, M.Tech. CSE (Software Engineering), M.Tech. CSE (Computer Network and Information Security), M.Tech. CSE (E-Security), M.Sc. CSE
MCSE0-F92	Big Data Analytics Concepts	
MCSE0-F93	Management Information System	
MCSE0-F94	Advanced Data Structures	
MBAD0 - F91	Principles and Practices of Management	M.B.A.
MBAD0 - F92	Total Quality Management	
MBAD0 - F93	Human Resource Management	
MBAD0 - F94	Marketing Management	
MBAD0 - F95	Project Management	
MTEX0-F91	Textile Chemistry-I	M.Tech. Textile Engg.
MCAP0-F91	Computer Applications in Business	MCA, PGDCA
MPHY0-F91	Physics of Materials	M.Sc. Physics
MMAT0-F91	Statistical Methods	M.Sc. Mathematics
MMEE0-F91	Industrial Safety & Environment	M.Tech. Mech. Engg., M.Tech. ME (Automation & Robotics), M.Tech. ME (CAD/CAM), M.Tech. ME (Industrial & Production), M.Tech. ME (Production), M.Tech. ME (Thermal Engg.)
MMEE0-F92	Supply Chain Management	
MCIE0-F91	Environment Management	M.Tech. Civil Engg., M.Tech. CE (Infrastructural Engg.), M.Tech. CE (Geotechnical Engg.), M.Tech. (Structural & Foundation Engg.), M.Tech. CE (Construction

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		Technology Management), M.Tech. CE (Structure Engg.)
MCHM0-F91	Oils and Fats	M.Sc. Chemistry
MECE0-F91	Computer Networks	M.Tech. Electronics & Instrumentation, M.Tech. ECE (Microelectronics), M.Tech. ECE (Embedded System), M.Tech. ECE (Signal Processing)
MECE0-F92	Digital Signal Processing	
MECE0-F93	Sensors & Transducers	
MECE0-F94	Electronic System Design	
MECE0-F95	Digital Circuits & Logic Design	
MELE0-F91	Advanced Electrical Machines	M.Tech. Electrical Engg., M.Tech. EE (Power System), M.Tech. EE (Instrumentation and Control Engg.)
MELE0-F92	Load Forecasting and Load Management	
MELE0-F93	Neural Networks & Fuzzy Logic	
MELE0-F94	Engineering Optimization	

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SOFTWARE PROJECT MANAGEMENT

Course Code: MITE0-F91 **L T P C** **Contact Hrs.**
3 0 0 3

Unit-1

Project Management Fundamentals- Basic Definitions, Project Stakeholders and Organizational, Influences on Project Management, Project Management Processes, Project Initiating Processes

Unit-2

Planning and Resourcing a Project - Identifying Requirements, Creating the Work Breakdown structure, Developing the Project Schedule, developing a Project Cost Estimate, Planning Quality, Organizing the Project Team, Planning for Potential Risks

Unit-3

Executing and Managing a Project - Project Executing Processes- Acquiring and Developing the Project Team, Managing the Project Team, Managing Stakeholder Expectations, Directing and Managing the Project while assuring Quality

Unit-4

Project Monitoring and Controlling Processes - Verifying and Controlling Scope, Managing Schedule and Cost, Controlling Quality, Monitoring and Controlling Risks. Integrated Change Control, Project Closing Process - Closing a Project

Recommended Books:

1. Software Engineering - Somerville (Addison Wesley)
2. Software Engineering-Pressmen.

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SOFT COMPUTING

Subject Code-MCSE0-F91 **L T P C** **Duration – 45 hrs**
3 0 0 3

COURSE OBJECTIVES

The objective of this course is to teach basic neural networks, fuzzy systems, Genetic Algorithms and optimization algorithms concepts and their relations**.**

COURSE OUTCOMES

CO1: Able to comprehend techniques and applications of Soft Computing in real world problems.

CO2: Able to follow fuzzy logic methodology and design fuzzy systems for various applications.

CO3: Able to design feed forward Artificial Neural Networks (ANN) and implement various methods of supervised learning.

CO4: Able to design feedback Artificial Neural Networks (ANN) and implement various methods of unsupervised learning

CO5: Able to appreciate the methodology of GA and its implementation in various applications.

COURSE CONTENT

UNIT-I (11 hrs)

Soft Computing: Introduction of soft computing, soft computing vs. hard computing, various types of soft computing techniques, applications of soft computing.

Fuzzy Logic: Fuzzy set versus crisp set, basic concepts of fuzzy sets, membership functions, basic operations on fuzzy sets and its properties. Fuzzy relations versus Crisp relation.

Fuzzy rule base system: Fuzzy propositions, formation, decomposition & aggregation of fuzzy rules, fuzzy reasoning, Fuzzy Inference Systems (FIS) – Mamdani Fuzzy Models – Sugeno Fuzzy Models – Tsukamoto Fuzzy Models, Fuzzification and Defuzzification, fuzzy decision making & Applications of fuzzy logic.

UNIT-II (12 hrs)

Structure and Function of a single neuron: Biological neuron, artificial neuron, definition of ANN and its applications. Neural Network architecture: Single layer and multilayer feed forward networks and recurrent networks. Learning rules and equations: Perceptron, Hebb's, Delta, winner take all and out-star learning rules. Supervised Learning Network: Perceptron Networks, Adaptive Linear Neuron, Multiple Adaptive Linear Neuron, Back Propagation Network, Associative memory networks, Unsupervised Learning Networks: Competitive networks, Adaptive Resonance Theory, Kohnen Self Organizing Map

UNIT-III (11 hrs)

Genetic algorithm: Fundamentals, basic concepts, working principle, encoding, fitness function, reproduction, Genetic modeling: selection operator, cross over, mutation operator, Stopping Condition and GA flow, Constraints in GA, Applications of GA, Classification of GA.

UNIT-IV (11 hrs)

Hybrid Soft Computing Techniques: An Introduction, Neuro-Fuzzy Hybrid Systems, Genetic Neuro-Hybrid systems, Genetic fuzzy Hybrid and fuzzy genetic hybrid systems

RECOMMENDED BOOKS

1. S, Rajasekaran & G.A. Vijayalakshmi Pai, 'Neural Networks, Fuzzy Logic & Genetic Algorithms, Synthesis & applications', 1st Ed., PHI Publication, **2003**.
2. S.N. Sivanandam& S.N. Deepa, 'Principles of Soft Computing', 2nd Ed., Wiley Publications, **2008**.
3. Michael Negnevitsky, 'Artificial Intelligence', 2nd Edn., Pearson Education, New Delhi, **2008.**
4. Timothy J. Ross, 'Fuzzy Logic with Engineering Applications', 3rd Edn., Wiley, **2011.**
5. Bose, 'Neural Network fundamental with Graph, Algoithm. & Application', TMH, **2004**.
6. Kosko, 'Neural Network & Fuzzy System', 1st Edn., PHI Publication, **2009.**
7. Klir &Yuan, 'Fuzzy sets & Fuzzy Logic: Theory & Application', PHI, **1995**.
8. Hagen, 'Neural Network Design', 2nd Edn., Cengage Learning, **2008**.

BIG DATA ANALYTICS AND CONCEPTS

Subject Code: CSE0-F92 **L T P C** **Duration – 45 hrs**
3 0 0 3

COURSE OBJECTIVE
COURSE OUTCOMES
COURSE CONTENT

UNIT-I (10 Hrs.)

Introduction to Big Data – Distributed File system – Big Data and Its importance, Traits of Big Data, Challenges of Conventional System, Web Data, Four V's, Drivers for Big data, Big Data Analytics, Applications of Big Data

Introduction to Map Reduce: The Map Tasks, grouping by Key, the reduce Tasks, Combiners, Details of Map Reduce Execution, Coping with Node Failures. Algorithms Using Map Reduce: Matrix-Vector Multiplication, Computing Selections and Projections, Union, Intersection, and Difference, Natural Join.

UNIT-II (12 Hrs.)

Introduction to Hadoop - Big Data – Apache Hadoop & Hadoop Eco System – Moving Data in and out of Hadoop – Understanding inputs and outputs of MapReduce - Data Serialization.

Hadoop Architecture - Hadoop Architecture, Hadoop Storage: HDFS, Common Hadoop Shell commands, Anatomy of File Write and Read., NameNode, Secondary NameNode, and DataNode, Hadoop MapReduce paradigm, Map and Reduce tasks, Job, Task trackers - Cluster Setup – SSH & Hadoop Configuration – HDFS Administering –Monitoring & Maintenance.

UNIT-III (9 Hrs)

HADOOP Ecosystem: Hadoop Ecosystem Components - Schedulers - Fair and Capacity, Hadoop 2.0 New Features - Name Node High Availability, HDFS Federation, MRV2

YARN Architecture: Background of YARN, Advantages of YARN, Different Commands in YARN, Running MRVL in YARN

UNIT –IV (9 Hrs)

HIVE – HIVE Architecture and Installation, Comparison with Traditional Database,

HIVEQL - Querying Data - Sorting and Aggregating, Map Reduce Scripts, Joins & Sub -queries

HBASE Concepts- Advanced Usage, Schema Design, Advance Indexing - PIG, Zookeeper - how it helps in monitoring a cluster, HBASE uses Zookeeper and how to Build Applications with Zookeeper.

Recommended Books

1. Boris lublinsky, Kevin t. Smith, Alexey Yakubovich, 'Professional Hadoop Solutions', Wiley Publications, **2015**
2. Chris Eaton, Dirk deroos et al., 'Understanding Big data', McGraw Hill, **2012**
3. Tom White, "HADOOP: The definitive Guide" , O Reilly **2012**
4. Vignesh Prajapati, "Big Data Analytics with R and Haoop", Packet Publishing **2013**
5. Tom Plunkett, Brian Macdonald et al, "Oracle Big Data Handbook", Oracle Press, **2014**

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MANAGEMENT INFORMATION SYSTEM

Course Code: MCSE0-F93 **L T P C** **Contact Hrs. 45**
3 0 0 3

LEARNING OBJECTIVES

The objective of this course is to introduce the students to the Management Information Systems and its application in organizations. The course would expose the students to the managerial issues relating to information systems and help them identify and evaluate various options in Management Information Systems.

LEARNING OUTCOMES

CO1 Students would be able to understand the usage of MIS in organizations and the constituents of the MIS.

CO2 Effectively using and administrating information Systems in different business settings **CO3** to illustrate how current technologies and decision- support tools can be utilized to the advantage of business operations

CO4 to explain fundamental concepts of data communications, computer networking and the related hardware

COURSE CONTENT

UNIT-I (10 Hrs.)

Introduction: Definition information system, role and impact of MIS, the challenges of Information system, Nature of MIS, Characteristics of MIS, Myths regarding MIS, Requirements of MIS, Problems & Solutions in implementing MIS, Benefits of MIS, Limitations of MIS, Significance of MIS, Components of MIS. Role of MIS, Major Management challenge to building and using information system in Organization, functions of management.

UNIT-II (12 Hrs.)

Information system and Organizations: The relationship between Organization and Information System, Information needs of different organization levels: Information concept as quality product, classification and value of information, methods of data and information collection. Strategic role of information system, Salient features of Organization, Information, management and decision making, How Organization affect Information Systems, How Information system affect Organization, Ethical and Social impact of information system.

UNIT-III (12 Hrs.)

Business application of Information System: Foundation Concepts Information systems in Business: Information system and technology, Business Applications, Development and Management. The internetworked E-business Enterprise: Internet, and Extranet in business. Electronic Commerce System: Electronics commerce Fundamentals, Commerce Application and issues. E-business Decision Support: Decision support in E-Business, Artificial Intelligence Technologies in business.

UNIT-IV (11 Hrs.)

Technical Foundation of Information System: Computers and information processing, Computer Hardware, Computer software, Managing data resources, Telecommunication, Enterprise: wide computing and networking.

Strategic and Managerial Implications of Information Systems: Strategic Information System: Introduction, Characteristics of Strategic Information Systems, Strategic
Information Systems (SISP), Strategies for developing an SIS, Potential Barriers to developing a Strategic Information System (SIS),
Decision Support System (DSS): Decision making concepts, methods, tools and procedures. Managing Information Resources: Introduction, IRM, Principal of Managing
Information Resources, IRM functions, Computer Security: Introduction, Computer Security, Types of Computer Security, Disaster Recovery Plan.

Recommended Books:

1. W.S. Jawadakar, 'Management Information System', 3rd Ed, McGraw Hill, **2006.**
2. J. O. Brien, 'Management Information System', 9th Edn., TMH, **2008**.
3. Uma G, Gupta, 'Management Information System', 5th Edn., TMH.
4. Kenneth C. Laudon, 'Management Information System Organization and Technology' 14th Edn., TMH, **2016**.
5. Jane P. Laudon, Kenneth C. Laudon, 'Essentials of Management Information System', 11th Edn., Pearson, **2017.**

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ADVANCED DATA STRUCTURES AND ALGORITHMS

Subject Code-MCSE0-F94 **L T P C** **Duration – 45 Hrs.**
3 0 0 3

LEARNING OBJECTIVES

To learn the advanced concepts of data structure and algorithms and its implementation. The course has the main ingredients required for a computer science graduate and has all the necessary topics for assessment of data structures and algorithms.

LEARNING OUTCOMES

CO1 Ability to apply and implement various data structures to algorithms and to solve problems.
CO2 Basic ability to analyze algorithms and to determine algorithm correctness and time efficiency class.
CO3 Ability to apply various traversing, finding shortest path and text pattern matching algorithm.
CO4 Know the concepts of tractable and intractable problems and the classes P, NP and NP-complete problems.

COURSE CONTENT:

UNIT-I (12 Hrs.)

Introduction to Basics: Significance and need of various data structures and algorithms, Arrays, Linked lists, Stacks, Queues, Priority queues, Heaps; Strategies for choosing the appropriate data structures.

Advanced Data Structures: Binary Search Tree, AVL Trees, Red-Black Trees, Splay Trees, B-trees, Fibonacci heaps, Data Structures for Disjoint Sets, Augmented Data Structures.

UNIT-II (11 Hrs.)

Algorithms Complexity and Analysis: Probabilistic Analysis, Amortized Analysis, Competitive Analysis, Internal and External Sorting algorithms: Quick Sort, Heap Sort, Merge Sort, Counting Sort, Radix Sort.

UNIT-III (11 Hrs.)

Graphs & Algorithms: Representation, Type of Graphs, Paths and Circuits: Euler Graphs, Hamiltonian Paths & Circuits; Cut-sets, Connectivity and Separability, Planar Graphs, Isomorphism, Graph Coloring, Covering and Partitioning, bridges, Depth- and breadth-first traversals, Minimum Spanning Tree: Prim's and Kruskal's algorithms, Shortest-path Algorithms: Dijkstra's and Floyd's algorithm, Topological sort, Max flow: Ford-Fulkerson algorithm, max flow – min cut.

String Matching Algorithms: Suffix arrays, Suffix trees, Brute Force, Rabin-Karp, Knuth-Morris-Pratt, Boyer-Moore algorithm.

UNIT-IV (11 Hrs.)

Approximation algorithms: Need of approximation algorithms: Introduction to P, NP, NP-Hard and NP-Complete; Deterministic, non-Deterministic Polynomial time algorithms; Knapsack, TSP, Set Cover, Open Problems.

Randomized algorithms: Introduction, Type of Randomized Algorithms, 2-SAT; Game Theoretic Techniques, Random Walks.

RECOMMENDED BOOKS:

1. E. Horowitz, S. Sahni and Dinesh Mehta, 'Fundamentals of Data structures in C++', Galgotia, **1999**.

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2. Thomas H.Corman, Charles E.Leiserson, Ronald L. Rivest, 'Introduction to Algorithms', 3rd Ed., PHI, **2009**.
3. Adam Drozdex, 'Data Structures and algorithms in C++', 2nd Ed., Thomson learning – vikas publishing house, **2001**.
4. G. Brassard and P. Bratley, 'Algorithmics: Theory and Practice', Prentice –Hall, **1988**.

PRINCIPLES AND PRACTICES OF MANAGEMENT

Subject Code: MBAD0-F91 **L T P C** **Duration: 40 Hrs.**
3 0 0 3

Learning Objectives: This course aims to provide a thorough and systematic coverage of management theory and practice. The course aims at providing fundamental knowledge and exposure of the concepts, theories and practices in the field of management. It focuses on the basic roles, skills and functions of management, with special attention to managerial responsibility for effective and efficient achievement of goals.

UNIT-I (10 Hrs.)

Introduction to Management: Definition, Nature, Significance and Scope. Functions of Manager, An Overview of Management Functions. Is managing a science or art? Evolution of Management Thought: Classical Approach, Scientific Management, General Administrative Theory, Quantitative Approach, Behavioral Approach, System approach and Contingency approach.

UNIT-II (10 Hrs.)

Planning and Decision Making: Types of Plans and Process of Planning, Nature of Objectives, Setting Objectives. Importance and Steps in Decision Making, Types of Decision and Decision Making Under Different Conditions. Group Decision Making. Decision Making Styles

Organizing: Nature and Significance, Process of Organizing, Bases of Departmentation, Delegation and Decentralization, Line & Staff relationship

Delegation: Concept and Elements. Authority, Responsibility, Accountability

. UNIT-III (10 Hrs.)

Coordination: Concept and Importance, Factors which Make Coordination Difficult, Techniques or Methods to Ensure Effective Coordination.

Control: Concept, Planning-Control Relationship, Process of Control, Traditional & Modern Techniques of Control

UNIT-IV (10 Hrs.)

Management by Objectives: Concept, Benefits and Weaknesses, Comparative Study of Indian, Japanese and American Management Culture

Current Trends in Management Practices: Workforce Diversity, e-Business

Course Outcomes: After completing the course student will be able to understand and explain the concept of management and its managerial perspective. It will equip students to map complex managerial aspect arise due to ground realities of an organization. They will Gain knowledge of contemporary issues in Management principles and various approaches to resolve those issues.

Recommended Books

1. Heinz Weihrich, Cannice & Koontz, 'Management (A Global Perspective)', Tata McGraw Hill.
2. Harold Koontz, and Heinz Weihrich, 'Essentials of Management: An international Perspective', Tata McGraw Hill.

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3. Stephen Robbins & Mary coulter, 'Management', Pearson Education
4. VSP Rao & VH Krishna, 'Managemen't', Excel Books
5. P. Subba Rao, 'Principles of Management', Himalaya Publishing

TOTAL QUALITY MANAGEMENT

Subject Code: MBAD0-F92 **L T P C** **Duration: 40 Hrs.**
3 0 0 3

UNIT-I (10 Hrs.)

Quality and Total Quality Management: Excellence in manufacturing/service, factors of excellence, relevance of TQM. Concept and definition of quality: Total quality control (TQC) and Total Quality Management (TQM), salient features of TQC and TQM. Total Quality Management Models, benefits of TQM

UNIT-II (10 Hrs.)

Just-in-time (JIT): Definition: Elements, benefits, equipment layout for JIT system, Kanban system MRP (Material Requirement planning) vs JIT system, Waste elimination, workers involvement through JIT: JIT cause and effect chain, JIT implementation.

Customer: Satisfaction, data collection and complaint, Redressal mechanism.

UNIT-III (10 Hrs.)

Planning Process: Policy development and implementation; plan formulation and implementation.

Process Management: Factors affecting process management, Quality function development (QFD), and quality assurance system.

Total Employees Involvement (TEI): Empowering employees: team building; quality circles; reward and Recognition; education and training, Suggestion schemes.

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UNIT-IV (10 Hrs.)

Problems solving: Defining problem, Problem identification and solving process, QC tools.

Benchmarking: Definition, concept, process and types of benchmarking

Quality Systems: Concept of quality system standards: relevance and origin of ISO 9000; Benefits; Elements of ISO 9001, ISO 9002, ISO 9003.

Advanced techniques of TQM: Design of experiments: failure mode effect analysis: Taguchi methods.

Recommended Books

1. Sunder Raju, 'Total Quality Management', Tata McGraw Hill.
2. M. Zairi, 'TQM for Engineers', Aditya Books.
3. J.L. Hradeskym, 'Total Quality Management Handbook', McGraw Hill.
4. Dalela and Saurabh, ISO 9000 quality System, Standard Publishers.

HUMAN RESOURCE MANAGEMENT

Subject Code: MBAD0-F93 **L T P C** **Duration: 45 Hrs.**
3 0 0 3

Learning Objectives: The objective of the paper is to make student aware of the various functions and importance of the HR department in any organization. It is basically concerned with managing the human resources, whereby the underlying objective is to attract retain and motivate the human resources in any organization, which is the most challenging and daunting look for any organization today.

UNIT-I (10 Hrs.)

Human Resources Management: Meaning, Scope, Objective, Functions, Roles and Importance. interaction with other functional areas. HRM & HRD a comparative analysis. Human Resource Planning: Meaning, Process & Methods of Human Resources Planning, Importance of HRIS. Job Analysis, Job Description, Job Specification. Concept of Job Evaluation

UNIT-II (10 Hrs.)

Recruitment & Selection: Concept, Process & Methods. Concept of Induction & Placement. Training & Development: Concept & Methods, Difference Between Training & Development, Internal Mobility: Promotion, Transfer, Demotion, Separation.

UNIT-III (10 Hrs.)

Performance Appraisal: Concept, methods & Process. Compensation Management- Wage & Salary Administration, Elements & Methods of Wage & Salary, Incentive Plans & Fringe Benefits, Quality of work life (QWL): Meaning, Development and Various Approaches of QWL, Techniques for improving QWL.

UNIT IV (10 Hrs.)

Industrial Relations: Meaning and importance. Collective Bargaining, Participative Management, Employee Grievances and their Resolution, Quality Circles, HR Audit, Contemporary Issues in HRM, Trade Union in India, Safety Provisions under Factories Act 1948, Social Security, ESI Act 1948.

Learning Outcomes: After completing this course the students should be able to understand the concepts, principles and processes of HRM, understand the crucial role that HRM plays in helping organizations all over the world adapt to the endless change today.

Recommended Books

1. Edwin B. Flippo, ‘Personal Management’, Tata McGraw Hill.
2. Bohlander, Snell &Vohra, ‘Human Resource Management’, Cengage Learning.
3. Gary Dessler, ‘Human Resource Management’, McMillan.
4. V.S.P. Rao, ‘Human Resource Management’, Excel Books.
5. C.B. Mamoria, ‘Personal Management’, Himalaya Publications.
6. T.N. Chabbra, ‘Human Resource Management’, Dhanpat Rai & Sons.
7. C.B. Gupta, ‘Human Resource Management’, Sultan Chand and Sons.
8. R.S. Dwivedi, ‘HRD in India Companies’, Himalaya Publications.

MARKETING MANAGEMENT

Subject Code: MBAD1-F94 **L T P C** **Duration: 40 Hrs.**
3 0 0 3

Learning Objectives: The course aims at making students understand concepts, philosophies, processes and techniques of managing the marketing operations of a firm in turbulent business environment. This course will provide better understanding of the complexities associated with marketing functions, strategies and provides students with the opportunity to apply the key concepts to practical business situations.

UNIT-I (10 Hrs.)

Understanding Marketing and Consumers: Definition, Importance, Scope, Various Marketing Concepts, Marketing Mix, Marketing vs Selling

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Consumer Behaviour: Understanding Consumer Behaviour, Factors Influencing Consumer Buying Behaviour, Business Buying Process, Understanding Business Buyer Behaviour.

UNIT-II (10 Hrs.)

Creating and Managing Product: Market Segmentation, Differentiation, Targeting and Positioning, Competitors Analysis.

Product Decisions: Product Mix, New Product Development, Product Life Cycle and Strategies.

Pricing Decisions: Objectives, Factors Affecting Pricing Decisions, Pricing Methods, Pricing Strategies

UNIT–III (10 Hrs.)

Delivering and Promoting Product: Supply Chain Decisions: Nature, Types, Channel Design and Channel Management Decisions, Retailing, Wholesaling, Managing Logistics and Supply Chain.

Promotion Decisions: Communication Process, Promotion Mix

UNIT–IV (10 Hrs.)

Emerging Trends in Marketing: Green Marketing, Network Marketing, Direct Marketing, Social Marketing, Viral Marketing, Customer Relationship Management (CRM), Rural Marketing

E-Commerce: Marketing in The Digital Age.

Note: Relevant Case Studies should be discussed in class.

Recommended Books

1. Kotler & Koshy, 'Marketing Management', Pearsons Education.
2. Ramaswamy & Nama kumari, 'Marketing Management', McMillan.
3. Etzel, Walker, Stanton, and Pandit, 'Marketing Management', Tata McGraw Hill.
4. Kurtz & Boone, 'Principles of Marketing', Cengage Learning.
5. Kotler & Armstrong, 'Principles of Marketing', Prentice Hall.
6. Biplab S. Bose, 'Marketing Management', Himalaya Publications.
7. Subhash c. Jain, 'Marketing Management', Cengage Learning.
8. Rajan Saxena, 'Marketing Management', Tata McGraw Hill.

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PROJECT MANAGEMENT

Subject Code: MBAD0- F95	**L T P C 3 0 0 3**	**Duration: 40 Hrs.**

Learning Objectives: To acquaint the students with the steps involved in the planning, implementation and control of projects.

UNIT-I (10 Hrs.)

Project Management Concepts Attributes of a Project, Project Life Cycle, The Project management Process, Benefits of Project Management, Needs Identification,

UNIT-II (10 Hrs.)

Project Selection, preparing a Request for Proposal, Soliciting Proposals, Project organization, the project as part of the functional organization, pure project organization, the matrix organization, mixed organizational systems.

UNIT-III (10 Hrs.)

Project Planning and Scheduling: Design of project management system; project work system; work breakdown structure, project execution plan, work packaging plan, project procedure manual; project scheduling; bar charts, line of balance (LOB) and Network Techniques (PERT/ CPM)/GERT, Resource allocation, Crashing and Resource Sharing

UNIT-IV (10 Hrs.)

Project Monitoring and Control and Project Performance: Planning, Monitoring and Control; Design of monitoring system, Coordination; Procedures, Meetings, Control; Scope/Progress control, Performance control, Schedule control, Cost control, Performance Indicators.

Note: Relevant Case Studies should be discussed in class.

Recommended Books

1. Kanda, 'Project Management – A Life Cycle Approach', PHI.
2. Gido, 'Project Management', Cengage Learnings.
3. Vasant Desai, 'Project Management' Himalaya Publications.
4. Maylor, 'Project Management', Pearson Education.
5. Prasanna Chandra, 'Projects, Preparation, Appraisal Budgeting & Implementation', Tata McGraw Hills.

TEXTILE CHEMISTRY – I

Subject Code: MTEX0-F91 **L T P C** **Contact Hrs.-40**
3 0 0 3

UNIT-I (10 Hrs.)

Introduction: Process line for pretreatment, colouration and finishing of textiles

Singeing: Object of the process, types of singeing, details of various singeing methods, drawbacks and advantages. Process and quality control aspects involved.

Desizing: Object, types, method details and mechanism of removal of starch in various methods. Efficiency of desizing.

Scouring: Objectives, mechanism of removal of impurities, recipe and controlling parameters involved. Scouring of coloured textiles. Scouring of natural, man-made and blended textiles. Evaluation of scouring efficiency.

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UNIT-II (10 Hrs.)

Bleaching: Objectives of bleaching. Hypochlorite, peroxide, chlorite and peracetic acid bleaching methods and their effectiveness on various textiles. Controlling parameters and mechanism involved in each method. Efficiency of bleaching.

Mercerization: Objectives, mechanism related to various physical and chemical changes in cotton during mercerization. Process parameters and operation details. Causticization. Wet and hot mercerization. Ammonia treatment of cotton. Performance of various mercerization /alkali treatment processes. Assessment of efficiency of mercerization: Barium activity number, its determination and interpretation.

Pretreatment machineries: Singeing m/c, J-box, kier, mercerizing machine,

UNIT-III (10 Hrs.)

Heat setting: Objectives and mechanism of setting. Different methods of heat setting and their effectiveness on various man made textiles and blends. Heat setting conditions and controls. Heat setting of polyester, nylon, acetate and their blends. Evaluation of degree of heat setting.

Mechanical Finishes: Physical and chemical softening processes, selection of chemical and evaluation of softening. Calendaring - its types, construction and function of various calendaring m/cs. Sanforizing - method, mechanism and machineries involved. Evaluation of sanforizing.

UNIT-IV (10 Hrs.)

Carbonization: Objectives, selection of chemical, process details, trouble shoots, precautionary measures and efficiency of carbonization.

Functional finishes: Problem of creasing, anti-crease finish on cotton. Choice of chemical, catalyst and process parameters. Drawback and advantages associated with use of various anti-crease chemicals. Measures to reduce release of formaldehyde. Water repellency and water repellent finishes on cotton. Evaluation of water repellency.

Recommended Books:

1. A.K. Roy Choudhary, 'Textile Preparation & Dyeing', Science Publishers USA, **2006**.
2. R.H. Peters, 'Textile Chemistry', Vol - II, Elsevier Publishing Company, London, **1967**.
3. R.M. Mittal and S.S., Trivedi, 'Chemical Processing of polyester / cellulosic Blends',
4. Ahmedabad Textile Industries Research Association, Ahmedabad, India, **1983.**
5. S.R. Karmakar, 'Chemical Technology in the Pretreatment Processes of Textiles', Textile
6. Science & Technology Series, Vol-12, 1st Edn., Elsevier, **1999**.
7. A.J. Hall, 'Textile Finishing', Haywood Books, London, **1996.**
8. V.A. Shenai, 'Technology of Bleaching& Mercerization'.
9. Vaidya, 'Textiles Auxiliaries& Finishing Chemicals'.
10. V.A. Shenai and N.M., Saraf, 'Technology of Textile Finishing', Sevak Publications, Mumbai, **1990.**

MRSPTU

COMPUTER APPLICATIONS IN BUSINESS

Subject Code: MCAP0-F91 **L T P C** **Contact Hrs.-40**
3 0 0 3

Course Objectives: The objective of this course is to provide an insight into basic features of computer systems and their applications in Managerial Decision Making. It also provides technical framework to students for understanding the emerging world of e-Business.

UNIT-I (10 Hrs.)

Introduction to Computers: Types of Computers, Storage Devices and Memories, Input/Output devices. Introduction to Software, Types of software – Software: its nature and qualities. Operating System: Types of Operating System, WINDOWS XP: Basic Operations, utilities and features.

UNIT-II (10 Hrs.)

MS Applications: MS Word – Basics, formatting text and documents, Mail Merge, Macros
MS Excel – Introduction, Creating a List, Graphs and Charts, Sorting, Filtering Data, Goal seek, Pivot tables, Freezing Panes, What-if Analysis, Splitting Windows, Basic Formulae in Excel.
MS PowerPoint – Basics, Creating effective presentation, Animations and Templates.
MS Access – Designing of Forms, Report generation using wizard.

UNIT-III (10 Hrs.)

Internet and E-Business: Introduction to internet and its applications, Intranet and Extranet, World Wide Web, Internet, Architectures, Internet Applications. E – business - E-Business framework, Infrastructure for E-Business, E - Shopping, Electronic Data Interchange, Components of Electronic Data Interchange, Creating Web Pages using HTML, Electronic Payment System.

UNIT-IV (10 Hrs.)

Computer Networks and Security: Overview of a Network, Types of Network, Network Topologies, Firewall, Encryption v/s Decryption, Cryptography, Public Key and Private Key, Digital Signatures.

Learning Outcomes: Students will able to understand the concepts of computer and various software related to it. The use of MS Office (Excel, Access & Power point) helps in different type of analysis and projection of reports related to the business management. The software helps in planning & coordinating the supply chain of the company.

Recommended Books:

1. Rainer and Potter, 'Introduction to Information Technology', John Wiley and Sons.
2. Roger Jennings, 'Microsoft Access 2010', Pearson Education.
3. Forouzan, 'Basics of Computer Science', Cengage Learning.
4. Joseph Brady & Ellen F Monk, 'Problem Solving Cases in Microsoft, Excel Thomson Learning'.
5. K. Saini & Pradeep Kumar, 'Computer Applications in Management', Anmol Publications.
6. Deepak Bharihoke, 'Fundamentals of Information Technology', Excel Books.

PHYSICS OF MATERIALS

Subject Code: MPHY0-F91 **LT P C** **3 0 0 3** **Contact Hrs.-48**

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UNIT-1 (12 Hrs.)

Polymer Materials

Polymer Structure: Molecular Weight, Shape, Structure and Configuration; Thermoplastic and Thermosetting, Mechanical Behavior of Polymers-stress strain behavior, Macroscopic and Viscoelastic deformation, Fracture of polymers, Mechanical Characteristics-Fatigue, Tear Strength and Hardness, Mechanisms of Deformation and strengthening of polymers. Crystallization, Melting and Glass Transition Phenomena in Polymers.

UNIT-II (12 Hrs.)

Composite Materials

Introduction, Particle-Reinforced Composites-Large, Fiber-Reinforced Composites: Influence of Fiber Length, Influence of Fiber Orientation and Concentration, The Fiber Phase, The Matrix Phase, Polymer-Matrix Composites, Metal-Matrix Composites, Ceramic-Matrix Composites.

UNIT-III (11 Hrs.)

Nano-Materials

Emergence of Nanotechnology, Micro to Nanoscale materials, Characteristics of Nanomaterials-Band gap, surface to volume ratio, Electron confinement for zero, one and two dimensional nanostructures, synthesis of nanomaterials with top down and bottom up approach, Methods of Synthesis- ball milling, sol-gel, Electro-spinning and Lithography techniques, Carbon nanotubes (synthesis and properties), applications of nanomaterials.

UNIT-IV (13 Hrs.)

Electrical, Magnetic and Thermal Properties of Materials

Electrical properties of materials: Conduction in ionic materials, Dielectric behavior, Field vectors and polarization types, Frequency dependent dielectric constant, Other Electrical characteristics of materials and its applications: Ferroelectricity, Piezoelectricity.

Magnetic Properties of Materials: Magnetic materials and its classifications, Domain and Magnetic Hysteresis, Magnetic storage, Magnetic Anisotropy, Soft and Hard magnetic materials.
Thermal properties of materials: Heat capacity, Thermal expansion, Thermal conductivity and Thermal stresses.

Recommended Books:

1. William D. Callister, 'Materials Science and Engineering: An Introduction', 4th Edn., John Wiley & Sons, Inc.
2. G.M. Chow & K.E. Gonsalves, 'Nanotechnology - Molecularly Designed Materials', 2nd Edn, American Chemical Society
3. K.P Jain, 'Physics of Semiconductor Nanostructures', Narosa Publishing House, **1997**.
4. G. Cao, 'Nanostructures and Nanomaterials: Synthesis, Properties and Applications', Imperial College Press, **2004.**

STATISTICAL METHODS

Subject Code: MMAT0-F91	**LT P C 3 0 0 3**	**Contact Hrs.-36**

UNIT–I (12 Hrs.)

Statistics:
Introduction, Importance and Scope of Statistics, Mean, Median, Mode, Mean Deviation and Standard Deviation.

Correlation and Regression:
Correlation: Introduction, Types of Correlation, Measurement of Correlation: Karl Pearson's Coefficient of Correlation, Spearman's Rank Correlation
Regression: Introduction, Utility, Method of Least Squares, Coefficient of Regression, Coefficient of Determination.

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UNIT -II (12 Hrs.)

Random Variables:
Definition, Probability distribution, Distribution functions, probability distribution function (pdf) and cumulative distribution function (cdf), Expectation and Variance.

UNIT -III (7 Hrs.)

Theory of Probability:
Additive and multiplicative law of probability, conditional probability and Bayes theorem.

Probability distributions:
Binomial, Poisson, Normal Distribution

UNIT -IV (5 Hrs.)

Sampling Distribution:
Concept of sampling distribution and its standard error, Tests of significance: Tests based on Normal Distribution, Chi-square, t and F statistic.

Recommended Books:

1. H. Morris, DeGroot and J. Mark Schervish, 'Probability and Statistics', Pearson Education; 4th Edn.
2. Vijay K. Rohatgi, A.K. Md. Ehsanes Saleh, 'An Introduction to Probability and Statistics', 2nd Edn., Wiley,
3. Jay L. Devore, 'Probability and Statistics for Engineering and the Sciences', Cengage', 8th Edn'.

4. S.C. Kapoor, V.K. Gupta, 'Fundamentals of Mathematical Statistics', 11th Edn., S. Chand,

INDUSTRIAL SAFETY AND ENVIRONMENT

Subject Code: MMEE0-F91	**L T P C** **3 0 0 3**	**Contact Hrs.-45**

UNIT-I (9 Hrs.)

Meaning & need for safety. Relationship of safety with plant design, equipment design and work environment. Industrial accidents, their nature, types and causes. Assessment of accident costs; prevention of accidents. Industrial hazards, Hazard identification techniques, Accident investigation, reporting and analysis.

UNIT-II (11 Hrs.)

Planning for safety & its Measures: Definition, purpose, nature, scope and procedure. Range of planning, variety of plans. Policy formulation and implementation of safety policies. Safety measures in a manufacturing organization, safety and economics, safety and productivity. Employees participation in safety. Safety standards and legislation.

UNIT-III (11 Hrs.)

Meaning of environment and need for environmental control: Environmental factors in industry. Effect of temperature, Illumination, humidity noise and vibrations on human body and mind. Measurement and mitigation of physical and mental "fatigue" Basics of environment design for improved efficiency and accuracy at work. Environment Standards: Introduction to ISO 14000; Environment standards for representative industries.

UNIT-IV (14 Hrs.)

Ventilation and heat Control Purpose of ventilation, Lighting, Noise & Vibrations. Physiology of heat regulation. Thermal environment and its measurement. Thermal comfort. Indices of heat stress. Thermal limits for comfort, efficiency and freedom from health risk. Natural ventilation. Mechanical ventilation. Air conditioning Process ventilation. Control of heat exposures: control at source, insulation, and local exhaust ventilation. Control of radiant heat, dilution ventilation. Local relief. Industrial Lighting: Purpose of lighting, benefits of good illumination. Phenomenon of lighting and safety. Lighting and the work. Sources and types of artificial lighting. Principles of good illumination. Recommended optimum standards of illumination. Design of lighting installation. Maintenance standards relating to lighting and colour. Noise & Vibrations: Continuous and impulse noise. The effect of noise on man. Noise measurement and evaluation of noise. Noise isolation. Noise absorption techniques. Silencers vibrations: Effect, measurement and control measures.

Recommended Books:

1. H.W. Heinrich, 'Industrial Accident Prevention,' McGraw Hill.
2. Joselin, Edward Arnold, 'Ventilation'.
3. Beranek, 'Noise Reduction', McGraw Hill.
4. D.C. Reamer, 'Modern Safety and health Technology,' R. Wiley.
5. Firenze, R.J. Kendale, 'The Process of Hazard Control'.

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SUPPLY CHAIN MANAGEMENT

Course Code: MMEE0-F92 **L T P C** **Contact Hrs. 42**
3 0 0 3

Unit-I (10 Hrs.)

Understanding the Supply Chain: Process view, Decision phases and importance of supply chain, Supply chain management and logistics, supply chain and the value chain, Competitive advantage, supply chain and competitive performance, changing competitive environment, Supply Chain drivers and obstacle.

Unit-II (12 Hrs.)

Matching supply and demand: The lead-time gap, Improving the visibility of demand, supply chain fulcrum, forecast for capacity, execute against demand, Demand management and aggregate planning, Collaborative planning, forecasting and replenishment.

Creating the responsive supply chain: Product 'push' versus demand 'pull' The Japanese philosophy, Foundations of agility, Route map to responsiveness.

Strategic lead-time management: Time-based competition, Lead-time concepts, Logistics pipeline management.

Unit-III (10 Hrs.)

Planning and managing inventories in a supply chain: managing economies of scale in supply chain cycle inventory, managing uncertainty in supply chain, determining optimal level of product availability.

Transportation, Network Design and Information Technology in a supply chain: transportation, facility design network design in a supply chain, extended enterprise and the virtual supply chain, role of information and information technology in the supply chain, Laying the foundations for synchronization, 'Quick response' logistics, Production strategies for quick response, Logistics systems dynamics.

Unit-IV (10 Hrs.)

Managing risk in the supply chain: Vulnerability in supply chains, Understanding the supply chain risk profile, managing supply chain risk, Achieving supply chain resilience.

Overcoming the barriers to supply chain integration: Creating the logistics vision, Problems with conventional organizations, Developing the logistics organization, Logistics as the vehicle for change, Benchmarking.

Recommended Books:

1. S. Chopra, and P. Meindl, ‘Supply Chain Management’, Prentice Hall, **2010**.
2. M. Christopher, ‘Logistics & Supply Chain Management’, FT Prentice Hall, **2011**.
3. John T. Mentzer, J. T., ‘Supply Chain Management’, Illustrated Edn., SAGE Publications, **2001**.
4. Michael Hugos, M.H., ‘Essentials of Supply Chain Management’, John Wiley, **2011**.
5. D. Simchi-Levi, P. Kaminsky, E. Simchi-Levi, ‘Designing and Managing the Supply Chain’, McGraw Hill Higher Education, **2011.**

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ENVIRONMENT MANAGEMENT

Subject Code: MCIE0-F91 **L T P C** **Duration – 45 Hrs.**
3 0 0 3

UNIT-I (12 Hrs.)

Global Environmental Problems: Global warming, green-house effect, ozone depletion, acid rain, oil pollution, radiation hazard and control, global climate change. Main clauses and basic steps for Environmental Management System certification. Environmental Laws/Acts.

UNIT-II (10 Hrs.)

Cleaner Production Technologies Need and benefits, cleaner production techniques and options, zero impact manufacturing initiatives CDM and carbon credits/case studies.

UNIT-III-(11 Hrs.)

Environment Impact Assessment: Definition and its importance for environment management, constituents of environment impact assessment, project data for EIA study, prediction of impacts, EIA methodologies, constraints in implementation of EIA, impact prediction on water resources projects and other relevant case studies. Environment pollution.

UNIT IV (12 Hrs.)

Degradation of Land Resources: Deforestation: Forest land, deforestation and its effects on land use and Environmental quality, wetland and their importance in environment, causes and extent of wasteland, Soil degradation problems, erosion, salinization, water logging, land use management & planning.

Recommended Books:

1. Peavy, Rowe, 'Techobanoglous, Environmental Engg.', Tata McGraw-Hill.
2. Mackenzie L. Davis, 'Environmental Engg.', Tata McGraw-Hill.
3. Baljeet S. Kapoor, 'Environmental Engg. An overview', Khanna Publishers.
4. Glbert H. Masters, 'Environmental Engineering and Science', Prentice Hall of India Pvt. Ltd.
5. G.N. Panday, G.C. Carney, 'Environmental Engineering', Tata McGraw-Hill.
6. P.D. Sharma, 'Ecology and Environment', Rastogi Publications.
7. P.A. Ray, 'Lcances Environmental Impact Assessment', Hand National Environmental Protection Council, Manile.

OILS AND FATS

Subject Code: MCHM0-F91 **L T P C** **Contact Hrs.**

Unit-I (10 Hrs.)

Lipids: Classification, role of lipids, synthesis of fatty acids. Introduction to edible oils, Methods of extracting vegetable oils, Edible oil, chemistry of edible fats; vegetable-oil separation technology; and water- and heat-promoted fat separation from animal and plant "fatty tissues". Differences between vegetable and mineral oil

Unit-II (10 Hrs.)

Rancidity, reversion, polymerization, saponification, refining process; the fat-modification processes(Hydrogenation), addition, phospholipids, lipid metabolism; intermediary metabolism of fatty acids, Physical properties - polymorphism, reactions of fats.

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Unit-III (10 Hrs.)

Estimation of oil in oil seeds, Estimation of free fatty acids, Saponification value of oils, Identification and quantification of fatty acids. The technologies applied to specialty fats; the storage and transport of oils and fats; and energy demands of the oil-milling and edible-fat processing operations.

Unit-IV (10 Hrs.)

Analysis of Oils and Fats: Softening point, Congent point, Titre point, cloud point, Iodine, Saponification, acid, hyroxyl, R-M and Polenske value, peroxide value of oil, Elaiden test.

Books Recommended:

1. M. Kolthoff, 'Treatise on Analytical Chemistry', Vol. I and I 4.
2. D. Pearson, 'Laboratory Techniques in Food Analysis'.
3. S. Ranganna, 'Handbook of Analysis and Quality Control for Fruits and Vegetable Products, 2nd Edn., McGraw Hill.
4. Nicholls, 'Aids to the analysis of Foods and Drugs'.
5. Karamer Twig, 'Quality Control for Food Industry', (AVI) 9.
6. C.B. Catodo, R.R. Sharon and N.W. Eleanor, 'Understanding Clinical Nutrition', Second Edn., Belmont CA: West/ Wadsworth-An International Thomson Publishing Company, **1988**.
7. R. Passmore, M.A. Eastwood, 'Human Nutrition and Dietetics', Edinburgh: Churchill Livingstone, **1990**.
8. H. Robinson Corinne, R.L. Marilyn, Wanda La and E.G. Ann, '19900 Normal and Therapeutic Nutrition', 17th Edn., Scotland: Macmillan Publishing.
9. M. Swaminathan, 'Food Science, Chemistry and Experimental Foods'.
10. G.F.F.J. Welcher, 'Standard Methods of Chemical Analysis', Vol I & II, 6th Edn.
11. S.N. Mahendru, 'Analysis of Food Products', Swan Publishers.
12. C.B. Catodo, R.R. Sharon and N.W. Eleanor, 'Understanding Clinical Nutrition', 2nd Edn., **1988**.

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COMPUTER NETWORKS

Subject Code: MECE0-F91 **L T P C** **Duration: 48 Hrs.**
3 0 0 3

Learning Objectives

This course provides an In-depth knowledge on computer networks and provides a good background for advanced studies in communication networks.

Learning Outcomes:

The students will be able to design different networks based on different Internet protocols and also able to work for different OSI layers.

Unit 1 (12 Hrs.)

Introduction and Overview: The need of Internet, TCP/IP Internet, Internet services, History& scope, Protocol standardization.

Review of Underlying Technologies: LAN, WAN, MAN, Ethernet Topology, Token Ring, ARPANET, PRO net technology, FDDI. Internetworking concepts and architectural model, application level Internet connection, Interconnection through IP gateway, users view.

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Unit II (12 Hrs.)

Internet Addresses: Universal Identifiers, Three Primary Classes of IP Addresses, Structure of IP packets, network and broadcast addresses, class less addressing, supernet/ subnet addressing,

Addressing Conventions, Mapping Internet Addresses to Physical Addresses (ARP/RARP), Determining Internet Addresses at Startup (DHCP, Bootp).

Unit III (12 Hrs.)

Internetworking: Internet as a virtual network, Internetworking devices (routers, bridges, gateways), Protocol layering, routing algorithms, congestion control techniques, ICMP, IP Fragmentation, difference between X.25 and Internet layering, Gateway to Gateway Protocol (GGP), OSPF, Exterior Gateway Protocol (EGP), Managing Internet.

Unit IV (12 Hrs.)

Security Issues: Reliable Transactions and Security on Internet, Data encryption, IPsec, SSL, Concept of Firewalls, Intrusion Detection Systems, Denial of Service Attacks.

Recommended Books:

1. Comer, 'Internetworking with TCP/IP', vol-1, PHI.
2. Stevan, 'TCP/IP Illustrated', Pearson.
3. Forouzan 'TCP/IP Suite', TMH.
4. Related IEEE/IEE Publications.

DIGITAL SIGNAL PROCESSING

Subject Code: MECE0-F92 **L T P C** **Duration: 48 Hrs.**
3 0 0 3

MRSPTU

UNIT I (12 Hrs.)

Introduction to DSP, Time and Frequency domain description of different type of signals & systems, Discrete time sequences systems, Linearity unit sample response, Convolution, Time invariant system, Stability criteria for discrete time systems.

UNIT II (12 Hrs.)

Introduction to Fourier transform of Discrete Time Signal and its properties, Inverse Fourier transform, Sampling of continuous time signal, Reconstruction of continuous time signal from sequences, Z-Transform and its properties, complex Z-plane, ROC. Relationship between Fourier Transform and Z-Transform, Inverse Z-Transform.

UNIT III (12 Hrs.)

Discrete Time Fourier Transform and its properties, Linear convolution, Circular convolution, convolution from DFT, FFT, Inverse Fast Fourier Transform, Decimation in time and frequency algorithm.

UNIT IV (12 Hrs.)

Filter categories, Finite impulse response filters, various design techniques of FIR filters, FIR filter design by Windowing method, Rectangular, Triangular and Blackman window, Kaiser window. Design of IIR by Approximation of derivatives, Impulse invariant method and Bilinear Transformation method. Steps in Filter Design of Butter worth, Elliptic filter, Chebyshev filters, Frequency Transformation, Applications of DSP. Introduction to DSP Processor.

Recommended Books

1. Oppenhavm & Scheffer, 'Discrete Time Processing', PHI.
2. Proakis& D.G. Monolakis, 'Digital Signal Processing', PHI.
3. S.K. Mitra, 'Digital Signal Processing', PHI.
4. Roman Kuc, MC, 'Digital Signal Processing', MGH Pub.
5. E.C. Ifeacher, B.W. Jervis, 'Digital Signal Processing', Addison Wesely.

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SENSORS AND TRANSDUCERS

Subject Code: MECE0-F93 **L T P C** **Duration: 48 Hrs.**
3 0 0 3

Learning Objectives:
The main aim of this course is to understand the role of sensors and transducers for different communication systems. In this different transducers for Temperature, pressure, Liquid level measurement will be discussed in detail.

Learning Outcomes:
For different process control industries sensors and transducers play a vital role. For DCS, SCADA or PLC operation basic idea about measurement will be boosted in the students.

UNIT-I (12 Hrs.)

Sensors/Transducers: Principles, Classification, Parameters, Characteristics (Static and Dynamic), Environmental Parameters (EP), Characterization.

Mechanical and Electromechanical Sensors: Introduction, Resistive Potentiometer, Strain Gauge (Resistance and Semiconductor), Inductive Sensors: Sensitivity and Linearity of the Sensor, Types-Capacitive Sensors, Electrostatic Transducer, Force/Stress Sensors Using Quartz Resonators, Ultrasonic Sensors.

UNIT –II (12 Hrs.)

Thermal Sensors: Introduction, Gas Thermometric Sensors, Thermal Expansion Type Thermometric Sensors, Acoustic Temperature Sensor, Dielectric Constant and Refractive Index Thermosensors, Helium Low Temperature Thermometer, Nuclear Thermometer, Magnetic Thermometer, Resistance Change Type Thermometric Sensors, Thermo-emf Sensors, Junction Semiconductor Types, Thermal Radiation Sensors, Quartz Crystal Thermoelectric Sensors, NQR Thermometry, Spectroscopic Thermometry, Noise Thermometry and Heat Flux Sensors.

Magnetic Sensors: Introduction, Sensors and the Principles Behind, Magnetoresistive Sensors(Anisotropic and Semiconductor), Hall Effect and Sensors, Inductance and Eddy Current Sensors, Angular/Rotary Movement Transducers (Synchros and Synchro-resolvers), Eddy Current Sensors, Electromagnetic Flowmeter, Switching Magnetic Sensors and SQUID Sensors.

UNIT-III (12 Hrs.)

Radiation Sensors: Introduction, Basic Characteristics, Types of Photosensistors/Photodetectors, X-ray and Nuclear Radiation Sensors and Fibre Optic Sensors.

Electroanalytical Sensors: Introduction, The Electrochemical Cell, The Cell Potential, Standard Hydrogen Electrode (SHE), Liquid Junction and Other Potentials, Polarization (Concentration, Reactive, Adsorption and Charge Transfer), Reference Electrodes, Sensor Electrodes and Electroceramics in Gas Media.

UNIT-IV (12 Hrs.)

Smart Sensors: Introduction, Primary Sensors, Excitation, Amplification, Filters, Converters, Compensation, Information Coding/Processing, Data Communication (Standards for Smart Sensor Interface) and The Automation

Sensors Applications: Introduction, On-board Automobile Sensors (Automotive Sensors),Home Appliance Sensors, Aerospace Sensors, Sensors for Manufacturing and Sensors for Environmental Monitoring.

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Recommended Books

1. D. Patranabis, 'Sensors and Transducers', 2nd Edn., PHI, **2003.**
2. W. Bolton, 'Mechatronics', 4th Edn., Pearson, **2011.**

ELECTRONIC SYSTEM DESIGN

Subject Code: MECE0-F94 **L T P C** **Duration: 48 Hrs.**
3 0 0 3

UNIT-I (12 Hrs.)

MSI and LSI Circuits and Their Applications: Review of Digital electronics concept, Arithmetic Circuits, Comparators, Multiplexers, Code Converters, XOR and AND OR INVERTER Gates, Wired Logic, Bus Oriented Structures, Tri-State Bus System, Propagation Delay.

UNIT-II (12 Hrs.)

Sequential Machines: The Concept of Memory, The Binary Cell, The Cell and The Bouncing Switch, Set/Reset, D, Clocked T, Clocked JK Flip Flop, Design of Clock F/F, Conversion, Clocking Aspects, Clock Skew, State Diagram Synchronous Analysis Process, Design Steps for Traditional Synchronous Sequential Circuits, State Reduction, Design Steps For Next State Decoders, Design of Out Put Decoders, Counters, Shift Registers and Memory.

UNIT-III (12 Hrs.)

Multi Input System Controller Design: System Controllers, Design Phases And System Documentation, Defining The System, Timing And Frequency Considerations, Functional, Position And Detailed Flow Diagram Development, MDS Diagram, Generation, Synchronizing Two System And Choosing Controller, Architecture, State Assignment, Next State Decoders And Its Maps, Output Decoders, Clock And Power Supply Requirements, MSI Decoders, Multiplexers In System Controllers, Indirect Addressed Multiplexers Configurations, Programmable System Controllers, ROM, PLA And PAL Based Design.

UNIT-IV (12 Hrs.)

Asynchronous Finite State Machines: Scope, Asynchronous Analysis, Design of Asynchronous Machines, Cycle and Races, Plotting and Reading the Excitation Map, Hazards, Essential Hazards Map Entered Variable, MEV Approaches to Asynchronous Design, Hazards in Circuit Developed by MEV Method, Electromagnetic Interference and Electromagnetic Compatibility Grounding and Shielding of Digital Circuits. Interfacing digital system with different media like fibre cable, co-axial cable etc.

Recommended Books:

1. Fletcher, 'An Engineering Approach to Digital Design', PHI, **1990.**
2. 'Designing with TTL Circuits', Texas Instruments.
3. Related IEEE/IEE Publications.

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DIGITAL CIRCUITS AND LOGIC DESIGN

Subject Code: MECE0-F95 **L T P C** **Duration: 48 Hrs.**
3 0 0 3

Learning Objectives

The use of digital circuitry is present in virtually all aspects of our lives and its use is increasing rapidly. Thus, this course aims to introduce postulates of Boolean algebra; methods for simplifying Boolean expressions and also outline the formal procedures for the analysis and design of combinational and sequential circuits. Next focus is to get student familiarize with concepts of digital logic families, D/A & A/D converters, memories and programmable logic devices.

Learning Outcomes:

After going through this subject in detail student will be able to understand Digital devices and in turn can learn and operate Microprocessor/Microcontroller more easily.

UNIT I (12 Hrs.)

Fundamentals of Digital Techniques: Digital signal, logic gates: AND, OR, NOT, NAND, NOR, EX-OR, EX-NOR, Boolean algebra. Review of Number systems. Binary codes: BCD, Excess-3, Gray, EBCDIC, ASCII, Error detection and correction codes.

UNIT II (12 Hrs.)

Combinational Design Using Gates: Design using gates, Karnaugh map and Quine Mcluskey methods of simplification. Combinational Design Using MSI Devices: Multiplexers and Demultiplexers and their use as logic elements, Decoders, Adders / Subtractors, BCD arithmetic circuits, Encoders, Decoders / Drivers for display devices.

UNIT III (12 Hrs.)

Sequential Circuits: Flip Flops: S-R, J-K, T, D, master-slave, edge triggered, shift registers, sequence generators, Counters, Asynchronous and Synchronous Ring counters and Johnson Counter, Design of Synchronous and Asynchronous sequential circuits.

Digital Logic Families: Switching mode operation of p-n junction, bipolar and MOS. devices. Bipolar logic families: RTL, DTL, DCTL, HTL, TTL, ECL, MOS, and CMOS logic families. Tristate logic, Interfacing of CMOS and TTL families.

UNIT IV (12 Hrs.)

A/D and D/A converters: Sample and hold circuit, weighted resistor and R -2 R ladder D/A Converters, specifications for D/A converters. A/D converters: Quantization, parallel -comparator, successive approximation, counting type, dual-slope ADC, specifications of ADCs. Programmable Logic Devices: ROM, PLA, PAL, FPGA and CPLDs. Finite State Machines: Finite state model, Memory elements and their excitation functions, Synthesis of Synchronous sequential circuits, Capabilities and limitations of FSM, Design, Modelling and Simulation of Moore and Mealy machines.

Recommended Books:

1. R.P. Jain, 'Modern Digital Electronics', 3rd Edn., TMH.
2. R.P. Jain,'Modern Digital Electronics', 4th Edn., TMH, **2011**.
3. Malvino& Leach, 'Digital Principals & Applications', 4th Edn., TMH, **1991**.
4. Fletcher, 'An Engg. Approach to Digital Design', Indian Edn., PHI, **2011**.
5. Digital Electronics by Sanjay Sharma', S.K. Kataria & Sons, 1st Edn., **2011**.

ADVANCED ELECTRICAL MACHINES

Subject Code: MELE0-F91 **L T P C**
3 0 0 3

Learning Objectives:

- To give a systematic approach for modeling and analysis of all rotating machines under both transient and steady state conditions.

Learning Outcomes:

- The students will be able to model all types of rotation machines including special machines.
- They will have complete knowledge about electromagnetic energy conversion and application of reference frame theories for modeling of machines.

UNIT-I

1.Polyphase Synchronous Machines: Mathematical: Basic Synchronous machine parameters, Voltage, Flux linkage and inductance relations, Park's transformation – its physical concept, equations of performance.

2.Balanced steady state analysis: Phasor equations and phasor diagrams, Power-angle characteristics, cylindrical rotor and Salient pole machines, Short circuit ratio

UNIT-II

3.Transient analysis & machine dynamics: Three phase short-circuits, Armature and field transients, Transient torque, Sudden reactive loading and Unloading. Transient Analysis-a qualitative approach, Reactance and Time –Constants from equivalent circuits, Measurement of reactance, Transient Power-angle characteristics, The basic electromechanical equation, Linearized analysis, Large Angular/oscillation, Non-linear analysis.

UNIT-III

4.Transformers & its transients: Multi-Circuit Transformers: General theory, Equivalent circuits, Three winding transformer as a multi-circuit transformer, Determination of parameters. In-rush current phenomena, Qualitative approach, Analytical approach, In-rush current in 3-phasetransformers.

UNIT-IV

5.Excitation phenomena in transformers: study of excitation and its effect on transformer performance, Harmonics in: Single phase transformers, three-phase transformers, Disadvantages of harmonics, Suppression of harmonics.

6.Unbalanced operation of three-phase transformers: Single-phase load on three-phase transformers, Single-Phasing in 3-phase transformers, Effect of using tertiary winding.

RECOMMENDED BOOKS:

1. B. Edikins, 'Generalized Theory of Electrical Machines'.
2. Concordia, 'Synchronous machines'.
3. E.W. Kim bark, 'Power System Stability', Vol. III., Wiley.
4. P.S. Bimbhra., 'Generalized Theory of Electrical Machines', **2010**.
5. E.W. Kimbark, 'Power System Stability', Vol. III, **1998**.
6. A. Draper, 'Electrical Machines', **2011.**

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LOAD FORECASTING AND LOAD MANAGEMENT

Subject Code: MELE0-F92	**L T P C** **3 0 0 3**

Learning Objectives:

- To give a systematic approach for load management and forecasting.
- To analysis of all trend coming related to recent case studies conditions.

Learning Outcomes:

- The students will acquire skills of load related energy management and tariff structure.
- They will have complete knowledge about annual and monthly peak demands.

UNIT-I

1.Load Forecasting: Classification and characterization of loads, Approaches to load forecasting, Forecasting methodology, Energy forecasting, Peak demand forecasting, Non-weather sensitive forecast and Weather sensitive forecast, Total forecast, Annual and monthly peak demand forecasts, Applications of state estimation to load forecasting.

UNIT-II

2.Load Management: Introduction to Load management, Electric energy production and delivery system structure (EEPDS), Design alternatives for EEPD systems, Communication/control techniques for load management, Tariff structure and load management, principles of macro and microeconomics and energy pricing strategies, Assessing the impacts of load management.

MRSPTU

UNIT-III

3. Energy Demand Forecasting:

Static and dynamic analysis of energy demand, Elements of energy demand forecasting, Methodologies and models for energy demand forecasting, Techno economic approach in energy demand forecasting, Energy auditing, Energy management, Power Pools and Energy Banking.

UNIT-IV

4. Trends and Case Studies:

Energy management strategy, Symbiotic relation between information, Energy models and decision making, Case studies like industrial energy forecasting, Transportation energy forecasting, Residential, Commercial and agricultural energy forecasting.

RECOMMENDED BOOKS:

1. J. Martino, ‘Technological Forecasting for Decision Making’, Elsevier Press, **1972**.
2. C.W. Gellings, P.E. Penn Well, ‘Demand Forecasting in the Electric Utility Industry’, Fairmount Press.
3. S. Makridakis, ‘Forecasting Methods and Applications’, John Wiley and Sons, **1997**.
4. R.G. Brown, ‘Smoothing, Forecasting and Prediction of Discrete Time Series’, PHI Int., **1963**.

NEURAL NETWORKS & FUZZY LOGIC

Subject Code: MELE0-F93 **L T P C**
3 0 0 3

Learning Objectives:

- To apply artificial neural networks in various electrical and electronics engineering applications.
- To expose students to fuzzy methods of analyzing problems which involve incomplete or vague criteria rather than crisp values.
- To investigates requirements analysis, logical design, and technical design of components for fuzzy systems development.

Learning Outcomes:

- The students acquire the skills required to innovate and build, smart and intelligent applications in electrical and electronics engineering.
- They will understand review of Neural Networks: models of a neuron, various activation functions, Threshold function, piecewise – linear function, stochastic model of a neuron, feedback.
- They will be able to take up fuzzy systems approach to solve applications in engineering.

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UNIT-I

Review of Neural Networks: models of a neuron, various activation functions: Threshold function, piecewise – linear function, stochastic model of a neuron, feedback.

UNIT-II

Network Architecture: Single layer feed forward network, multiplayer feed forward network, recurrent network, knowledge representation.

UNIT-III

Learning Processes: Memory Based Learning Hebbian Learning, Competitive Learning, Boltzmann Learning, learning with a teacher, learning without a teacher, adaptation, single layer perceptions, multi-layer perceptions.

UNIT-IV

Introduction to fuzzy logic: membership function, rule generation, fuzzy concept, fuzzification, defuzzification, time dependent fuzzy logic, temporary fuzzy logic, fuzzy artificial neural network, neuro fuzzy control, fuzzy neural nets, Fuzzy Based ABS system, applications.

RECOMMENDED BOOKS:

1. Simon Haykin, ‘Neural Networks’.
2. Eleine Rich, Kevin Knight, ‘Artificial Intelligence’.
3. Stamatios V. Kartalopoulos, ‘Understanding Neural Networks and Fuzzy Logic’.
4. Hungenahally Jain, ‘Neural Intelligent System’.

ENGINEERING OPTIMIZATION

Subject Code: MELE0-F94 **L T P C**
3 0 0 3

Learning Objectives:

- To learn essential optimization techniques for applying to day to day problems.
- To study of genetic algorithms with relation to application in power system.
- To acquire knowledge of dynamic programming.

Learning Outcomes:

- After learning the techniques, they can apply to engineering and other problems.
- They can get skills to optimize the variety of programming.

UNIT I

Introduction: Definition, Classification of optimization problems, Classical Optimization Techniques, Single and Multiple Optimization with and without inequality constraints.

UNIT II

Linear Programming (LP) and Non Linear Programming (NLP): Simplex method of solving LP, revised simplex method, duality, Constrained Optimization, Theorems and procedure, linear programming, mathematical model, solution technique, duality. Steepest descent method, Conjugate gradient method, Newton Method, Sequential quadratic programming, Penalty function method, augmented Lagrange multiplier method.

MRSPTU

UNIT III

Dynamic Programming (DP): Multistage decision processes, concept of sub-optimization and principle of optimality, Recursive relations, Integer Linear programming, Branch and bound algorithm.

UNIT IV

Genetic Algorithm (GA): Introduction to Genetic Algorithm, working principle, coding of variables, fitness function, GA operators; Similarities and differences between GA and traditional methods; Unconstrained and constrained optimization using genetic Algorithm, real coded GA, Advanced GA, global optimization using GA, Applications to power system.

Recommended Books:

1. D.A. Pierre, 'Optimization Theory with Applications', Wiley Publications.
2. H.A. Taha, 'Operations Research: An Introduction' 7th Edn., Pearson Education Edition, Asia, Delhi.
3. S.S. Rao, 'Optimization –Theory and Applications', Wiley-Eastern Limited.
4. D.P. Kothari & J.S. Dhillon, 'Power System Optimization', PHI Publishers.
5. Donald E. Kirk, 'Optimal Control Theory', Dover Publications, New York.
6. Kalyanmoy Deb, 'Optimization for Engineering Design: Algorithms and Examples', PHI Publishers.

PG OPEN ELECTIVES-II 2016 BATCH ONWARDS		
Internal	External	Total
40	60	100

NOTE: MORE COURSES MAY BE ADDED IN THIS LIST LATER ON

PG OPEN ELECTIVES-II 2016 BATCH ONWARDS		
COURSE CODE	**COURSE**	**NOT APPLICABLE FOR PROGRAMMES**
MITE0-F92	Network Security and Ethical Hacking	M.Tech. IT, M.Tech. IT & CW, M.Sc. IT
MCSE0-F95	Advanced Operating Systems	M.Tech. CSE, M.Tech. CSE (Software Engineering), M.Tech. CSE (Computer Network and Information Security), M.Tech. CSE (E-Security), M.Sc. CSE
MCSE0-F96	Enterprise Resource Management	
MCSE0-F97	Advanced Computer Networks	
MCSE0-F98	Digital Image processing	
MCSE0-F99	Database Management Systems	
MBAD0-F96	Accounting & Financial Management	M.B.A.
MBAD0-F97	Business Ethics	
MBAD0-F98	EEIM	
MBAD0-F99	Basic Accounting	
MCHM0-F92	Dyes, Soaps and Detergents	M.Sc. Chemistry
MMEE0-F93	Advanced Power Plant Engineering	ME (Automation & Robotics), M.Tech. ME (CAD/CAM), M.Tech. ME (Industrial & Production), M.Tech. ME (Production), M.Tech. ME (Thermal Engg.)
MPHY0-F92	Science of Renewable Energy Resources	M.Sc. Physics
MECE0-F96	Fundamentals of Electronic Communications	M.Tech. Electronics & Instrumentation, M.Tech. ECE (Microelectronics), M.Tech. ECE (Embedded System), M.Tech. ECE (Signal Processing)
MECE0-F97	Electronic Instrumentation	
MECE0-F98	Reliability Engineering	
MECE0-F99	Linear Control Systems	
MMAT0-F92	Ordinary Differential Equations	M.Sc. Mathematics
MMAT0-F93	Numerical Methods	
MELE0-F95	Advanced Transducer Technology	M.Tech. Electrical Engg., M.Tech. EE (Power System), M.Tech. EE (Instrumentation & Control Engg.)
MELE0-F96	Electric Traction System	
MELE0-F97	Power Electronic Devices & Controllers	

NETWORK SECURITY AND ETHICAL HACKING

Course Code: MITE0-F92	**L T P C** **3 0 0 3**	**Contact Hrs.**

Introduction

Network Security, Functionality and ease of use Triangle, Essential Terminology and Elements of Security (Threat, Attack, Vulnerabilities, Target of Evaluation, Exploit), Concept of ethical hacking Phases involved in hacking, Penetration Testing and Ethical Hacking

Foot Printing

Introduction to foot printing, Information gathering methodology of the hackers, Active and passive reconnaissance

Scanning

Scanning, Elaboration phase, active scanning. Enumeration, DNS Zone transfer. Detecting live systems on the target network, discovering services running /listening on target systems, understanding port scanning techniques, Identifying TCP and UDP services running on the target network, Understanding active and passive fingerprinting

System Hacking

Aspect of remote password guessing, Role of eavesdropping, Various methods of password cracking, Key (stroke) Loggers, Understanding Sniffers and their working, Comprehending Active and Passive Sniffing, Man-in-the-Middle Attacks, ARP Spoofing/Poisoning and Redirection, DNS and IP Sniffing, HTTPS Sniffing.

Trojans and backdoors

Trojan, Overt and Covert Channels, Working of Trojans, Different Types of Trojans, Different ways of Trojan’s entry into a system, Indications of a Trojan Attack

Session Hijacking

Understanding Session Hijacking, spoofing vs. hijacking, Phases involved in Session Hijacking, Types of Session Hijacking, Session hijacking Tools.

Hacking Wireless Networks

Introduction to 802.11, Role of WEP, Cracking WEP Keys, Sniffing Traffic, Wireless DOS attacks, WLAN Scanners, WLAN Sniffers, Hacking Tools, Securing Wireless Networks.

Recommended Books:

1. Rajat Khare, ‘Network Security and Ethical Hacking’, Luniver Press, **2006**.
2. Thomas Mathew, ‘Ethical Hacking’, OSB Publisher, **2003**.
3. Stuart McClure, Joel Scambray and George Kurtz, ‘Hacking Exposed: Network Security Secrets & Solutions’, McGraw-Hill, **2005**.
4. ‘Ethical Hacking and Network Defense’, Cengage Learning, **2009**.
5. Eric Core, ‘Hackers Beware’, EC-Council Press, **2003.**

ADVANCED OPERATING SYSTEM

Subject Code-MCSE0-F95	**L T P C** **3 0 0 3**	**Duration – 45 hrs**

COURSE OBJECTIVES:

To learn the fundamentals of Operating Systems and gain knowledge on Distributed operating system concepts that includes architecture, Mutual exclusion algorithms, Deadlock detection algorithms and agreement protocols

COURSE OUTCOMES:

CO1 Discuss the various synchronization, scheduling and memory management issues

CO2 Demonstrate the Mutual exclusion, Deadlock detection and agreement protocols of Distributed operating system

CO3 Discuss the various resource management techniques for distributed systems

CO4 Identify the different features of real time and mobile operating systems

COURSE CONTENT

UNIT-I (11 hrs)

Fundamentals of Operating Systems: Strategies of operating system, Structures of operating system, overview – Synchronization Mechanisms – Processes and Threads - Process Scheduling –Deadlocks: Detection, Prevention and Recovery – Models of Resources – Memory Management Techniques.

Distributed Operating Systems: Issues in Distributed Operating System – Architecture – Communication Primitives –Lamport's Logical clocks – Causal Ordering of Messages – Distributed Mutual Exclusion Algorithms – Centralized and Distributed Deadlock Detection Algorithms – Agreement Protocols.

UNIT-II (12 hrs)

Distributed Resource Management: Distributed File Systems – Design Issues - Distributed Shared Memory – Algorithms for Implementing Distributed Shared memory–Issues in Load Distributing – Scheduling Algorithms – Synchronous and Asynchronous Check Pointing and Recovery – Fault Tolerance – Two-Phase Commit Protocol – Non blocking Commit Protocol – Security and Protection.

UNIT-III (11 hrs)

Real Time And Mobile Operating Systems: Basic Model of Real Time Systems - Characteristics- Applications of Real Time Systems –Real Time Task Scheduling - Handling Resource Sharing - Mobile Operating Systems –Micro Kernel Design - Client Server Resource Access – Processes and Threads – Memory Management – File system, Networked file system

UNIT-IV (11 hrs)

CASE STUDIES: Linux System: Design Principles - Kernel Modules - Process Management Scheduling –Memory Management - Input-Output Management - File System – Interprocess Communication. iOS and Android: Architecture and SDK Framework - Media Layer -Services Layer - Core OS Layer – File System.

RECOMMENDED BOOKS

1. Andrew S. Tanenbaum and Maarten van Steen, 'Distributed Systems: Principles and Paradigms', 2nd Edn., Prentice Hall, **2007**.
2. Mukesh Singhal and Niranjan G. Shivaratri, 'Advanced Concepts in Operating Systems – Distributed, Database, and Multiprocessor Operating Systems', Tata McGraw-Hill, **2001**.
3. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, 'Operating System Concepts', 7th Edn., John Wiley & Sons, **2004**.
4. Daniel P. Bovet and Marco Cesati, 'Understanding the Linux kernel', 3rd Edn., O'Reilly, **2005**.
5. Rajib Mall, 'Real-Time Systems: Theory and Practice', Pearson Education India, **2006**.
6. Neil Smyth, 'iPhone iOS 4 Development Essentials – Xcode', 4th Edn., Payload media, **2011**.

ENTERPRISE RFESOURCE PLANNING

Course Code: MCSE0-F96 **L T P C** **Contact Hrs. 45**
3 0 0 3

COURSE OBJECTIVES

This course will explore the concepts, principles, and state-of-the-art methods in successfully integrating Enterprise Resource Planning (ERP) systems into extant enterprise architectures. The course will help both functional area and IT managers understand the respective role of users, enterprise architects, developers and managers in the selection, preparation, implementation and management of large and complex enterprise applications

COURSE OUTCOMES

CO1 Understand and gain insight into process views of organizations and tools and techniques used to model both as-is and to-be models.

CO2 Know and be able to apply key technical terminology in enterprise information systems as they apply in different ERP products and development methods

CO3 to understand various actions and business modules in ERP

CO4 to understand market and various applications of ERP systems

COURSE CONTENT

UNIT-I (10 hrs)

ERP AND TECHNOLOGY: Introduction, Related Technologies, Business Intelligence. E-Commerce and E-Business, Business Process Reengineering, Data Warehousing, Data Mining, OLAP, Product life Cycle management, SCM, CRM

UNIT-II (12 hrs)

ERP IMPLEMENTATION: Implementation Challenges, Strategies, Life Cycle, Pre-implementation Tasks, Requirements Definition, Methodologies, Package selection, Project Teams, Process Definitions, Vendors and Consultants, Data Migration, Project management, Post Implementation Activities.

UNIT-III (12 hrs)

ERP IN ACTION & BUSINESS MODULES: Operation and Maintenance, Performance, Maximizing the ERP System, Business Modules, Finance, Manufacturing, Human Resources, Plant maintenance, Materials Management, Quality management, Marketing, Sales, Distribution and service.

UNIT-IV(11hrs)

ERP MARKET: Marketplace, Dynamics, SAP AG, Oracle, PeopleSoft, JD Edwards, QAD Inc, SSA Global, Lawson Software, Epicor, Intuitive.

ERP Application: Enterprise Application Integration, ERP and E-Business, ERP II, Total quality management, Future Directions, Trends in ERP.

RECOMMENDED BOOKS

1. Alexis Leon, ‘ERP DEMYSTIFIED’, Tata McGraw Hill, 2nd Ed, **2008**.
2. Mary Sumner, ‘Enterprise Resource Planning’, Pearson Education, **2007**.
3. Jim Mazzullo, ‘SAP R/3 for Everyone’, Pearson,**2007**.
4. Jose Antonio Fernandz, ‘The SAP R /3 Handbook’, Tata McGraw Hill, **1998**.
5. Biao Fu, ‘SAP BW: A Step-by-Step Guide’, 1st Ed, Pearson Education, **2003**.

ADVANCED COMPUTER NETWORKS

Subject Code-MCSE0-F97 **L T P C** **Duration – 45 hrs**
3 0 0 3

COURSE OBJECTIVES:

This course provides knowledge about computer network related hardware and software using a layered architecture. It is also offer good understanding of the concepts of network security, wireless, Adhoc and various emerging network technologies.

COURSE OUTCOMES:

CO1: Able to explain the Fundamentals of Computer Networks and their layered architecture. Also acquire knowledge about ATM Layered model and LAN Emulation.

CO2: Able to explain about various Transport and Application Layer Protocols. Also acquire knowledge about various congestion control mechanisms and network management.

CO3: Able to explain Features, advantages and applications of Adhoc Networks, Adhoc versus Cellular networks, Network architecture and Technologies. Evolution with the examples of wireless communication systems other techniques of Cellular Networks like 2G, 2.5G and 3G Technologies. Also able to explain wireless local loop (WLL), Wireless and local Area Networks (WLANs).

CO4: Able to define the Fundamentals of network security, various authentication protocols and E-mail Security.

COURSE OUTCOME

UNIT-I (11 hrs)

Computer networks and layered architecture, Asynchronous Transfer Mode- ATM layered model, switching and switching fabrics, network layer in ATM, QOS, LAN emulation.

UNIT-II (11 hrs)

Transport Layer-Elements of transport protocols; Internet transport protocols: TCP and UDP, TCP connection management, congestion control. Application Layer-Network application architectures: Client-server, P2P and hybrid; Application layer protocols: DNS, FTP, TFTP, TELNET, HTTP and WWW, SMTP and electronic mail; Network management and SNMP.

UNIT-III (13 hrs)

Adhoc and Cellular networks- Features, advantages and applications, Adhoc versus Cellular networks, Network architecture, Protocols: MAC protocols, Routing protocols, Technologies. Wireless Communication Systems- Evolution, examples of wireless communication systems, 2G Cellular networks, Evolution for 2.5G TDMA Standards, IS-95B for 2.5G CDMA. Wireless and Mobile Networks-Wireless links and network characteristics, wireless local loop (WLL), Local Multipoint Distribution System (LMDS), Wireless local Area Networks (WLANs), Bluetooth and Personal Area Networks.

UNIT-IV (10 hrs)

Introduction to Network Security- Cryptography, symmetric and public-key algorithms, digital signatures, communication security, and authentication protocols, E-mail security, PGP and PEM.

RECOMMENDED BOOKS

1. B.A. Forouzan, 'Data Communication and Networking', 5th Edn., Tata McGraw-Hill, **2013**.
2. A.S. Tanenbaum, 'Computer Networks', 4th Edn., Pearson Education, **2002.**
3. William Stallings, 'Network Security and Cryptography', 6th Edn., Prentice-Hall of India, **2013**.

4. Theodore S. Rappaport, ‘Wireless Communication: Principles and Practices’, 2nd Edn., Pearson Education, **2001**.
5. D.E. Comer and R.E. Droms, ‘Computer Networks and Internets’, Prentice-Hall, 4th Edn., **1998**.
6. Sunil Kumar S. Manvi, Mahabaleshwar S. Kakkasageri, ‘Wireless and Mobile Networks: Concepts and Protocols’, 2nd Edn., Wiley India, **2016**.

DIGITAL IMAGE PROCESSING

Course Code: MCSE0-F98 **L T P C** **Contact Hrs. 45**
3 0 0 3

COURSE OBJECTIVES:

Visual information plays an important role in many aspects of our life. Much of this information is represented by digital images. Digital image processing is ubiquitous, with applications including television, tomography, photography, printing, robot perception, and remote sensing. This is an introductory course to the fundamentals of digital image processing. It emphasizes general principles of image processing, rather than specific applications.

COURSE OUTCOMES:

CO1: To introduce the digital images, processing with digital images, application areas of the field, fundamentals step to process images, image acquisition and digitization and understand image processing system.

CO2: To learn basic image transforms, image enhancement in spatial as well as frequency domain, to make them aware about various filters used for enhancement. Aim is to introduce histograms in image processing.

CO3: To study the image restoration of degraded images and processing of colour images and Introduction to wavelets.

CO4: To understand the image compression in order to save bandwidth and storage, image segmentation techniques, representation of image and basics of morphological processing operations.

COURSE CONTENT:

UNIT-I (11 hrs)

Introduction: Digital Images and their Representation, Digital image processing, Application areas of digital image processing. Fundamental Steps in Image Processing, Elements of a Digital Image Processing System.

Digital Image Fundamentals: Elements of Visual Perception, A Simple Image Model, Image acquisition, Sampling and Quantization, Some Basic Relationships between Pixels, Mathematical Preliminaries, 2D Linear Space Invariant Systems,2D Convolution and Correlation.

UNIT-II (12 hrs)

Image Enhancement: Some Simple Intensity Transformations, Image Subtraction, Image Averaging, Spatial Domain Methods, Smoothing Filters, Sharpening Filters, Frequency Domain Methods, Lowpass Filtering, Highpass Filtering, Generation of Spatial Masks from Frequency Domain Specifications, Histogram Processing: Streaching, Equalization and Specification.

Image Transforms: 2D Orthogonal and Unitary Transforms, Properties and Examples. Introduction to the Fourier Transform, The Discrete Fourier Transform, 2D DFT, FFT, DCT, Hadamard Transform, Haar Transform, KL Transform.

UNIT-III (11 hrs)

Image Restoration: Degradations Model, Degradation Model for continuous and discrete functions, Diagonalization of Circulant and Block - Circulant Matrices, Effects of Diagonalization on the Degradation Model, Algebraic Approach to Restoration: Unconstrained Restoration, Constrained Restoration, Inverse Filtering, weiner filters, Removal of Blur Caused by Uniform Linear Motion, Restoration in the Spatial Domain, Geometric Transformation.

Color Image processing and wavelets: Color Image Processing Fundamentals, Color Models: RGB, CMY, CMYK, HSI, Relationship Between Different Models, Introduction to waveletts and resolution analysis.

UNIT-IV (11 hrs)

Image Compression: Fundamentals: Coding Redundancy, Interpixel Redundancy, Psychovisual Redundancy, Fidelity Criteria. Image Compression Models, Loss Less Variable Length, Huffman, Arithmetic Coding, Bit Plane Coding, Loss Less Predictive Coding, Lossy Transform (DCT) Based Coding, Sub Band Coding.

Image Segmentation: Edge Detection, Line Detection, Curve Detection, Edge Linking and Boundary Extraction, Image Representation: Boundary Representation, Region Representation and Segmentation, Morphological Processing: Dilation, Erosion, Opening and Closing, Hit And Miss Algorithms.

RECOMMENDED BOOKS

1. Rafael. C. Gonzalez & Richard E. Woods. 'Digital Image Processing', 2/e Pearson Education, **2006**
2. W.K. Pratt. 'Digital Image Processing',3rd Edn., John Wiley & sons, Inc. **2006**
3. M. Sonka et.al, 'Image Processing, Analysis and Machine Vision', 2nd Edn., Thomson, Learning, India Edition, **2007**.
4. Kenneth R. Castleman, 'Digital Image Processing', Pearson Education, **1995**.
5. S. Jayaraman, S. Esakkirajan, T. Veerakumar, 'Digital Image Processing', McGraw Hill Education, **2009**.
6. Anil Jain. K, 'Fundamentals of Digital Image Processing', Prentice Hall of India, **1989**.

DATABASE MANAGEMENT SYSTEMS

Subject Code-MCSE0-F99	**L T P C** **3 0 0 3**	**Duration – 45 hrs**

COURSE OBJECTIVES

To familiarize the students with Data Base Management system

COURSE OUTCOME

CO1 To provide introduction to database systems and various models.
CO2 To provide introduction to relational model and SQL
CO3 To understand about Query Processing and Transaction Processing.
CO4 To learn the concept of failure recovery and concurrency control

COURSE CONTENT

UNIT-I (11 hrs)

Introduction to Database Systems: File Systems Versus a DBMS, Advantages of a DBMS, Describing and Storing Data in a DBMS, Database System Architecture, DBMS Layers, Data independence.

Data Models: Relational Model, Network Model, Hierarchical Model, ER Model: Entities, Attributes and Entity Sets, Relationships and Relationship Sets, Constraints, Weak Entities, Class Hierarchies, Aggregation, Conceptual Database Design with the ER Model, Comparison of Models.

UNIT-II (12 hrs)

The Relational Model: Introduction to the Relational Model, ER to Relational Model Conversion, Integrity Constraints over Relations, Enforcing Integrity Constraints, Relational Algebra, Relational Calculus, Querying Relational Data

Relational Query Languages: SQL: Basic SQL Query, Creating Table and Views, SQL as DML, DDL and DCL, SQL Algebraic Operations, Nested Queries, Aggregate Operations, Integrity Constraints in SQL, Cursors and Triggers

Basic Query Optimization Strategies

UNIT-III (11 hrs)

Database Design: Functional Dependencies, Reasoning about Functional Dependencies, Normal Forms, Schema Refinement, 1NF, 2NF, 3NF, BCNF, 4NF, 5NF, Domain Key Normal Forms.

Transaction and Concurrency Management: ACID Properties, Serializability, Two-phase Commit Protocol, 2PL protocol, Lost Update Problem, Inconsistent Read Problem. Concurrency Control, Lock Management, Read-Write Locks, Deadlocks Handling.\

UNIT-IV (11 hrs)

Physical Data Organization: File Organization and Indexing, Index Data Structures, Hashing, B-trees, Clustered Index, Sparse Index, Dense Index, Fixed length and Variable Length Records.

Database Protection: Threats, Access Control Mechanisms: Discretionary Access Control, Mandatory Access Control, Grant and Revoke, Role Based Security, Encryption and Digital Signatures.

RECOMMENDED BOOKS:

1. Abraham Silberschatz, Henry F. Korth, S. Sudarshan, 'Database System Concepts', 6th Edn., Tata McGraw-Hill, **2011**.
2. Ramez Elmasri, Shamkant Navathe, 'Fundamentals of Database Systems', 5th Edn., Pearson Education, **2010**.
3. C.J. Date, 'An Introduction to Database Systems', Pearson Education, 8th Edn., **2006**.
4. Alexis Leon, Mathews Leon, 'Database Management Systems', Leon Press, 1st Edn., **2008.**
5. S.K. Singh, 'Database Systems Concepts, Design and Applications', 2nd Edn., Pearson Education, **2011**.
6. Raghu Rama Krishnan, Johannes Gehrke, 'Database Management Systems', 3rd Edn., Tata McGraw-Hill, **2014**

ACCOUNTING AND FINANCIAL MANAGEMENT

Subject Code – MBAD0- F96 **L T P C** **Duration – 40 Hrs**
3 0 0 3

Course Objectives: To provide an understanding of the function, the roles, the goals and the processes of corporate financial management, covering the sourcing of finances and their issues in investment and operations. Problem-solving methodology will be used to illustrate the theories and tools in financial decision making.

Unit I (10 Hrs)

Overview: Accounting Concepts, Conventions and Principles, Accounting Equation, International Accounting Principles and Standards; Branches of Accounting: Financial, Cost and Management Accounting and Their Inter-Relationships, Mechanics of Accounting: Double Entry System of Accounting, Journalizing of Transactions

Unit II (10 Hrs)

Preparation of Final Accounts: Profit & Loss Account, Profit & Loss Appropriation Account and Balance Sheet, Common Size Statement; Comparative Balance Sheet and Trend Analysis
Cost Accounting – Objectives, Elements of Cost, Marginal Costing, Absorption Costing, Target Costing, Standard Costing, Different Methods of Costing, Break Even Analysis, Its Uses and Limitations, Break Even Chart

Unit III (10 Hrs)

Financial Management Nature, Scope and Objectives of Financial Management, Ratio Analysis Fund Flow Statement and Cash Flow Statement, Working Capital Decision: Meaning, Nature and Scope of Working Capital – Component of Working Capital – Factors affecting Working Capital, Working Capital Strategies

Unit IV (10 Hrs)

Cost of Capital, WACC, Investment Decision: Nature and Significance of Investment Decision, Capital Budgeting Techniques: Discounted and Non-Discounted Methods (Pay Back, ARR, NPV, IRR, Benefit Cost Ratio), Long Term and Short Term Sources of Funds

Course Outcomes: After completing this course the students should be able to make optimum decisions pertaining to raising funds, making investments & managing the assets of a corporation, big or small, with an ultimate goal of creating value.

Recommended Books

1. Brigham, 'Financial Management: Text & Cases', Cengage Learning
2. Brealy & Myres, Principles of Corporate Finance', Tata McGraw Hill
3. Ambrish Gupta. "Financial Accounting For Maanagement" Pearson Education, 2nd Edition.
4. I.M. Pandey, 'Financial Management', Vikas Publishers
5. S. P. Jain and K. L. Narang," Principles of Accounting" Kalyani Publishers, New Delhi, **2004**

BUSINESS ETHICS

Subject Code: MBAD0- F97 **L T P C** **Duration: 40 Hrs**
3 0 0 3

UNIT-I (10 Hrs)

Introduction to Ethics and Values and their importance in business: Ethical issues in Capitalism and Market System, Ethical and Social System. The Social Responsibility of Business, Ethical Conflict, Whistle Blowing

UNIT-II (10 Hrs)

Ethics and Organization, Ethics in Human Resource Management and Organizational Culture, Ethics in Marketing, Ethics in Finance, Ethical Codes and Incentives in Corporate S ector

UNIT-III (10 Hrs)

Broader Ethical issues in Society – Corruption, Ecological Concern, Discrimination on the Basis of Gender, Caste or Race, Ethics and Information Technology

UNIT-IV (10 Hrs)

Impact of Group Policies and Laws of Ethics, Resolving Ethical dilemma

Recommended Books

1. R.C. Shekhar, 'Ethical Choices in Business', Response Book, New Delhi.
2. S.C. Chakraborty, 'Managerial Transaformation by Value', Sage Publications, New Delhi **1993**
3. Ananta K. Giri, 'Values, Ethics and Business: Challenges for Education and Management', Rawat Publication, Jaipur

ENGINEERING ECONOMICS & INDUSTRIAL MANAGEMENT

Subject Code: MBAD0- F98 **L T P C** **Duration: 40 Hrs**
3 0 0 3

Objectives: To run an organization Finance and Human resources are the key factors. Their proper utilization decides its success. This course will give the basic understanding of both these resources.

UNIT-I (8 Hrs)

Prerequisite: Basic Management Principles, C S.

Introduction: Scope of economics for engineers; Concept of: Goods, Utility, Value, Price, Capital, Money, Income; Law of Demand & Supply; Time value of money.

UNIT-II (11 Hrs)

Cost Analysis: Cost classification: Prime cost , Overhead cost , Selling and Distribution Cost , Fixed cost, Variable cost, , Implicit cost, Explicit cost, Replacement cost, Opportunity cost, Marginal cost and Sunk cost; Break even analysis; Economic order quantity.

Depreciation: Causes and Methods: Straight line method, Reducing balance method, Repair provision method, Annuity method, Sinking fund method, Revaluation method, Sum of the digit method.

UNIT-III (10 Hrs)

Replacement analysis: Reasons and factors for replacement; Determination of economic life of an asset; Payback period method, Annual cost method, Present worth method.

Human Resource Management: Definition; Functions of HRM; Process of Human Resource Planning**;** Methods of Recruitment; Meaning of Placement and Induction.

UNIT-IV (11 Hrs)

Training and Development: Difference between Training and Development; methods of training and development; Promotion: merit v/s seniority; Performance Appraisal: Traditional and Modern methods; Meaning of Career Planning and Development; Career anchors; Career paths for various types of jobs; Problems in career Planning and Development.

Recommended Books

1. T.R. Jain, 'Micro Economics' V.K. Publications.
2. P. Khanna, 'Industrial Engineering and Management', Dhanpat Rai Publication (P) Ltd.
3. M.S. Mahajan, 'Industrial Engineering and Production Management', Dhanpat Rai & Co. Pvt. Ltd.
4. T.N. Chhabra, 'Human Resource Management', Dhanpat Rai & Co.
5. P.L. Mehta, 'Managerial Economics', Sultan Chand & Sons.

BASIC ACCOUNTING

Subject Code: MBAD0-F99 **L T P C** **Duration: 40 Hrs**
3 0 0 3

Objective/s & Expected Outcome: This course provides an orientation in the field of accounting and basic accounting fundamentals. After completion of this course, candidate would be able to record and post transactions in the basic accounting equation and maintain subsidiary ledgers.

UNIT-I (10 Hrs)

Basic Accounting Concepts: Background of Accounting, Introduction, importance and scope, Accounts– Types and classification; basic terms– Capital, Income, Expenditure, Expenses, Assets, Liabilities and application to Problems. Accounting Equation, Double Entry System. Generally accepted accounting principles (GAAP)

UNIT-II (10 Hrs)

Journal and Ledger- Journal and recording of entries in journal with narration; Ledger –Posting from Journal to respective ledger accounts. Basic concepts of purchase book, sales book and cashbook.

UNIT-III (10 Hrs)

Trial Balance: Need and objectives; Application of Trial Balance; different types of errors escaped, trial Balance preparation.

UNIT-IV (10 Hrs)

Final Accounts: Final Accounts without adjustments. Bank Reconciliation Statement: Bank transactions, Preparation of simple bank reconciliation statement. Application of Computer in Accounting

Recommended Books

1. Jawahar Lal, 'Managerial Accounting', 1st Edn.
2. R.K. Mittal & M.R. Bansal, 'Financial Accounting'.
3. Rajni Sofat & Preeti Hiro, 'Basic Accounting', 2nd Edn.
4. Bhattacharya & Deaden, 'Accounting for Management', Paperback Edn., Vikas Publications, **1986.**
5. R.L Gupta & V.K. Gupta, 'Financial Accounting' (Part I and Part II).
6. S.N. Maheshwari, 'Fundamental Accountancy'.
7. Antony & Reece, 'Accounting Principal', 6th Edn.

DYES, SOAP AND DETERGENTS

Subject Code: MCHM0-F92 **L T P C** **Contact Hrs.**

UNIT–I (12hrs.)

Dyes:

Introduction, Classification of Dyes, Theory of colour and chemical constitution (Valence Bond Theory, M. O. Theory, Witt's Theory) textile fibers and application of dyes. Analysis and estimation of dyes. Fastness and properties, Synthesis and application of the following dyes: Methyl violet and Eosin, Fluorescein, Congo red, Auramine and Malachite green, Methylene blue, Alizarine, Direct black 1, Direct green, indanthrene blue and Dibenzanthrone, Eriochrome Black T, Rhodamine B and Acriflavine.

UNIT-II (8hrs.)

Soaps: Introduction, Raw Materials, Manufacturing process, Classification, mechanism of cleaning action, Recovery of glycerin from spent lye. Estimation of free alkali and phenol in soap.

UNIT-III (8 hrs.)

Detergents: Introduction, Classification of surface active agents, Anionic, Cationic, Amphoteric and non-ionic detergents, Principal groups of synthetic detergents, Biodegradability of surfactants, Difference between soaps and detergents, Enzyme containing and Eco friendly detergents (Zeolites).

UNIT-IV (12 hrs.)

Analysis of soaps and detergents: General scheme of analysis, sampling, alcohol soluble materials, moisture and volatile matter, analysis of soap (saponifia ble, unsaponifiable) and for unsaponified matter in soaps, active ingredient and equivalent combined SO3 3- , Tests for soaps: total fatty acids, fatty anhydride combined alkali, and anhydrous soap, free glycerol, Tests for synthetic detergents: Unsulfonated or unsulfated matter, ester SO3, Alkalinity, chlorides, silicate, phosphate, borates, UV spectroscopic analysis of detergents: Biodegradability of detergents, Determination of sodium alkyl benzene sulfonate, determination of sodium toluene sulfonate, determination of sodium xylene sulfonate, determination of germicides in soaps and detergents

Books Recommended

1. F.W. Billmeyer, 'Textbook of Polymer Science', 3rd Edn., **1994**.
2. F. Rodrigue, 'Principles of Polymer Systems', Tata McGraw Hill, New Delhi.
3. P.J. Flory, 'Principles of Polymer Systems', Cornell University Press, New York.
4. Dryden, 'Chemical Process Industries, Shrieves Chemical Technology'.
5. Shah and Pandey, 'Chemical Technology'.
6. G.R. Chatwal, 'Synthetic Dyes'.
7. M. Swaminathan, G.F. Longonan, 'The Analysis of Detergents and Detergent Products', J W.
8. Davidsohn & B.M. Mlwidaky, 'Synthetic Detergents', Book Center, Mumbai.
9. P.P. Singh and D.W. Rangokav, 'An Introduction to Synthetic Dyes'.
10. K. Venkat Ramman, 'The Chemistry of Synthetic Dyes', Vol I and II.
11. O.P. Agarwal, 'Synthetic Organic Chemistry: Dyes and Drugs'.

ADVANCED POWER PLANT ENGINEERING

Course Code: MMEE0-F93	**L T P C** **3 0 0 3**	**Contact Hrs.42**

Unit-I (10 Hrs)

Introduction: Energy sources for generation of electric power, types of power plant-their special features and applications, present status and future trends of energy resources, overview of utility systems, project implementation stages, load curves, tariff methods.

Unit-II (12 Hrs)

Conventional Power Generation: site selection, plant layout, steam generators, turbines, fossil and nuclear fuels, pulverizers and coal feeding, mill reject, combustion in furnace, coal handling, ash handling, electrostatic precipitators and bag filters, water systems, condensers, cooling towers, safety aspects, waste disposals, cogeneration, hydroelectric power generation, turbine specific speeds.

Unit-III (10 Hrs)

Non-Conventional Power Generation: Fluidized bed combustion, energy generation through wind, geothermal, tidal and solar energy, nuclear energy.

Unit-IV (10 Hrs)

Process Utility Systems: Bulk solids storage and transport systems – silo/hoppers, conveyors, selection and process and instrumentation diagram for pumps, fans and compressors, piping system design, pipe supports, different valves, fittings, instrumentation and data logging systems, industrial fire protection systems, dust hazards.

Recommended Books

1. P.K. Nag, 'Power Plant Engineering', McGraw-Hill, **2007**.
2. A.K. Raja, A.P. Srivastava & M. Dwivedi, 'Power Plant Engineering', New Age Int., **2006**.
3. C. Elanchezhian, L. Saravankumar, B.V. Ramnath, 'Power Plant Engineering', I-K Int., **2007**.
4. T.C. Elliot, K. Chen, R. Swanekamp, 'Stanadard Handbook of Power Plant Engineering', McGraw Hill Education, **1998**.

SCIENCE OF RENEWABLE ENERGY SOURCES

Subject Code: MPHY0-F92 **L T P C** **Duration:**
3 0 0 3

Unit 1

Introduction

Production and reserves of energy sources in the world and in India, need for alternatives, renewable energy sources.

Unit 2

Energy

Thermal applications, solar radiation outside the earth's atmosphere and at the earth's surface, fundamentals of photovoltaic energy conversion. Direct and indirect transition semi-conductors, interrelationship between absorption coefficients and band gap recombination of carriers.

Types of solar cells, p-n junction solar cell, Transport equation, current density, open circuit voltage and short circuit current, description and principle of working of single crystal, polycrystalline and amorphous silicon solar cells, conversion efficiency. Elementary ideas of Tandem solar cells, solid-liquid junction solar cells and semiconductor-electrolyte junction solar cells. Principles of photo electrochemical solar cells. Applications.

Unit 3

Hydrogen Energy

Environmental considerations, solar hydrogen through photo electrolysis and photocatalytic process, physics of material characteristics for production of solar hydrogen. Storage processes, solid state hydrogen storage materials, structural and electronic properties of storage materials, new storage modes, safety factors, use of hydrogen as fuel; use in vehicles and electric generation, fuel cells, hydride batteries.

Unit 4

Other Sources

Nature of wind, classification and descriptions of wind machines, power coefficient, energy in the wind, wave energy, ocean thermal energy conversion (OTEC), system designs for OTEC.

Recommended Books:

1. S.P. Sukhatme, 'Solar Energy', Tata McGraw-Hill, New Delhi, **2008**.
2. Fonash, 'Solar Cell Devices', Academic Press, New York, **2010**.
3. Fahrenbruch and Bube, 'Fundamentals of Solar Cells, Photovoltaic Solar Energy', Springer, Berlin, **1983**.

4. Chandra, 'Photoelectrochemical Solar Cells', 1st Edn., New Age, New Delhi.

FUNDAMENTALS OF ELECTRONIC COMMUNICATIONS

Subject Code: MECE0-F96	L T P C 3 0 0 3	Duration: 45 Hrs.

Course Objectives:

1. To understand the essentials of communication system.
2. To provide the students about the concepts of analog and digital modulation techniques
3. To impart basic knowledge of wireless communication.

Course Outcomes:

1. An ability to learn analog communication system and modulation techniques
2. An ability to understand design of useful circuits required in analog communication system.
3. An ability to explore working of transmitter and receiver circuits used in communication.
4. To explore about wireless communication.

UNIT-I (10 hrs)

Introduction to Communication Systems: The essentials of a Communication system, modes and media's of Communication, Classification of signals and systems, Fourier Analysis of signals. Analog Communication & Digital Communication, Basic concepts of Modulation, Demodulators, Channels, Multiplexing & Demultiplexing.

UNIT-II (12 hrs)

Amplitude Modulation: Amplitude modulation, Generation of AM waves, Spectrum of AM, Demodulation of AM waves, DSBSC, Generation of DSBSC waves, Coherent detection of DSBSC waves, single side band modulation, generation of SSB waves, vestigial sideband modulation (VSB). **Angle Modulation:** Basic definitions: Phase modulation (PM) & frequency modulation(FM), narrow band frequency modulation, wideband frequency modulation, spectrum of FM.

UNIT-III (12 hrs)

Pulse Analog Modulation: Introduction to Sampling theory, Time division (TDM) and Frequency Division Multiplexing (FDM), Pulse Amplitude Modulation (PAM), Pulse Time Modulation. **Digital Modulation Techniques:** Introduction to ASK, FSK, BPSK, QPSK, M-ary PSK. PC-PC data Communication.

UNIT-IV (11hrs)

Wireless Communication: Introduction to wireless communication systems, Applications of wireless communication systems, Types of wireless communication systems, trends in mobile communication systems.

Recommended Books:

1. Simon Haykins, 'Communication Systems', 4th Edn., John Wiley & Sons.
2. Singh & Sapre, 'Communication Systems', TMH.
3. G. Kennedy, 'Electronic Communication Systems', TMH.
4. Frenzel, 'Communication Electronics', TMH.
5. Theodore S. Rappaport, 'Wireless Communications: Principles and Practice', PHI Publication.

ELECTRONIC INSTRUMENTATION

Subject Code: MECE0-F97	L T P C 3 0 0 3	Duration: 45 Hrs.

Learning Objectives:

1. To provide knowledge about different types of measuring, waveform generation, and analysis electronics instruments.
2. Exposure to various methods of data transmission and transduction.
3. Elaborate discussion about recorder & display devices.

Course Outcomes

1. Able to understand operation of different instruments and able to describe different terminology related to measurements.
2. A recognition and understanding of various analog measuring instruments.
3. Design Various types of Bridge circuits.
4. Measurement of Resistance and understanding of CRO

UNIT – I (11Hrs)

Units, Dimensions and Standards: SI Units, Determination of absolute units of current and resistance, Standards of EMF, Resistance, Capacitance, Mutual inductance and their construction, Equivalent circuit representation, Figures of Merit, Construction of variable standards and Decade Boxes.

General Theory of Analog Instruments: Primary and secondary instruments, indicating recording and integrating types, operating torques damping and controlling torques, Torque/ weight ratio, pointers and scales.

UNIT–II (12Hrs)

Analog Measuring Instruments: Principles of operation, Construction, Errors, calibration, areas of application of the following types of instruments for measurement of voltage, current, power, energy, frequency and power factor: (a) PMMC (b) Dynamometer (c) Moving Iron (d) Induction (e) Thermal (f) Electrostatic Extension of Ranges by Shunts. Multipliers: Power and Energy Measurements in Poly phase Circuits.

Potentiometers (Only Principles, Operation & applications of DC & AC potentiometer) (a) Simple concepts of potentiometers. (b) Principle of DC potentiometer, applications. (c) Principle operation of AC potentiometer with advantages/ Disadvantages/ applications.

UNIT – III(11Hrs)

Measurement of Resistances: Low, Medium & High Resistance their measurement.

Bridges: Measurement of R, L, C, M, O by Wheatstone, Kelvin, Maxwell Hay, Anderson, Owen, Heaviside, Campbell, Schering, Wien bridges, Bridge sensitivity, Errors, Detectors, Shielding and screening, Wanger, Earthing.

UNIT-IV (11 Hrs)

Cathodes Ray Oscilloscopes: Principles and working of CRO, CRO– probes, Measurement of voltage, frequency and phase angle with CRO.

Recommended Books:

1. A.K. Sawhney, Electrical & electronic Measurement and Instrumentation, Dhanpat Rai & Publishers.
2. J B Gupta, A course in Electrical and Electronics Measurement & Instrumentation, S.K. Kataria & Sons.
3. W.D. Cooper, Electronic Instrumentation and Measurement techniques, PHI.

RELIABILITY ENGINEERING

Subject Code: MECE0-F98 **L T P C** **Duration: 45 Hrs.**

3 0 0 3

Learning Objectives

1. To provide students with a comprehensive understanding on various aspects of reliability engineering
2. To enable students to understand reliability considerations in designing machine components, elements and systems
3. To ensure sound maintenance of machines and systems and bring about reliability improvement
4. To perform reliability engineering analysis and its management throughout the product life cycle.

Course Outcomes

After successful completion of this course the students will be able to:

1. Demonstrate understanding of basic reliability measures such as failure rate, availability, MTTR, etc.
2. Compute and evaluate reliability for redundant, series, and parallel systems
3. Develop fault trees and apply various reliability models to identify and analysis possible faults in machine systems and assess their impact on overall system reliability & maintainability.
4. Use reliability improvement techniques and undertake product testing.

UNIT-I (12 Hrs)

Introduction: Definition for Reliability, Static and Dynamic Reliability Need for reliability Engineering, success and failure models, Causes of failures, catastrophic failures and degradation failures Characteristic types of failures, useful life of components, Exponential case of chance failure, Reliability Measures; MTBF, MTTR, hazard rate, probability distribution function, Derivation for exponential distribution function, other kinds of distributions, Binomial, Poisson uniform, Raleigh, Weibull, Gamma distribution, marks, Chains, failures data analysis.

UNIT-II (11 Hrs)

Series Parallel Systems: Reliability Block Diagrams, series systems, parallel systems, K-out of-M systems, open and short circuits failures, standby systems.

Reliability Analysis of Non-Series Parallel System: Boolean algebra Method, Outset approach, delta star method, logical signal relation method, Bay's Theorem Method.

Reliability Prediction: objective of reliability prediction, classification, and information sources for failure rate data, prediction methodologies, general requirements, Role and limitations of Reliability prediction.

UNIT-III (11Hrs)

Reliability Allocation: subsystems reliability improvement, allocation for new units, criticality.

Maintainability and Availability: forms of maintenance, measures of Maintainability and availability, maintainability function, availability function, two unit parallel system with repair, Markov Model for two unit systems, preventive maintenance, provision of spares.

UNIT-IV (11Hrs)

Reliability Testing: kinds of testing, component reliability measurements, parametric methods, confidence limits, accelerated testing, equipment acceptance testing, standard life testing plans, accelerated life testing, system safety analysis-FMECA, risk priority number and its allocation.

Economics of Reliability Engineering: Reliability cost, Life Cycle Costing, effect of reliability on cost, reliability achievement cost models, reliability Utility cost models, Replacement policies.

Recommended Books:

1. K.K. Agarwal, 'Reliability Engineering', Kluwer Academic Press, USA.

2. E. Balagurusamy, ‘Reliability Engineering’, Tata McGraw Hill.
3. L.S. Srinath, ‘Reliability Engineering’, East West Press Pvt. Ltd.
4. Brijendra Singh, ‘Quality Control and Reliability Analysis’, Khanna Publishers.
5. E.E. Lewis, ‘Introduction to Reliability Engineering’, John Wiley and Sons.

LINEAR CONTROL SYSTEMS

Subject Code: MECE0-F99 **L T P C** **Duration: 45 Hrs.**
3 0 0 3

Learning Objectives:

1. To introduce the elements of control system and their modelling using various Techniques.
2. To introduce methods for analysing the time response, the frequency response and the stability of systems
3. To introduce the state variable analysis method

Course Outcomes:

Upon completion of the course, students will be able to:

1. Analytical comparison between open & close loop system.
2. Modelling of linear control system.
3. Time domain and frequency domain analysis of control systems required for stability analysis.
4. Analysis of state models for linear control system.

UNIT-I (8 Hrs)

Basic Concepts: Historical review, Definitions, Classification, Relative merits and demerits of open and closed loop systems.

UNIT-II (11Hrs)

Mathematical Models of Control System: Linear and non-linear systems, Transfer function, Mathematical modelling of electrical, mechanical and thermal systems, Analogies, Block diagrams and signal flow graphs.

Control Components: DC servomotor, AC servomotor, Potentiometers, Synchronous, Stepper-motor.

UNIT-III (14 Hrs)

Time and Frequency Domain Analysis: Transient and frequency response of first and second order systems, Correlation ship between time and frequency domain specifications, Steady-state errors and error constants, Concepts and applications of P, PD, PI and PID types of control.

Stability Analysis: Definition, Routh-Hurwitz criterion, Root locus techniques, Nyquist criterion, Bode plots, Relative stability, Gain margin and phase margins.

UNIT-IV (12Hrs)

State Variable Analysis: Introduction, Concept of State, State variables & State models, State Space representation of linear continuous time systems. State models for linear continuous –time systems, State variables and linear discrete time systems, Solution of state equations, Concept of Controllability & Observability.

Recommended Books:

1. K. Ogata, ‘Discrete time Control Systems’, Prentice Hall International.
2. Nagrath and Gopal, ‘Control System Engineering’, New Age International.
3. Warwick, Kevin, ‘An Introduction to Control Systems’, World Scientific Publishing Co. Pvt. Ltd.

4. Distefano, Joseph J. Stubberud, R. Allen, Williams, J. Ivan, 'Feedback and Control Systems', Schaums Series, TMH.

ORDINARY DIFFERENTIAL EQUATIONS

Subject Code: MMAT0-F92 **LT P C** **Contact Hrs.-32**
3 0 0 3

UNIT–I (10 Hrs.)

Linear Differential Equations: Basic theory of linear differential equations with constant coefficients, Homogeneous linear differential equations of second and higher order with constant coefficients, Method of variation of parameters to solve second degree equations.

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UNIT–II (10 Hrs.)

Cauchy's homogeneous and Legendre's linear equation, Simultaneous linear equations with constant coefficients**.**

UNIT–III (7 Hrs.)

Leibnitz's linear and Bernoulli's equation, exact differential equations, Equations reducible to exact form by integrating factors**.**

UNIT–IV (5 Hrs.)

System of differential equations, Eigenvalue problems: Sturm-Liouville problem.

Recommended Books

1. D.A. Murray, 'Introductory Course in Differential Equations,' Orient Longman (India), **1967.**
2. Simmons, 'Differential Equations', TMH Edn., New Delhi, **1974**.
3. M.S.P. Eastham, 'Theory of Ordinary Differential Equations,'Van Nostrand, London, **1970**.
4. S.L. Ross, 'Differential Equations', John Wiley & Sons, NewYork, **1984**.
5. Erwin Kreyszig, 'Advanced Engineering Mathematics', John Wiley and Sons, New York.
6. Richard Bronson, 'Differential Equations,' 2nd Edn., Schaum's Outline Series,

NUMERICAL METHODS

Subject Code: MMAT0-F93 **LT P C** **Contact Hrs.-36**
3 0 0 3

UNIT–I (12 Hrs.)

Errors in numerical calculations: Error and their analysis, General error formula, Errors in a series approximation. Solution of Algebraic and Transcendental Equations: Bisection Method, Regula-Falsi Method, Iteration method, Newton-Raphson Method.

UNIT–II (12 Hrs.)

Solution of linear system of equations: Gauss-Elimination Method, Gauss Jordan method, Eigen value problems (by Power method only), Jacobi Method, Gauss- Seidal Method.

UNIT–III (7 Hrs.)

Interpolation: Finite differences, Difference of a polynomial, Newton's formula for interpolation, Central difference interpolation formula, Interpolation with unevenly spaced points, Newton's divided differences formula

UNIT–IV (5 Hrs.)

Numerical Integration: Trapezoidal rule, Simpson's 1/3 rule, Simpson 3/8th rule, Newton-cots integration formula, Gaussian integration (one dimensional).

Recommended Books

1. M.K. Jain, S.R.K. Iyengar and R.K. Jain, 'Numerical Methods Scientific and Engineering Computation', 4th Edn,, New Age International Publishers, New Delhi, **2003.**
2. S.S. Sastry, 'Introductory Methods of Numerical Analysis',. 5th Edn, PHI, **2012**

ADVANCED TRANSDUCER TECHNOLOGY

Subject Code: MELE0-F95 **L T P C** **Contact Hrs.-36**
4 0 0 4

Unit- I

Introduction to Transducers and Its Classification, Characteristics of Transducers, Selection Criteria of Transducers, Errors in measurement. Types of errors – Statistical analysis of measurement data – Mean, Standard Deviation, Probability errors.

Unit -II

Variable Resistance transducers and its types. Concept of Three Wire and Four Wire RTDs. Potentiometers, strain gauges, resistance thermometers, thermistors, hotwire anemometers, Variable Inductance and variable capacitance transducers. Piezoelectric, Magnetostrictive, Electromagnetic transducers, thermo-electric sensor, semiconductor temperature sensors. Force balance transducers.

UNIT- III

Analog Signal Conditioning Techniques: Bridge Amplifier, Carrier Amplifiers, Charge Amplifiers and Impedance Converters, Modulation and demodulation Techniques, dynamic compensation, linearization, multiplexing and de-multiplexing.

UNIT -IV

Digital Interfacing Techniques: Interfaces, processors, code converters, liberalizers, Single transmission Cable transmission of analog and digital signal, fiber optic signal transmission, radio, telemetry, pneumatic transmission. Signal Display/Recording systems, Graphic display systems, storage oscilloscope, recorders-ink, thermal, UV, Smart Sensors.

RECOMMENDED BOOKS:

1. E.O. Doeblin, 'Measurement Systems: Application and Design', McGraw Hill International.
2. D. Patranabis, 'Sensors and Transducers', Wheeler Pub., New Delhi.
3. Murthy, D.V.S., 'Transducers and Instrumentation', PHI, New Delhi.
4. Swobada, G., 'Telecontrol: Methods and Applications of Telemetry and Remote Control', Van Nostrand.
5. H.K. Newbert, 'Instrument Transducers', Oxford University Press.

ELECTRIC TRACTION SYSTEM

Subject Code: MELE0-F96 **L T P C** **Contact Hrs.-36**
4 0 0 4

UNIT-I

1. Traction Systems and Latest Trends: Present scenario of Indian Railways – High speed traction, Metro, Latest trends in traction-Metro, monorail, Magnetic levitation Vehicle, Steam, diesel, diesel-electric, Battery and electric traction systems, General arrangement of D.C., A.C. single phase and 3-phase, Composite systems, Choice of traction system - Electric and Diesel-Electric.

UNIT-II

2. Mechanism of Train Movement: Analysis of speed time curves for main line, suburban and urban services, Simplified speed time curves. Relationship between principal quantities in speed time curves, Requirement of tractive effort, Specific energy consumption and Factors affecting it.

UNIT-III

3. Traction Motors and their Control: Features of traction motors, Significance of D.C. series motor as traction motor, A. C. Traction motors-single phase, Three phase, Linear Induction Motor, Comparison between different traction motors, Series-parallel control, Open circuit, Shunt and bridge transition, Pulse Width Modulation control of induction motors, Types of electric braking system.

UNIT-IV

4. Electric Locomotives: Important features of electric locomotives, Different types of locomotives, Current collecting equipment, Coach wiring and lighting devices, Power conversion and transmission systems, Control and auxiliary equipment, Distribution systems pertaining to traction (distributions and feeders), Traction sub-station requirements and selection, Method of feeding the traction sub- station.

RECOMMENDED BOOKS:

1. R.B. Brooks, 'Electric Traction Hand Book', Sir Isaac Pitman and Sons Ltd. London.
2. A.T. Dover, Mac Millan, 'Electric Traction', Dhanpat Rai and Sons, New Delhi.
3. J. Upadhyay, S.N. Mahendra, 'Electric Traction', Allied Publishers Ltd., Dhanpat Rai and Sons, Delhi.
4. H. Partab, 'Modern Electric Traction', Dhanpat Rai and Sons, New Delhi.
5. J.B. Gupta, 'Electric Power Utilization', Kataria and Sons, New Delhi.

POWER ELECTRONIC DEVICES AND CONTROLLERS

Subject Code: MELE0-F97 **L T P C** **Contact Hrs.-36**
4 0 0 4

Learning Objectives:

1. Learn the physics of device operation, static and dynamic characteristics, ratings, protection, operating limitations and safe operating area
2. Know about the design issues of drive circuits and their usage
3. Understanding the different types of inverters and cyclo-converters

Learning Outcomes:

1. Knowledge of power semiconductor devices and their Gate and base drive circuits
2. Develop skills to utilize the different PWM schemes
3. Know about the different types of power converters and their applications

UNIT-I

1.Review of semiconductor devices: Conduction Process in semiconductors, pn Junction, Charge control description, Avalanche breakdown, Power diodes, Thyristors, Gate Turn Off thyristor (GTO), VI characteristics, Dynamic characteristics, ratings, protection.

UNIT-II

2.Power MOSFETand IGBT: Basic structure, I-V Characteristic, Physics of device operation, switching characteristics, operating limitation and safe operating area.

3.Emerging devices and circuits: Power junction Field effect transistor (FET), Integrated Gate-Commutated Thyristor (IGCT), Field Control Thyristor, Metal oxide semiconductor (MOS) Control Thyristor etc. Power ICs, New semiconductor materials.

UNIT-III

4.Snubber circuits: Types of Snubber circuits, needs of Snubber circuit with diode, thyristor and transistors, Turn-off Snubber, over voltage snubber, turn on snubber, Snubber for bridge circuit configurations, GTO Snubber circuit.

UNIT-IV

5.Gate and basic drive circuits: Design Consideration, De-coupled drive circuits, electrically isolated drive circuits, cascade connected drive circuits, Power device protection in drive circuits, circuit layout considerations.

RECOMMENDED BOOKS:

1. ‘Power Electronics: Converters, Applications and Design’ by Mohan, Undeland and Robbins John Wiley Sons.
2. ‘Power Electronics Handbook’ by Rashid M.H., Elsevier Press (Academic Press Series).
3. ‘The Power Thyristor and its Applications’ by Finney D., McGraw Hill, New York.
4. ‘Power Electronics’ by Lander C. W., McGraw Hill Book Co., U.K.
5. ‘Power Electronics - Circuit

M. TECH. ELECTRICAL ENGINEERING

Total Contact Hours = 22 Total Marks = 600 Total Credits = 21

1^{ST} SEMESTER		Contact Hrs			Marks			Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
MELE1-101	Advanced Power System Analysis & Design	4	0	0	40	60	100	4
MELE1-102	Modern Control Theory	4	0	0	40	60	100	4
MELE1-103	Applied Instrumentation & Measurements	4	0	0	40	60	100	4
MELE1-104	Power System Software Lab	0	0	2	60	40	100	1
Departmental Elective-I (Select any one)		4	0	0	40	60	100	4
MELE1-156	Energy Management and Energy Auditing							
MELE1-157	Microprocessors & Embedded Control							
MELE1-158	Non-Conventional Energy Resources							
MELE1-159	Wind Energy and Small Hydro Energy Station							
Departmental Elective-II (Select any one)		4	0	0	40	60	100	4
MELE1-160	EHVAC & HVDC Transmission Systems							
MELE1-161	Digital Signal Processing & its Applications							
MELE1-162	Adaptive Control							
MELE1-163	Discrete Time Control Systems							
Total		**20**	**0**	**2**	**260**	**340**	**600**	**21**

MRSPTU

Total Contact Hours = 22 Total Marks = 600 Total Credits = 21

2^{nd} SEMESTER		Contact Hrs.			Marks			Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
MELE1-205	Power System Operation and Control	4	0	0	40	60	100	4
MELE1-206	Advanced Electrical Machines	4	0	0	40	60	100	4
MELE1-207	Power Electronic Devices & Controllers	4	0	0	40	60	100	4
MELE1-208	Simulation Lab.	0	0	2	40	60	100	1
Departmental Elective-III (Select any one)		4	0	0	40	60	100	4
MELE1-264	Power System Modelling & Dynamics							
MELE1-265	Customized Power Devices							
MELE1-266	Advanced Electrical Machine Design							
MELE1-267	Artificial Intelligent Techniques							
Open Elective-I		4	0	0	40	60	100	4
Total		**20**	**0**	**2**	**240**	**360**	**600**	**21**

Total Contact Hours = 24 **Total Marks = 500** **Total Credits = 24**

3^{RD} SEMESTER		Contact Hrs			Marks			Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
Departmental Elective-IV (Select any one)		4	0	0	40	60	100	4
MELE1-368	Power System Dynamics & Stability							
MELE1-369	Advanced Power System Protection							
MELE1-370	Smart Grid Technologies							
MELE1-371	Engineering Optimization							
Departmental Elective-V (Select any one)		4	0	0	40	60	100	4
MELE1-372	Power System Planning							
MELE1-373	Electric Traction System							
MELE1-374	Power System Reliability							
MELE1-375	Distribution System Operation & Analysis							
MELE1-309	Project	0	0	8	60	40	100	12
MELE1-310	Seminar	0	0	4	100	0	100	2
MELE1-311	Research Lab.	0	0	4	60	40	100	2
Total		**8**	**0**	**16**	**300**	**200**	**500**	**24**

MRSPTU

Total Credits = 24

4^{TH} SEMESTER		Contact Hrs.			Evaluation Criteria	Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Satisfactory/ Unsatisfactory**	
MECE5-411	Thesis	0	0	24		24

Overall

Semester	**Marks**	**Credits**
1st	600	21
2nd	600	21
3rd	500	24
4th	--	24
Total	**1700**	**90**

ADVANCED POWER SYSTEM ANALYSIS AND DESIGN

Subject Code: MELE1-101/MELE3-103 **L T P C** **Duration: 45 Hrs.**
4 0 0 4

UNIT-1

1. Load Flow (8 Hrs.)

Network modeling – Conditioning of Y Matrix – Load Flow-Newton Rapson method- Decoupled – Fast decoupled Load flow -three-phase load flow.

UNIT-2

2. DC Power Flow (9 Hrs.)

Single phase and three phase -AC-DC load flow - DC system model – Sequential Solution Techniques – Extension to Multiple and Multi-terminal DC systems – DC convergence tolerance – Test System and results.

UNIT-3

3. Fault Studies (9 Hrs.)

Analysis of balanced and unbalanced three phase faults – fault calculations – Short circuit faults – open circuit faults.

4. System Optimization (12 Hrs.)

Strategy for two generator systems – generalized strategies – effect of transmission losses - Sensitivity of the objective function- Formulation of optimal power flow-solution by Gradient Method-Newton's method.

UNIT-4

5. State Estimation (7 Hrs.)

Method of least squares – statistics – errors – estimates – test for bad data – structure and formation of Hessian matrix – power system state estimation.

RECOMMENDED BOOKS:

1. J.J. Grainger and W.D. Stevenson, 'Power System Analysis', Tata McGraw Hill, New Delhi, **2003**.
2. J. Arrillaga and C.P. Arnold, 'Computer Analysis of Power Systems', John Wiley and Sons, New York, **1997**.
3. M.A. Pai, 'Computer Techniques in Power System Analysis', Tata McGraw Hill, New Delhi, **2006**.

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MODERN CONTROL THEORY

Subject Code: MELE1-102/ **L T P C** **Duration: 44 Hrs.**
4 0 0 4

UNIT-1

1. Mathematical Preliminaries (12 Hrs.)

Fields, Vectors and Vector Spaces – Linear combinations and Bases – Linear Transformations and Matrices – Scalar Product and Norms – Eigen-values, Eigen Vectors and a Canonical form representation of Linear operators – The concept of state – State Equations for Dynamic systems – Time invariance and Linearity – Non-uniqueness of state model – State diagrams for Continuous-Time State models.

UNIT-2

2. State Variable Analysis (10 Hrs.)

Linear Continuous time models for Physical systems– Existence and Uniqueness of Solutions to Continuous-Time State Equations – Solutions of Linear Time Invariant Continuous-Time State Equations – State transition matrix and its properties. General concept of controllability – General concept of Observability – Controllability tests for Continuous-Time Invariant Systems –

Observability tests for Continuous-Time Invariant Systems – Controllability and Observability of State Model in Jordan Canonical form – Controllability and Observability Canonical forms of State model.

UNIT-3

3. Non Linear Systems (8 Hrs.)

Introduction – Non Linear Systems - Types of Non-Linearties – Saturation – Dead-Zone - Backlash – Jump Phenomenon etc.; Singular Points – Introduction to Linearization of nonlinear systems, Properties of Non-Linear systems – Describing function–describing function analysis of nonlinear systems – Stability analysis of Non-Linear systems through describing functions. Introduction to phase-plane analysis, Method of Isoclines for Constructing Trajectories, singular points, phase-plane analysis of nonlinear control systems.

UNIT-4

4. Stability Analysis (7 Hrs.)

Stability in the sense of Lyapunov, Lyapunov's stability and Lypanov's instability theorems - Stability Analysis of the Linear continuous time invariant systems by Lyapunov second method – Generation of Lyapunov functions – Variable gradient method – Krasooviski's method. State feedback controller design through Pole Assignment – State observers: Full order and Reduced order.

5. Optimal Control (7 Hrs.)

Introduction to optimal control - Formulation of optimal control problems – calculus of variations – fundamental concepts, functional, variation of functional – fundamental theorem of theorem of Calculus of variations – boundary conditions – constrained minimization – formulation using Hamiltonian method – Linear Quadratic regulator.

RECOMMENDED BOOKS:

1. M. Gopal 'Modern Control System Theory', New Age International, **1984.**
2. K. Ogata 'Modern Control Engineering', Prentice Hall, **1997.**
3. I.J. Nagarath and M. Gopal, 'Control Systems Engineering', New Age International (P) Ltd.
4. M. Gopal, 'Digital Control and State Variable Methods', Tata Mc Graw-Hill Companies, **1997**.
5. H. Zak, 'Systems and Control by Stains Law', Oxford Press, **2003**.
6. Kuo, 'Digital Control Systems', 2nd Edn., Oxford University Press, **2003**.

APPLIED INSTRUMENTATION & MEASUREMENT

Subject Code: MELE1-103 **L T P C** **Duration: 40 Hrs.**
4 0 0 4

UNIT-1

1. Transducers (10 Hrs.)

Classification of Transducers including analog and digital transducers, Selection of Transducers, Static and Dynamic response of transducer System, Measurement of length & thickness, linear Displacement, Angular Displacement, force, weight, torque, Moisture, Level, Flow, pH & Thermal Conductivity, Measurement of Frequency, Proportional, Geiger Muller & Scintillation Counters.

UNIT-2

2. Telemetry (8 Hrs.)

Basic Principles, Proximity & remote Action Telemetry systems, Multiplexing; Time Division and frequency division.

UNIT-3

3. Display Devices (10 Hrs.)

Various types of Display Device, Digital Voltmeters, Dual Slope DVMS, Digital encoders, Analog and Digital encoders, Analog and Digital Data Acquisition System, A/D Converter. Fiber Optic

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Technology for data transmission, Supervisory Control and Data Acquisition Systems (SCADA), Q-meter. Electrical noise in control signals, its remedial measures.

UNIT-4

4. Virtual Instrumentation (12 Hrs.)

Introduction to Virtual Instrumentation, conventional vs. Virtual instrumentation, advantages and basic representations. Introduction to Lab view. Applications of virtual instrumentation in various fields like Industrial applications, defense, Medical.

RECOMMENDED BOOKS:

1. W.D. Cooper & A.D. Helfrick, 'Electronic Instrumentation and Measurement Techniques', PHI.
2. B.C. Nakra and K.K. Chaudhary, 'Instrumentation Measurement Analysis', Tata McGraw-Hill.
3. Hermann, K.P. Neubert, 'Instrument Transducers'.
4. pH Mansfleld, 'Electrical Transducers for Industrial Measurement'.
5. Mani Sharma, Rangan,'Instrumentation systems'.
6. Borden & Thgnel, 'Principles & Methods of Telemetry'.
7. Foster, 'Telemetry Method'.
8. Sanjay Gupta & Joseph John, 'Virtual Instrumentation Using Lab VIEW', TMG; Tata McGraw Hills, **2005**.
9. Robert H. Bishop, 'Learning with Lab VIEW 7 Express', Pearson Education, **2005**.
10. Related IEEE/IEE Publications.

POWER SYSTEM SOFTWARE LAB.

Subject Code: MELE1-104 **L T P C**
0 0 2 1

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Development of algorithms & flowcharts and digital simulation of the following using ETAP/MATLAB Software package:

1. Z-bus and Y-bus formulation
2. Load flow studies
3. Fault analysis
4. Transient stability studies
5. Economic load dispatch

ENERGY MANAGEMENT & ENERGY AUDITING

Subject Code: MELE1-156 **L T P C** **Duration: 40 Hrs.**
4 0 0 4

UNIT-1

1. Energy Scenario (9 Hrs.)

Energy needs of growing economy, Long term energy scenario, Energy pricing, Energy sector reforms, Energy and environment: Air pollution, Climate change, Energy security, Energy conservation and its importance, Energy strategy for the future, Energy conservation Act- 2001 and its features.

UNIT-2

2. Energy Management and Audit (9 Hrs.)

Definition, Energy audit- need, Types of energy audit, Energy management (audit) approach- understanding energy costs, Bench marking, Energy performance, matching energy use to requirement, Maximizing system efficiencies, Optimizing the input energy requirements, Fuel and energy substitution, Energy audit instruments.

3. Data Gathering (6 Hrs.)

Level of responsibilities, energy sources, control of energy and uses of energy get Facts, figures and impression about energy /fuel and system operations, Past and Present operating data, Special tests, Questionnaire for data gathering.

UNIT-3

4. Analytical Techniques (5 Hrs.)

Incremental cost concept, mass and energy balancing techniques, Inventory of Energy inputs and rejections, Heat transfer calculations, Evaluation of Electric load characteristics, process and energy system simulation.

UNIT-4

5. Evaluation of Saving Opportunities (5 Hrs.)

Determining the savings in rupees' Noneconomic factors, Conservation opportunities, estimating cost of implementation.

6. Energy Audit and Instruments (6 Hrs.)

The plant energy study report- Importance, contents, effective organization, report writing and presentation, Instruments for Audit and Monitoring Energy and Energy Savings, Types and Accuracy.

RECOMMENDED BOOKS:

1. W.R. Murphy, G. Mckay, 'Energy Management', Butterworths.
2. C.B. Smith, 'Energy Management Principles', Pergamon Press.
3. I.G.C. Dryden, 'Efficient Use of Energy', Butterworth Scientific.
4. A.V. Desai, 'Energy Economics', Wiley Eastern.
5. D.A. Reay, 'Industrial Energy Conservation', Pergammon Press.
6. W.C. Turner, 'Energy Management Handbook', John Wiley and Sons, A Wiley Interscience.
7. Publication.
8. 'CIBSI Guide – User's Manual', U.K.
9. 'CRC Handbook of Energy Efficiency', CRC Press.

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MICROPROCESSORS AND EMBEDDED CONTROL

Subject Code: MELE1-157 **L T P C** **Duration: 42 Hrs.**

4 0 0 4

UNIT-1

1. Overview (9 Hrs.)

Microprocessor 8086, Architecture, PIN Diagram, BIU and EU, memory addressing, Clock generator 8284, buffers and latches, maximum and minimum modes.

UNIT-2

2. Addressing Modes (10 Hrs.)

Addressing modes of 8086, Assembly language Programming, Assemblers and Procedures, Macros, Interrupts. Interfacing of 8086: IC 8155 (Static RAM with ports and timers), 8755 (EPROM with I/O ports), 8251A (USART), 8255 A, 8253/8254,8257 and 8259 controllers.

UNIT-3

3. Microcontroller (10 Hrs.)

Introduction to microcontrollers, Architecture, Pin Diagram, I/O ports, Internal RAM and registers, Interrupts, addressing modes, memory organization and external addressing, Instruction set. Interfacing with LCD, ADC, DAC, Stepper motor, Key Board and sensors.

UNIT-4

4. Embedded Systems (13 Hrs.)

Introduction, Classification, Processors, Hardware units, Software embedded into systems, applications and products of embedded systems, Structural Units in processor, Memory Devices, I/O Devices, Buses, Interfacing of Processor memory and I/O devices. Case Study of an embedded system for a smart card.

RECOMMENDED BOOKS

1. Mazidi, Mazidi & McKinlay, 'The 8051 Microcontroller and Embedded Systems using Assembly and C', PHI.
2. Myke Predko, 'Programming and Customizing the 8051 Micro-controller', Tata McGraw-Hill edn.
3. R.A. Gaonkar, 'Fundamentals of Microcontrollers and Applications in Embedded Systems (with the PIC18 Microcontroller Family)', Penram Publishing India.
4. K. Shibu, 'Embedded Systems', Tata McGraw Hill Publishing, New Delhi, **2009**.
5. Barry B. Brey, 'The Intel Microprocessors 8086/8088, 8086, 80286, 80386, 80486, Pentium, Pentium Pro Processor, Pentium II, Pentium III, Pentium 4, Architecture, Programming and Interfacing', Prentice Hall of India Private Limited, New Delhi, **2003**.
6. John Peatman, 'Design with Microcontroller', McGraw Hill Publishing Co. Ltd, New Delhi.

NON-CONVENTIONAL ENERGY RESOURCES

Subject Code: MELE1-158 **L T P C** **Duration: 41 Hrs.**
4 0 0 4

UNIT-1

1. Introduction to Energy Sources (5 Hrs.)

World Energy Futures, Conventional Energy Sources, Non-Conventional Energy Sources, Prospects of Renewable Energy Sources.

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UNIT-2

2. Solar Energy (10 Hrs.)

Introduction to Solar Radiation and its measurement, Introduction to Solar Energy Collectors and Storage. Applications of Solar Energy: Solar, Thermal Electric Conversion Systems, Solar Electric power Generation, Solar Photo-Voltaic, Solar Cell Principle, Semiconductor Junctions, Conversion efficiency and power output, Basic Photovoltaic System for Power Generation.

UNIT-3

3. Wind Energy (9 Hrs.)

Introduction to wind energy Conversion, the nature of the wind, Power in the wind. Wind data and energy estimation, Site Selection Considerations, Basic Components of a Wind Energy Conversion System, Classification of WEC Systems, Schemes for Electric Generation using Synchronous Generator and Induction Generator, Wind energy Storage.

UNIT-4

4. **Direct Energy Conversion Processes (11 Hrs.)**

Magneto Hydro Dynamic Power Generation: Principles of MHD power generation, Open Cycle Systems, Closed Cycle Systems, Voltage and power output, Materials for MHD generators. Basic principles of thermo-electric power-generation, Seebeck, Peltier, Thomson effects, Thermo-Electric power generator, Analysis, materials. Thermionic emission and work function, Basic thermionic generation. Classification of Fuel Cells, Types, Advantages, Electrodes, Polarization. The basic Nuclear Function and Reactions Plasma Confinement, Thermo Nuclear Function Reactions.

5. Energy from Biomass (6 Hrs.)

Biomass conversion technologies, photosynthesis, Bio-gas generation, types of bio-gas plants. Biomass as a Source of Energy: Method for obtaining energy from Bio-mass, Biological Conversion of Solar Energy.

RECOMMENDED BOOKS:

1. G.D. Rai, 'Non-Conventional Sources of Energy', Khanna Publishers.
2. David Boyles, 'Bio Energy', Elis Horwood Ltd.

3. N.K. Bansal and M. Kleemann, M. Heliss, 'Renewable Energy Sources and Conversion Technology, Tata McGraw Hill, **1990**.
4. R.A. Coombie, 'Direct Energy Conversion', Pitman.
5. O.P. Vimal and P.D. Tyagi, 'Bio Energy Spectrum', Bio Energy and Wasteland Development Organization.

WIND ENERGY AND SMALL HYDRO POWER STATION

Subject Code: MELE1-159 **L T P C** **Duration: 40 Hrs.**
4 0 0 4

UNIT-1

1. Wind Energy (12 Hrs.)

Introduction, general theory of wind machines, basic laws and concepts of aerodynamics, Micro-siting, Description and performance of the horizontal–axis wind machines. Introduction to blade design, Description and performance of the vertical–axis wind machines, generation of electricity by wind machines and case studies.

UNIT-2

2. Hydro Power Plant (10 Hrs.)

Overview of micro mini and small hydro, site selection and civil works. Penstocks and turbines, speed and voltage regulation, investment issues,

UNIT-3

3. Tariffs (8 Hrs.)

Study of load management and tariff scheme, distribution and marketing issues related to power generation.

UNIT-4

4. Hybrid Power System (10 Hrs.)

Wind and hydro based stand-alone / hybrid power systems, control of hybrid power systems, wind diesel hybrid systems

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RECOMMENDED BOOKS:

1. J.F. Manwell, J.G. McGowan and A.L. Rogers, 'Wind Energy Explained – Theory, Design and Application', John Wiley & Sons, Ltd., **2002**.
2. O.L. Martin Hansen, 'Aerodynamics of Wind Turbines', Earthscan, **2008**.
3. Fernando D. Bianchi, Hernan De Battista and Ricardo J. Mantz, 'Wind Turbine Control Systems- Principles, Modelling and Gain Scheduling Design', Springer, **2007.**
4. Adam Harvey, Andy Brown and Priyantha Hettiarachi, 'Micro-Hydro Design Manual: A Guide to Small-Scale Water Power Schemes', ITDG, **1993**.
5. Maria Laguna, 'Guide on How to Develop a Small Hydropower Plant', ESHA, **2004**.
6. 'Good & Bad of Mini Hydro Power', edited by Roman Ritter, GTZ, **2009**.

EHVAC AND HVDC TRANSMISSION SYSTEM

Subject Code: MELE1-160 **L T P C** **Duration: 45 Hrs.**
4 0 0 4

UNIT-1

1. Overview (6 Hrs.)

Comparison of EHV AC and DC transmission, description of DC transmission systems, modern trends in AC and DC transmission.

2. EHV AC Systems (8 Hrs.)

Limitations of extra-long AC transmission, Voltage profile and voltage gradient of conductor, Electrostatic field of transmission line, Reactive Power planning and control, traveling and standing waves, EHV cable transmission system.

UNIT-2

3. Static Var System (6 Hrs.)

Reactive VAR requirements, Static VAR systems, SVC in power systems, design concepts and analysis for system dynamic performance, voltage support, damping and reactive support.

4. HVDC System (7 Hrs.)

Converter configurations and their characteristics, DC link control, converter control characteristics; Monopolar operation, converter with and without overlap, smoothing reactors, transients in DC line, converter faults and protection, HVDC Breakers.

UNIT-3

5. Corona and Interference (7 Hrs.)

Corona and corona loss due to EHV AC and HVDC, Radio and TV interference due to EHV AC and HVDC systems, methods to reduce noise, radio and TV interference.

6. Harmonic Filters (5 Hrs.)

Generation of harmonics, Design of AC filters, DC filters.

UNIT-4

7. Power Flow Analysis in AC/DC Systems (6 Hrs.)

Component models, solution of DC load flow, per unit system for DC quantities, solution techniques of AC-DC power flow equations, Parallel operation of HVDC/AC systems, Multi terminal systems.

RECOMMENDED BOOKS:

1. K.R. Padiyar, 'HVDC Power Transmission Systems', Wiley Eastern Ltd., New Delhi.
2. E. Kimbark, 'Direct Current Transmission', Vol-I, John-Wiley and Sons, NY.
3. J. Arrillaga, 'HVDC Transmission', IEE Press, London.
4. R.D. Begamudre, 'EHV AC Transmission Engineering', Wiley Eastern Press.

MRSPTU

DIGITAL SIGNAL PROCESSING AND APPLICATIONS

Subject Code: MELE1-161	**L T P C** **4 0 0 4**	**Duration: 45 Hrs.**

UNIT-1

1. Introduction (10 Hrs.)

Limitations of analog signal processing, Advantages of digital signal processing and its applications; Some elementary discrete time sequences and systems; Basic elements of digital signal processing such as convolution, correlation and autocorrelation, Concepts of stability, causality, linearity, difference equations. DFT and its properties; Linear Periodic and Circular convolution; Linear Filtering Methods based on DFT; Fast Fourier Transform algorithm using decimation in time and decimation frequency techniques; Goertzel algorithm.

UNIT-2

2. Z Transform (6 Hrs.)

Introduction, Z-Transform, Region of convergence; Inverse Z Transform methods, properties of Z transform.

UNIT-3

3. Design of Digital Filters (12 Hrs.)

Structures of realization of discrete time system, direct form, Cascade form, parallel form and lattice structure of FIR and IIR systems. Linear Phase FIR filters; Design methods for FIR filters; IIR filter design by Impulse Invariance, Bilinear Transformation, Matched Z-Transformation, Analog and Digital Transformation in the Frequency Domain. Finite Precision Effects: Fixed point and Floating point representations, Effects of coefficient unitization, Effect of round off noise in digital filters, Limit cycles.

UNIT-4

4. DSP Processors (10 Hrs.)

Architectures of ADSP and TMS series of processor. Digital Signal Processing Principles, Algorithms and Application.

RECOMMENDED BOOKS:

1. Alan V. Oppenheim, Ronald W. Schafer, 'Discrete-Time Signal Processing', John R. Back, Prentice Hall.
2. S. Salivahan, A. Vallavaraj, Gnanpiya, 'Digital Signal Processing', Tata McGraw Hill.
3. S.K. Mitra, 'Digital Signal Processing - A Computer based Approach', Tata McGraw Hill.
4. Jervis, 'Digital Signal Processing‖', Pearson Education India.
5. 'Introduction to Digital Signal Processing', 1st Edn., Johny R. Johnson, Prentice Hall, **2006.**

ADAPTIVE CONTROL SYSTEM

Subject Code: MELE1-161 **L T P C** **Duration: 40 Hrs.**

4 0 0 4

UNIT-1

1. Introduction to Adaptive Control (6 Hrs.)

Development of adaptive control problem-The role of Index performance (IP) in adaptive systems-Development of IP measurement process model.

UNIT-2

2. System Response Identification (10 Hrs.)

Identification by Cross Correlation - Synthesis techniques for flat spectrum Pseudo random signals - Quasi Linearization-Impulse Response Expansion-Identification using matched filter, Adaptive control using steepest Descent.

3. Perturbation Systems (5 Hrs.)

Single and Multi-dimensional adaptive systems – Stability Analysis of Sinusoidal perturbation adaptive controllers – Formulation of signal synthesis system.

UNIT-3

4. Self-Tuning Regulators (Str) and Model Reference Adaptive Systems (10 Hrs.)

Introduction - Pole Placement Design-Indirect Self-tuning regulators - Continuous Time Self-Tuners - Direct self-tuning regulators - Linear quadratic self - Tuning regulators - Adaptive predictive control. The MIT rule – Determination of Adaptation Gain – Design of MRAS using Liapunov theory – BIBO Stability – Applications to Adaptive control- Model Free Adaptive Control.

UNIT-4

5. Gain Scheduling (9 Hrs.)

Principle-Design of Gain Scheduling Controllers - Nonlinear Transformations of second Order Systems Applications of Gain Scheduling. Case study - ABB Adaptive Controllers, Satt Control ECA40, The First Control Adaptive Controller.

RECOMMENDED BOOKS:

1. Karl J. Astrom and Bjorn Wittenmark, 'Adaptive Control', 2nd Edn., Pearson Education Inc., New Delhi, **2008**.
2. Shankar Sastry and Marc Bodson, 'Adaptive Control – Stability, Convergence and Robustness', Prentice Hall, Englewood Cliffs, New Jersey, **1989**.
3. L. Ljung, 'System Identification: Theory for the User', Prentice Hall, Englewood Cliffs, **1999**.

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4. V.V. Chalam, 'Adaptive Control Systems – Techniques and Applications', Marcel Dekker Inc., New Jersey, **1987**.
5. Kumpathi S. Narendra, Romeo Ortega and Peder Dorator, 'Advances in Adaptive Control', IEEE Press, New Jersey, 1991.
6. Petros A. Loannov and Jing Sun, 'Robust Adaptive Control', Prentice Hall Inc.

DISCRETE TIME CONTROL SYSTEMS

Subject Code: MELE1-163 **L T P C** **Duration: 45 Hrs.**
4 0 0 4

UNIT-1

1. Introduction (7 Hrs.)

Configuration of the basic Digital Control Systems, types of sampling operations, Sample and Hold operations, Sampling theorem, Basic discrete time signals.

UNIT-2

2. Analysis of Digital Control Systems (9 Hrs.)

Z-Transforms, Properties of Z-Transform, Inverse Z-Transforms, Pulse Transfer Function, Difference equations, Z-Transform method for solving the difference equations, Block diagram and signal flow graph analysis, Time response of digital control systems.

UNIT-3

3. Stability Methods (8 Hrs.)

Mapping between s-plane and z-plane, stability methods: Modified Routh Criterion, Jury's method, modified Schur-Cohn criterion.

4. Models of Digital Control Systems (5 Hrs.)

Digital temperature control System, Digital position control system, stepping motors and their control.

UNIT-4

5. Control Systems Analysis Using State Variable Methods (8 Hrs.)

State variable representation, conversion of state variable models to transfer function and vice-versa, Eigen values and Eigen vectors, Solution of state equations, Concepts of controllability and observability.

6. State Variable analysis of Digital Control Systems (8 Hrs.)

State variable description of digital control systems, conversion of state variable models to pulse transfer function and vice versa, solution of state difference equations, controllability and observability.

RECOMMENDED BOOKS:

1. M. Gopal, 'Digital Control and State Variable Methods', Tata McGraw-Hill.
2. K. Ogata, 'Discrete Time Control Systems', Pearson Education, Singapore, Thomson Press India.
3. B.C. Kuo, 'Digital Control Systems', Prentice Hall.
4. I.J. Nagrath & Gopal, 'Control System Engineering', John Wiley & Sons.
5. K.K. Aggarwal, 'Control System Analysis and Design', Khanna Publishers.

POWER SYSTEM OPERATION AND CONTROL

Subject Code: MELE1-205/MELE3-101 **L T P C** **Duration: 45 Hrs.**
4 0 0 4

Learning Objectives:

- To impart learning about the power system controls namely load frequency and AVR control for both single-machine infinite bus system and multi machine systems.

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- To learn optimal system operation through optimal generation dispatch, unit commitment, hydro-thermal scheduling and pumped storage plant scheduling and their implementation through various classical methods

Learning Outcomes:

- Understanding about the power system controls namely load-frequency and AVR control for both single-machine infinite bus system and multi machine systems,
- Student will understand the optimal system operation through optimal generation dispatch, unit commitment, hydro-thermal scheduling and pumped storage plant scheduling and their implementation through various classical methods.

Unit-1

INTRODUCTION: Characteristics of power generation units (thermal, nuclear, hydro, pumped hydro), variation in thermal unit characteristics with multiple valves, Economic dispatch with and without line losses, lambda iteration method, gradient method, Economic dispatch without line losses, economic dispatch with line losses, Newton Raphson method, base point and participation factors.

Unit-2

TRANSMISSION LOSSES: Coordination equations, incremental losses, penalty factors, B matrix loss formula (without derivation), methods of calculating penalty factors.

UNIT COMMITMENT: constraints in unit commitment, priority list method, Dynamic programming method and Lagrange relaxation methods.

Unit-3

HYDRO THERMAL CO-ORDINATION: Introduction to long range and short range hydro scheduling, Types of short range scheduling problem, Scheduling energy. The short term hydro-thermal scheduling problems and its solution by Lambda-Gamma iteration method and gradient method

GENERATION WITH LIMITED ENERGY SUPPLY: take or pay fuel supply contract, composite generation production cost function, gradient search techniques.

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Unit-4

OPTIMAL POWER FLOW FORMULATION: gradient and Newton method, linear programming methods.

AUTOMATIC GENERATION CONTROL: load frequency control, single area system, multi-area system, tie line control, automatic voltage control.

RECOMMENDED BOOKS:

1. D.P. Kothari and J.S. Dillon, 'Power System Optimization', Prentice-Hall of India Pvt. Ltd. New Delhi, **2011.**
2. G.L.K. Kirchmayer, 'Economic Operation of Power Systems', John Willey & Sons, N.Y., **2004.**
3. A.J. Wood, B.F. Wollenberg, 'Power Generation Operation and Control', **1998.**
4. D.P. Kothari and I.J. Nagrath, 'Modern Power System Analysis', Tata McGraw Hill Publishing Company Ltd., New Delhi, **1999.**

ADVANCED ELECTRICAL MACHINES

Subject Code: MELE1-206	**L T P C** **4 0 0 4**	**Duration: 45 Hrs.**

Learning Objectives:

1. To give a systematic approach for modelling and analysis of all rotating machines under both transient and steady state conditions.

Learning Outcomes:

1. The students will be able to analyse all types of electrical machines.

2. Students attain complete knowledge about electromagnetic energy conversion and time response analysis of reference frame theories for modelling of machines.

Unit-1

POLYPHASE SYNCHRONOUS MACHINES: Mathematical: Basic Synchronous machine parameters, Voltage, Flux linkage and inductance relations, Park's transformation – its physical concept, equations of performance.

BALANCED STEADY STATE ANALYSIS: Phasor equations and phasor diagrams, Power-angle characteristics, cylindrical rotor and Salient pole machines, Short circuit ratio

Unit-2

TRANSIENT ANALYSIS & MACHINE DYNAMICS: Three phase short-circuits, Armature and field transients, Transient torque, Sudden reactive loading and Unloading. Transient Analysis-a qualitative approach, Reactance and Time –Constants from equivalent circuits, Measurement of reactance, Transient Power-angle characteristics, The basic electromechanical equation, Linearized analysis, Large Angular/oscillation, Non-linear analysis.

Unit-3

TRANSFORMERS & ITS TRANSIENTS: Multi-Circuit Transformers: General theory, Equivalent circuits, Three winding transformer as a multi-circuit transformer, Determination of parameters. In-rush current phenomena, Qualitative approach, Analytical approach, In-rush current in 3-phasetransformers.

Unit-4

EXCITATION PHENOMENA IN TRANSFORMERS: study of excitation and its effect on transformer performance, Harmonics in: Single phase transformers, three-phase transformers, Disadvantages of harmonics, Suppression of harmonics.

UNBALANCED OPERATION OF THREE-PHASE TRANSFORMERS: Single-phase load on three-phase transformers, Single-Phasing in 3-phase transformers, Effect of using tertiary winding.

RECOMMENDED BOOKS

1. B. Edikins 'Generalized Theory of Electrical Machines'.
2. Concordia, 'Synchronous Machines'.
3. E.W. Kim Bark, 'Power System Stability', Vol. III., Wiley.
4. P.S. Bimbhra, 'Generalized Theory of Electrical Machines', **2010.**
5. E.W. Kimbark., 'Power System Stability', Vol. III, **1998**.
6. A. Draper, 'Electrical Machines', **2011.**
7. 'Magnetic Circuits and Transformer', MIT Staff, **2004.**

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POWER ELECTRONIC DEVICES AND CONTROLLERS

Subject Code: MELE1-207/MELE3-102 L T P C Duration: 45 Hrs.
4 0 0 4

Learning Objectives:

- Learn the physics of device operation, static and dynamic characteristics, ratings, protection, operating limitations and safe operating area
- Know about the design issues of drive circuits and their usage
- Understanding the different types of inverters and cyclo-converters

Learning Outcomes:

- Knowledge of power semiconductor devices and their Gate and base drive circuits
- Develop skills to utilize the different PWM schemes
- Know about the different types of power converters and their applications

UNIT-1

REVIEW OF SEMICONDUCTOR DEVICES: Conduction Process in semiconductors, pn Junction, Charge control description, Avalanche breakdown, Power diodes, Thyristors, Gate Turn Off Thyristor (GTO), VI characteristics, Dynamic characteristics, ratings, protection.

UNIT-2

POWER MOSFET AND IGBT: Basic structure, I-V Characteristic, Physics of device operation, switching characteristics, operating limitation and safe operating area.

EMERGING DEVICES AND CIRCUITS: Power junction Field effect transistor (FET), Integrated Gate-Commutated Thyristor (IGCT), Field Control Thyristor, Metal oxide semiconductor (MOS) Control Thyristor etc. Power ICs, New semiconductor materials.

UNIT-3

SNUBBER CIRCUITS: Types of Snubber circuits, needs of Snubber circuit with diode, thyristor and transistors, Turn-off Snubber, over voltage snubber, turn on snubber, Snubber for bridge circuit configurations, GTO Snubber circuit.

UNIT-4

GATE AND BASIC DRIVE CIRCUITS: Design Consideration, De-coupled drive circuits, electrically isolated drive circuits, cascade connected drive circuits, Power device protection in drive circuits, circuit layout considerations.

RECOMMENDED BOOKS:

1. Mohan, Undeland and Robbins, ‘Power Electronics: Converters, Applications and Design’, John Wiley and Sons.
2. M.H. Rashid, ‘Power Electronics Handbook’, Elsevier Press (Academic Press Series).
3. D. Finney, ‘The Power Thyristor and its Applications’, McGraw Hill, New York.
4. C.W. Lander, ‘Power Electronics’, McGraw Hill Book Co., U.K.
5. M.H. Rashid, ‘Power Electronics - Circuits, Devices and Applications’, PHI, India.

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SIMULATION LAB.

Subject Code: MELE1-208/MELE3-208 L T P C
0 0 2 1

EXPERIMENTS

1. Introduction to MATLAB and its basic commands.
2. MATLAB program to simulate Ferranti effect.
3. MATLAB program to model transmission lines.
4. MATLAB program to solve load flow equations by Gauss-Seidel method.
5. MATLAB program to find optimum loading of generators neglecting transmission losses.
6. MATLAB program to find optimum loading of generators with penalty factors.
7. MATLAB program to solve swing equation using point-by-point method.
8. Simulink model of single area load frequency control with and without pi controller and without pi controller in Simulink.
9. Simulink model for two area load frequency control.
10. Simulink model for evaluating transient stability of single machine connected to infinite bus.
11. Gauss Seidel load flow analysis using MATLAB Software.
12. Newton Raphson method of load flow analysis using MATLAB Software.
13. Fast decoupled load flow analysis using MATLAB Software.
14. Fault analysis using MATLAB Software.
15. Economic dispatch using MATLAB Software.

POWER SYSTEM MODELLING AND DYNAMICS

Subject Code: MELE1-264 **L T P C** **Duration: 45 Hrs.**
4 0 0 4

Learning Objectives:

1. This course aims to give basic knowledge about the dynamic mechanisms behind angle and voltage stability problems in electric power systems, including physical phenomena and modelling issues.

Learning Outcomes:

At the end of this course,

1. Will be able to solve the reactive power problems in power system
2. Students will be able to analyse and understand the electromagnetic and electromechanical phenomena taking place around the synchronous generator.

UNIT-I

Static Model of Power System Components:

Generator, single circuit & multi-circuit transmission line, regulating & phase shifting transformer, VAr compensators and Loads for balanced and unbalanced conditions. Formulation of Admittance and Impedance Matrices for balanced and unbalanced conditions, their modifications, Sparcity and Optimal ordering,

UNIT-II

TRANSIENT STABILITY ANALYSIS

Review of numerical integration methods: Euler and Fourth Order Runge-Kutta methods, Numerical stability and implicit methods, Interfacing of Synchronous machine (variable voltage) model to the transient stability algorithm (TSA) with partitioned –explicit and implicit approaches – Interfacing SVC with TSA-methods to enhance transient stability.

UNIT III

UNIFIED ALGORITHM FOR DYNAMIC ANALYSIS OF POWER SYSTEMS

Need for unified algorithm-numerical integration algorithmic steps-truncation error-variable step size –handling the discontinuities-numerical stability-application of the algorithm for transient. Mid-term and long-term stability simulations.

UNIT IV

TRANSMISSION, GENERATION AND LOAD ASPECTS OF VOLTAGE STABILITY ANALYSIS

Review of transmission aspects –Generation Aspects: Review of synchronous machine theory – Voltage and frequency controllers –Limiting devices affecting voltage stability –Voltage-reactive power characteristics of synchronous generators –Capability curves – Effect of machine limitation on deliverable power –Load Aspects –Voltage dependence of loads –Load restoration dynamics – Induction motors –Load tap changers –Thermostatic load recovery –General aggregate load models.

RECOMMENDED BOOKS:

1. R. Ramnujam, 'Power System Dynamics Analysis and Simulation', PHI, Learning Private Limited, New Delhi, **2009.**
2. P. Kundur, 'Power System Stability and Control', McGraw-Hill, **1993**.
3. J.D. Grainger, 'Power System Analysis', Tata McGraw Hill Publishing Company, **2008**.
4. L.P. Singh, 'Advanced Power System Analysis and Dynamics', 3rd Edn., Wiley Eastern, New Delhi, **2012.**

MRSPTU

CUSTOMIZED POWER DEVICES

Subject Code: MELE1-265 **L T P C** **Duration: 45 Hrs.**
4 0 0 4

Learning Objectives

1. To study of advances in Power Electronics Industry led to rapid development of Power Electronics controllers for fast real and reactive power control and to introduce these advancements.

Learning Outcomes

1. Upon successful completion of this course, students will be able to select suitable FACTS device for the enhancement of power transfer capability and to control the power flow in an efficient manner.

UNIT-I

Static Power Frequency Changers

Fundamental Ideas: Historical Background, Basic Operational features and Operating Principles. Mathematical Representation (output voltage and Input Current) of Static Frequency Changers. Synthesis of the Output Voltage Waveform, Control of the Output Voltage (PWM, Amplitude Dependent Frequency Modulation, Phase Shift). Unwanted Components of Output Voltage, Analysis of the Input Current. Extra basal Components of the Input Current. Control Circuit Principles: Implementation of Modulating Functions. End Stop Control, Control of UDFFC, NCC and CDFFC. Forced Commutation of Frequency Changers: Fundamental Principles of Hard and Soft Commutation, Points of Connection of Commutating Circuits. Some Basic Commutating Circuits. Application of Static Frequency Changers: Speed Control of AC Machines, Constant Frequency Power Supplies and Static VAR Generators.

UNIT-II

Compensators and Power Flow Controllers:

Static shunt compensators, Static series compensators, Static Voltage and phase angle regulators, Principle of operation of Controllers, Control and characteristics, Model of IPFC for power flow and optimum power flow studies. FACTS Controller interactions –SVC–SVG interaction -co-ordination of multiple controllers using linear control techniques –Quantitative treatment of control coordination.

UNIT-III

Power Quality Improvement:

Harmonic filters: passive, Active and hybrid filters –Custom power devices: Network reconfiguring Devices, Load compensation using DSTATCOM, Voltage regulation using DSTATCOM, protecting sensitive loads using DVR, UPQC –control strategies: P-Q theory, Synchronous detection method –Custom power park –Status of application of custom power devices.

Difference in role of FACTS devices in transmission and distribution networks

UNIT-IV

Recent Trends:

Application of basic active filters, multilevel and multipulse converters and Z-source inverter in various FACTS and FACDS devices for improving the performances of transmission system net work and distribution system network, respectively.

RECOMMENDED BOOKS:

1. Y.H. Song and A.T. Johns, ‘Flexible AC Transmission Systems’, IEEE Press, **1999**.
2. N.G. Hingorani and L. Gyragyi, ‘Understanding FACTS (Concepts and Technology of Flexible AC Transmission System)’, Standard Publishers & Distributors, **2001**.
3. R.M. Mathur and R.K. Verma, ‘Thyristor based FACTS Controllers for Electrical Transmission Systems’, IEEE Press, **2002**.

MRSPTU

ADVANCED ELECTRICAL MACHINES DESIGN

Subject Code: MELE1-266 **L T P C** **Duration: 45 Hrs.**
4 0 0 4

Learning Objectives:

1. To give a systematic approach for modelling and analysis of all rotating machines under both transient and steady state conditions.

Learning Outcomes:

1. Develop the basic elements of generalized theory and derive general equations for voltages and currents applicable to all types of rotating machines, to deal comprehensively with their steady-state, dynamic and transient analysis.
2. Obtain the voltage and torque equations for a symmetrical induction machine in terms of machine variables and transform these equations by applying reference-frame theory to Analyse the dynamic performance of the machine.
3. Apply Park"s transformation to transform the time varying synchronous machine equations to a time-invariant set of equations and study the dynamic performance.
4. Linearize the nonlinear equations of induction and synchronous machines to study the dynamic behaviour of small displacements about the operating point.

UNIT-I

Introduction: Design of Machines, Factors, limitations, Modern trends. Materials: Conducting, magnetic and insulating materials. Calculations of mmf for air gap and teeth, real and apparent flux densities, iron losses, field form, leakage flux, specific permanence. Modes of heat dissipation, Temperature gradients, types of enclosures, types of ventilation, conventional and direct cooling, amount of coolants used, Ratings.

UNIT-II

Transformer and DC Machine

Transformer: Magnetic circuit, core construction and design, winding types, insulation, Loss allocation and estimation, Reactance, Temperature rise.

D C Machine:

No. of poles and main dimensions, armature, windings, Magnetic circuit and Magnetisation curve, Commutator and brushes.

UNIT-III

AC Machine

Induction Machine-3 Phase: Rating specifications, standard frame sizes, Main dimensions' specific loadings, Design of stator windings, Rotor design –slots and windings, calculations of equivalent circuit parameters.

Synchronous Machine: Main dimensions, Magnetization characteristic, Field winding design.

UNIT-IV

Computer Aided Design of Electrical Machines

Analysis and synthesis approaches, design algorithms, Introduction to optimization techniques, Implementing computer program for design of three phase induction motor.

RECOMMENDED BOOKS:

1. A.K. Sawhney, 'A Course in Electrical Machine Design', Dhanpat Rai & Co.
2. A.E. Clayton & N.N. Hancock, 'The Performance and Design of Direct Current Machines', CBS Publishers and Distributors.
3. E.S. Hamdi, 'Design of Small Electrical Machine', John Wiley and Sons, **1994**.
4. M. Ramamoorty, 'Computer Aided Design of Electrical Equipment', Eastern Press Private Limited, **1989**.
5. M.G. Say, 'Design and Performance of Machines', CBS Publications, **1981**.

MRSPTU

ARTIFICIAL INTELLIGENT TECHNIQUES

Subject Code: MELE1-267/ MELE2-267/ MELE3-267 **L T P C 4 0 0 4** **Duration: 45 Hrs.**

Learning Objectives:

1. To apply artificial neural networks in various electrical and electronics engineering applications.
2. To expose students to fuzzy methods of analysing problems which involve incomplete or vague criteria rather than crisp values.
3. To investigates requirements analysis, logical design, and technical design of components for fuzzy systems development.

Learning Outcomes:

1. The students acquire the skills required to innovate and build, smart and intelligent applications in electrical and electronics engineering.
2. They will understand review of Neural Networks: models of a neuron, various activation functions, Threshold function, piecewise – linear function, stochastic model of a neuron, feedback.
3. They will be able to take up fuzzy systems approach to solve applications in engineering.

UNIT I

NEURAL NETWORKS (9 hours)

Neural Networks – biological neurons – Artificial neurons – activation function – learning rules – feed forward networks – supervised & Unsupervised learning – perceptron network- linear separability – back propagation networks Algorithms-Radial basis function networks.

UNIT II

ASSOCIATIVE MODELS AND CONTROL SCHEMES IN NN (9 hours)

Auto & hetero associative memory – bi-directional associative memory – Self organizing feature Maps-Hopfield Networks-Neural Networks for non – linear system – Schemes of Neuro control – System identification – forward model and – Inverse model – Case studies.

UNIT III

FUZZY LOGIC AND GENETIC ALGORITHM (9 hours)

Fuzzy set - Crisp set – vagueness – uncertainty and imprecision – fuzzy set – fuzzy operation-properties – crisp versus fuzzy relations – fuzzy relations –fuzzy Cartesian product and composition – composition of fuzzy Relations-Fuzzy to crisp conversion –structure of fuzzy logic controller – database – rule base – Inference engine.

GA: Working principles – terminology – Importance of mutation – comparison with traditional methods – constraints and penalty function – GA operators – Real coded GAs.

UNIT IV

APPLICATIONS (9 hours)

Applications of Neural network, Fuzzy system & Genetic algorithms for power systems and power electronics Systems-Designing of controllers using Simulation Software, NN tool box & Fuzzy Logic Toolbox.

RECOMMENDED BOOKS:

1. Timothy J. Ross, 'Fuzzy Logic with Engineering Applications', McGraw Hill International Edition, USA, **1997**.
2. Awrence Fausatt, 'Fundamentals of Neural Networks', Prentice Hall of India, New Delhi, **1994**.
3. Simon Haykin, 'Neural Networks – A Comprehensive Foundation', Pearson Education Asia, **2002**.

MRSPTU

ELECTIVE-IV: POWER SYSTEM DYNAMICS & STABILITY

Subject Code: MELE1-368/ MELE3-207 L T P C Duration: 45 Hrs.
4 0 0 4

Learning Objectives:

1. To know the elementary mathematical model and system response to small disturbances.
2. To impart the concepts of transient stability.
3. To impart knowledge on voltage stability.

Learning Outcomes:

After Completion of this course students will be able to

1. Solve mathematical calculations and swing equation and obtain classical model of an infinite bus system.
2. Analyse the effect of small speed changes in multi machine synchronous machines and voltage regulator governor system.
3. Understand the transient stability analysis under common disturbances including the short circuits and find clearing time to solution for swing equation by step by step method.

UNIT-I

1. Overview: Angular Stability, Transient stability, steady state stability, dynamic stability, Small Signal, Voltage Stability.

2. Transient Stability Analysis: Single Machine - Infinite Bus System, Equal Area Criterion, Multi-machine Stability, Network Reduction and Numerical Integration Methods, Methods of Improvement.

UNIT-II

3. Small Signal Stability Analysis: Eigen Value and Participation Factor Analysis; Single machine -Infinite Bus and Multi-machine Simulation; Effect of Excitation System and AVR, improvement of Damping, Power System Stabilizer and Static VAR System (SVS) supplementary controls.

UNIT-III

4. Sub Synchronous Oscillations: Sub Synchronous Resonance (SSR) Phenomenon, Counter measures to SSR problems.

UNIT-IV

5. Voltage Stability: PV and QV curves, Impact of Load and Tap changer Dynamics; Static Analysis, Sensitivity and Continuation Methods; Dynamic Simulation, Introduction to Bifurcation Analysis; Proximity Indices, Methods to enhance Stability Margin.

RECOMMENDED BOOKS:

1. P. Kundur, 'Power System Stability and Control', McGraw Hill.
2. C.W. Taylor, 'Power System Voltage Stability', McGraw Hill.
3. P.M. Anderson and A.A. Foud, 'Power System Control and Stability', IEEE Press.
4. E. Kimbark, 'Power System Stability', Vol. I, II & III, IEEE Press.

ADVANCED POWER SYSTEM PROTECTION

Subject Code: MELE1-369 / MELE3-206 L T P C Duration: 45 Hrs.
4 0 0 4

Learning Objectives:

1. To facilitate the students, understand the basic concepts and recent trends in power system protection.
2. To enable the students design and work with the concepts of digital and numerical relaying.

Learning Outcomes:

On completion of the course the students would be skilled enough to work with various type of schemes used for different apparatus protection.

MRSPTU

UNIT-I

1. Fundamentals: Types of relays, their classifications and theory Phase and amplitude comparators. Static Comparators Computer Applications to protective relaying.

2. Circuit Breakers: Physical stress in circuit breakers, Vacuum circuit breakers, SF6 Circuit breakers Direct current C.B's, Short circuit testing of circuit breakers, Comparison of different types of circuit breakers.

UNIT-II

3. Transmission Line Protection: Carrier Current Protection, Applications of microwave Channels for protective relaying, Selection of suitable static relaying scheme for transmission line protection. Performance specifications of distance relays, effect of fault resistance and effects of power swings on operation of relays and Distance relay settings.

UNIT-III

4. Generators and Transformers Protection: CT's and PTs burden and accuracy and their connections. Protection of rotor winding. Miscellaneous protection schemes for generators and transformers, Over fluxing protection of transformers.

UNIT-IV

5. Differential Relays: Operating Characteristics, Restraining Characteristics, Analysis of Electromagnetic and differential Static relays schemes.

6. Bus zone Protection: Types of bus bar faults, Protection requirements, protection schemes and modern trend in bus-bar protection.

RECOMMENDED BOOKS:

1. T.S. Madhava Rao, 'Power System Protection (Static Relays)', Tata McGraw-Hill, **1989**.
2. A.R. Van C. Warrington, 'Protective Relays', Chapman and Hall, London, **1968**.
3. S.K. Basu and S. Chaudhary, Raju Primlan 'Power System Protection', Oxford and IBH Press, **1983**.
4. Ravindra Nalh, M. Chander, 'Power System Protection and Switch Gear', John Wiley Eastern, **1989**.
5. Sunil S. Rao., 'Power System Protection and Switch Gear', Khanna Publishers, **1989**.
6. Related IEEE/IEE Publications.

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SMART GRID TECHNOLOGIES

Subject Code: MELE1-370/ MELE3-162 L T P C Duration: 45 Hrs.
4 0 0 4

UNIT- I

1. Introduction to Smart Grid (10 Hrs.): Evolution of Electric Grid, Concept of Smart Grid, Definitions, Need of Smart Grid, Functions of Smart Grid, Opportunities & Barriers of Smart Grid, Difference between conventional & smart grid, Concept of Resilient & Self-Healing Grid, Present development & International policies in Smart Grid. Case study of Smart Grid. CDM opportunities in Smart Grid.

UNIT-II

2. Smart Grid Technologies (10 Hrs.)

Part 1: Introduction to Smart Meters, Real Time Pricing, Smart Appliances, Automatic Meter Reading (AMR), Outage Management System (OMS), Plug in Hybrid Electric Vehicles (PHEV), Vehicle to Grid, Smart Sensors, Home & Building Automation, Phase Shifting Transformers.

Part 2: Smart Substations, Substation Automation, Feeder Automation. Geographic Information System(GIS), Intelligent Electronic Devices (IED) & their application for monitoring & protection, Smart storage like Battery, SMES, Pumped Hydro, Compressed Air Energy Storage, Wide Area Measurement System (WAMS), Phase Measurement Unit (PMU).

UNIT-III

3. Micro grids and Distributed Energy Resources (10 Hrs.): Concept of micro grid, need & applications of micro grid, formation of micro grid, Issues of interconnection, protection & control of micro grid. Plastic & Organic solar cells, Thin film solar cells, Variable speed wind generators, fuel cells, micro turbines, Captive power plants, Integration of renewable energy sources

UNIT-IV

4. Power Quality Management in Smart Grid (10 Hrs.): Power Quality & EMC in Smart Grid, Power Quality issues of Grid connected Renewable Energy Sources, Power Quality Conditioners for Smart Grid, Web based Power Quality monitoring, Power Quality Audit.

5. Information and Communication Technology for Smart Grid: Advanced Metering Infrastructure (AMI), Home Area Network (HAN), Neighborhood Area Network (NAN), Wide Area Network (WAN). Bluetooth, Zig-Bee, GPS, Wi-Fi, Wi-Max based communication, Wireless Mesh Network, Basics of CLOUD Computing & Cyber Security for Smart Grid. Broadband over Power line (BPL). IP based protocols.

BOOKS RECOMMENDED:

1. Ali Keyhani, N. 'Integration of Green and Renewable Energy in Electric Power Systems', Marwali, Min Dai, Wiley.
2. Clark W. Gellings, 'The Smart Grid: Enabling Energy Efficiency and Demand Response', CRC Press.
3. Akihiko Yokoyama, Janaka E kanayake, Nick Jenkins, Kithsiri Liyanage, Jianzhong Wu, 'Smart Grid: Technology and Applications', Wiley.
4. Jean Claude Sabonnadière, Nouredine Hadjsaïd, 'Smart Grids', Wiley Blackwell.

MRSPTU

ENGINEERING OPTIMIZATION

Subject Code: MELE1-371/ MELE3-371/ MELE0-F94
L T P C
4 0 0 4
Duration: 45 Hrs.

UNIT I

Introduction: Definition, Classification of optimization problems, Classical Optimization Techniques, Single and Multiple Optimization with and without inequality constraints.

UNIT II

Linear Programming (LP) and Non Linear Programming (NLP): Simplex method of solving LP, revised simplex method, duality, Constrained Optimization, Theorems and procedure, linear programming, mathematical model, solution technique, duality. Steepest descent method, Conjugate gradient method, Newton Method, Sequential quadratic programming, Penalty function method, augmented Lagrange multiplier method.

UNIT III

Dynamic Programming (DP): Multistage decision processes, concept of sub-optimization and principle of optimality, Recursive relations, Integer Linear programming, Branch and bound algorithm.

UNIT IV

Genetic Algorithm (GA): Introduction to Genetic Algorithm, working principle, coding of variables, fitness function, GA operators; Similarities and differences between GA and traditional methods; Unconstrained and constrained optimization using genetic Algorithm, real coded GA, Advanced GA, global optimization using GA, Applications to power system.

RECOMMENDED BOOKS:

1. D.A. Pierre, 'Optimization Theory with Applications', Wiley Publications.
2. H.A. Taha, 'Operations Research: An Introduction', 7th Edn., Pearson Education Edition, Asia, Delhi.
3. S.S. Rao, 'Optimization –Theory and Applications', Wiley-Eastern Limited.

4. D.P. Kothari & J.S. Dhillon, 'Power System Optimization', PHI Publishers.
5. Donald E. Kirk, 'Optimal Control Theory', Dover Publications, New York.
6. Kalyanmoy Deb, 'Optimization for Engineering Design: Algorithms and Examples', PHI Publishers.

POWER SYSTEM PLANNING

Subject Code: MELE1-372 / MELE3-205 **L T P C** **Duration: 45 Hrs.**
4 0 0 4

Learning Objectives:

1. To acquire skills in planning and building reliable power system.

Learning Outcomes:

1. The scope of employability in power utilities will increase.
2. The management skills required in the field of power system engineering is enhanced.

UNIT-I

1. Introduction: power system planning, objective, stages in planning and design, the electric utility industry, growth characteristics generation, transmission and distribution systems.

2. Demand/energy forecasting: electricity consumption pattern, peak demand and energy forecasting by trend and economic projection methods. Review of load forecasting.

UNIT-II

3. Power System Planning: Investment planning: traditional generation expansion planning models, integrated resource planning models, production cost simulation models.

4. Generating system capability planning: probabilistic models of generating units, growth rate, rate of generation capacity, outage performance and system evaluation of loss of load and loss of energy indices, power supply availability assessment, Expansion planning, unit maintenance schedule, unit effective load carrying capability.

5. Transmission system planning: automatic transmission system expansion planning, automatic transmission planning using interactive graphics.

UNIT-III

6. Distribution system planning and automation: load characteristics, design of sub transmission lines and distribution, substations, design considerations of' primary and secondary distribution systems, voltage drop and power loss calculations.

7. Interconnected systems: multi-area reliability analysis, power pool operation and power exchange energy contracts, quantification of economic and reliability benefits of pool operation.

UNIT-IV

8. Power system Expansion planning: formulation of least cost optimization problem involving capital, operation and maintenance costs of candidate units of different types.

RECOMMENDED BOOKS:

1. Y. Wallach, 'Power System Planning', McGraw Hill International.
2. P. Sullivan, 'Power System Planning', McGraw Hill International.
3. S. Dasari, 'Electric Power System Planning', IBT Publishers, New Delhi.
4. R. Billinton, 'Power System Reliability Calculation', MIT Press, USA.
5. Endreyni, 'Reliability Modelling in Electric Power System', John Wiley, New York.
6. J.R. McDonald, 'Modern Power System Planning', McGraw Hill International.
7. A.S. Pabla, 'Electrical Power System Planning', Macmillan, **1998**.

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ELECTRIC TRACTION SYSTEM

Subject Code: MELE1-373 **L T P C** **Duration: 45 Hrs.**

4 0 0 4

UNIT-I

1. Traction Systems and Latest Trends: Present scenario of Indian Railways – High speed traction, Metro, Latest trends in traction-Metro, monorail, Magnetic levitation Vehicle, Steam, diesel, diesel-electric, Battery and electric traction systems, General arrangement of D.C., A.C. single phase and 3-phase, Composite systems, Choice of traction system - Electric and Diesel-Electric.

UNIT-II

2. Mechanism of Train Movement: Analysis of speed time curves for main line, suburban and urban services, Simplified speed time curves. Relationship between principal quantities in speed time curves, Requirement of tractive effort, Specific energy consumption and Factors affecting it.

UNIT-III

3. Traction Motors and their Control: Features of traction motors, Significance of D.C. series motor as traction motor, A. C. Traction motors-single phase, Three phase, Linear Induction Motor, Comparison between different traction motors, Series-parallel control, Open circuit, Shunt and bridge transition, Pulse Width Modulation control of induction motors, Types of electric braking system.

UNIT-IV

4. Electric Locomotives: Important features of electric locomotives, Different types of locomotives, Current collecting equipment, Coach wiring and lighting devices, Power conversion and transmission systems, Control and auxiliary equipment, Distribution systems pertaining to traction (distributions and feeders), Traction sub-station requirements and selection, Method of feeding the traction sub- station.

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RECOMMENDED BOOKS:

1. R.B. Brooks, 'Electric Traction Hand Book', Sir Isaac Pitman and sons Ltd., London.
2. A.T. Dover, Mac Millan, 'Electric Traction', Dhanpat Rai and Sons, New Delhi.
3. J. Upadhyay S.N. Mahendra, 'Electric Traction', Allied Publishers Ltd., Dhanpat Rai and Sons, Delhi.
4. H. Partab, 'Modern Electric Traction', Dhanpat Rai and Sons, New Delhi.
5. J.B. Gupta, 'Electric Power Utilization', Kataria and Sons, New Delhi.

POWER SYSTEM RELIABILITY

Subject Code: MELE1-374/ MELE3-264 **L T P C** **Duration: 45 Hrs.**

4 0 0 4

Learning Objectives

To develop an understanding of power system reliability evaluation by using deterministic and probabilistic techniques.

Learning Outcomes

Upon successful completion of this course, a student will be able to:

Understand the application of basic probability theory and distribution to power system

Identify the main subsystems of a power system and their constituent components

To produce mathematical models for generator, transmission line and load

Apply techniques for reliability evaluation of individual systems

Apply techniques for reliability evaluation of composite systems

UNIT-I

1. Basic Reliability Concepts: The General reliability function, Hazard rate, MTTF, Markov processes.

2. Static Generating Capacity Reliability Evaluation: Capacity outage probability tables, loss of load probability method, Frequency and duration approach.

UNIT-II

3. Spinning Generation Capacity Reliability Evaluation: Spinning reserve, spinning reserve capacity evaluation, Load forecasting methods, Load forecast uncertainty, maximum capacity levels, Derated capacity levels.

UNIT-III

4. Transmission System Reliability Evaluation: Average interruption rate method, Frequency and duration method, Stormy and normal weather effects, The Markov process approach.

UNIT-IV

5. Composite System Reliability Evaluation: Conditional probability approach, two–plant single load system, multi plant multi load system

RECOMMENDED BOOKS:

1. R. Billinton, 'Power System Reliability Calculation', MIT Press, USA.
2. Endreyni, 'Reliability Modelling in Electric Power System', John Wiley, New York.
3. Ali Chowdhury Don Koval, 'Power Distribution System Reliability: Practical Methods and Applications', Wiley-IEEE Press.

DISTRIBUTION SYSTEM OPERATION AND ANALYSIS

Subject Code: MELE1-375/ MELE3-369 L T P C
4 0 0 4

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UNIT-I

1. System Planning: Introduction, Distribution system planning, Factors affecting system planning, present planning techniques, planning models, Introduction to optimum line network. future trends in planning, systems approach, distribution automation. Load Characteristic: Basic definitions, relation between load and loss factors, maximum diversified demand, load forecasting, Load management.

UNIT-II

2. System Design and Operation: Criteria, system developers, dispersed generation, distribution systems, economics and finance, mapping, Design of substation and feeder, Operation criteria, voltage measurements, harmonics, load variations, system losses, Introduction to energy management.

UNIT-III

3. Voltage Regulation and Automation: Quality of Service and Voltage Standards, Voltage Control, Line Drop Compensation, Distribution capacitor automation, Voltage fluctuations, SCADA and Communication with Load Dispatch Centres.

UNIT-IV

4. Distribution System Protection: Objective of distribution system protection, high impedance faults coordination of protective devices: fuse to fuse co-ordination, re-closer to re-closer coordination, re-closer to fuse coordination, re-closer to substation transformer high side fuse coordination, fuse to circuit breaker coordination, re-closer to circuit breaker coordination, lightning protection.

RECOMMENDED BOOKS:

1. Gonen, Turan, 'Electric Power Distribution System Engineering', CRC PRESS, **2012**, 3rd Indian Reprint.
2. A.S. Pabla, 'Electric Power Distribution', 6th Edn., TMH, **2011**,

3. ‘Electric Power Distribution Handbook’, Thomas Allen Short.

PROJECT

Subject Code: MELE3-309/ MELE1-309/ MELE2-309 **L T P C**

Learning Objectives:

1. To propose engineering based project in a clear and concise manner.
2. Allow students to develop problem solving, analysis, synthesis and evaluation skills.

Learning Outcomes:

1. Synthesis of knowledge.
2. To demonstrate the aptitude of applying the own knowledge to solve a specific problem.
3. To mature the knowledge.
4. Able to organize, compile and record all work details in an efficient manner

Each student will be required to complete a Project and submit a Project Report on a topic on any of the areas of modern technology related to Electrical Engineering including interdisciplinary fields. The project will carry 10 credits. Its evaluation will be done as under:

Internal Marks		**External Marks**	
1. Formulation of Problem	10	Implementation	10
2. Design	10	Result & Analysis	10
3. Implementation	20	Report	10
4. Testing & Analysis	10	Viva-Voce	10
5. Report	10	----	---
Total Marks	60	**Total Marks**	40

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SEMINAR

Subject Code: MELE1-310/ MELE2-310/ MELE3-310 **L T P C**

Learning Objectives:

1. To identify, understand and discuss current advanced research topic.
2. To gain experience in the critical assessment of the available scientific literature
3. To practice the use of various resources to locate and extract information using offline & online tools, journals

Learning Outcomes:

1. An ability to utilize technical resources
2. An ability to write technical documents and give oral presentations related to the work completed.
3. To learn preparation and presentation of scientific papers in an exhaustive manner

Each student will be required to prepare a Seminar Report and present a Seminar on a topic in any of the areas of modern technology related to Electrical Engineering including interdisciplinary fields.

Seminar will carry 4 credits. It will be done on any topic within/outside the curriculum. Its evaluation will be done as under:

Sr. No.	**Parameters for Evaluation**	**Internal Marks**	**External Marks**
1	Depth & Coverage of Topic	40	-
2	PPT Presentation & Report	20	-

3	Presentation	20	-
4	Questions & Answers	20	-
Total		**100**	**-**

RESEARCH LAB.

Subject Code: MELE1-311/ MELE2-311/ MELE3-311 L T P C

Students will be made familiar with one or more available softwares like MATLAB, ETAP, GAMS, Power System Toolbox, Power world Simulator, Network Simulator, LABVIEW, etc. so that students can use any one or more of them for their dissertation. Students will be advised to go through maximum research papers and conclude a particular domain to work further.

DISSERTATION

Subject Code: MELE1-412/ MELE2-412/ MELE3-412 L T P C

Learning Objectives: To learn, practice, and critique effective scientific writing and to formulate the research objectives clearly, state claims and evidence clearly, assess validity of claims, evidence, outcomes, and results.

Learning Outcomes:

1. Design and execute a meaningful research project that demonstrates spatial thinking and uses the knowledge and skills.
2. Define and analyse a problem in latest research areas.
3. Formulate and write a research proposal.
4. Able to learn effectively record data and experiments so that others can understand them.
5. Communicate the findings by means of a thesis, written in the format specified by the department/institute.

Each student will be required to complete a Dissertation and submit a written Report on the topic on any of the areas of modern technology related to Electrical Engineering including interdisciplinary fields in the Final semester of M.Tech. Course.

The thesis will carry 24 credits and will be evaluated as under:

Dissertation will be evaluated as under:

Sr. No.	Parameters for Evaluation	Internal Marks	External Marks
1	Originality	12	08
2	Presentation	12	08
3	Contents & Volume of work	18	12
4	Discussion (Contribution of candidate)	18	12
Total		**60**	**40**

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