MAHARAJA RANJIT SINGH PUNJAB TECHNICAL UNIVERSITY, BATHINDA

[Established by Govt. of Punjab under Punjab Act 5 of 2015 and UGC Act 2 (f) and 12(B)]

AGENDA: 2ND MEETING OF FACULTY OF ENGINEERING & TECHNOLOGY

MEETING VENUE: COMMITTEE ROOM

DATE: 13-08-2018
TIME: 11:00 A.M.

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) &12(B)]
DEAN ACADEMIC AFFAIRS

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Ref. No.: DAA/MRSPTU/2018/ 1943 **Date:** 03/08/2018

SUBJECT: 2nd MEETING OF FACULTY OF ENGINEERING & TECHNOLOGY ON 13.08.2018.

To

1. **Dr. (Prof.) Paramjeet Singh,** **Chairperson**
Dean Faculty (Engineering & Technology),
Former Professor of Chemical Engineering & Former Registrar,
Panjab University Chd., Former Registrar, Adesh University, Bathinda.
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3. **Dr. Ashok Kumar Goel** **Member**
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5. **Dr. Manjeet Bansal** **Member**
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Gurshan 03/8/18

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41. **Dr. Sandeep Mann,** **Member**
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Sir/Madam,

It is to inform you that 2nd **Meeting of Faculty of Engineering & Technology** has been scheduled on 13/08/2018 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. TA/Honorarium will be paid as per MRSPTU, Bathinda norms.
Detailed agenda is attached.

Note: It is to be noted that while claiming TA for travel by own car/taxi, toll tax receipts on the route are to be attached.

03/8/18

DEAN ACADEMIC AFFAIRS,
MRSPTU, BATHINDA

Copy to:

1) PA to Vice Chancellor MRSPTU, Bathinda for information to the Vice Chancellor, please
2) Registrar, MRSPTU, Bathinda
3) Finance Officer, MRSPTU, Bathinda.

ITEM NO. 02.01 INFORMATION REGARDING 2ND MEETING OF STANDING COMMITTEE OF MRSPTU ACADEMIC COUNCIL HELD ON 26.2.2018

It is for information of the members that 2nd Meeting of Standing Committee of MRSPTU Academic Council was held on 26.2.2018. Minutes of this Meeting are enclosed (**ANNEXURE-I, Pages 06-22)**. It was decided that the syllabus be put up in the meeting of Chairpersons of the concerned Boards of Studies. So syllabi of the Programmes covered in the agenda for 2nd meeting of Standing Committee of Academic Council are also included in the agenda for this meeting.

The Members of Faculty please note it.

ITEM NO. 02.02 APPROVAL OF SYLLABI OF UNDER GRADUATE PROGRAMMES

Syllabi of Under Graduate Programmes have been prepared **(ANNEXURE-II: Pages 23-591)**.

TABLE-I

S.N.	ITEM	PAGE NO.
1	B.Tech. (Civil Engg.) 5th – 8th Sem. 2016 Batch onwards	23-48
2	B.Tech. (Automobile Engg.) 3rd – 6th Sem. 2016 Batch onwards	49-79
3	B.Tech. (Electrical & Electronics Engg.) 5th – 8th Sem. 2016 Batch onwards	80-130
4	B.Tech. (Electronics & Communications Engg.) 3rd – 8th Sem. 2016 Batch onwards	131-190
5	B.Tech. (Electronics & Telecommunications Engg.) 3rd – 8th Sem. 2016 Batch onwards	191-250
6	B.Tech. (Electronics & Instrumentation Engg.) 3rd – 8th Sem. 2016 Batch onwards	251-303
7	B.Tech. (Information Technology) 5th – 8th Sem. 2016 Batch onwards	304-351
8	B.Tech. (Marine Engg.) 3rd – 6th Sem. 2016 Batch onwards	352-381

9	B.Tech. (Agriculture Engg.) 5th – 6th Sem. 2016 Batch onwards	382-405
10	B.Tech. (Electrical Engg.) 5th – 8th Sem. 2016 Batch onwards	406-459
11	B.Tech. (Chemical, Food) 1st Year Syllabus 2018 Batch	460-477
12	B.Tech. (Civil, Aeronautical) 1st Year Syllabus 2018 Batch	478-496
13	B.Tech. (CSE, IT, Textile) 1st Year Syllabus 2018 Batch	497-514
14	B.Tech. (EE, ECE, ETE, EI, EEE) 1st Year Syllabus 2018 Batch	515-532
15	B.Tech. (ME) 1st Year Syllabus 2018 Batch	533-551
16	Soft Skills I-IV	552-555
17	UG Open Electives-I 2016 Batch onwards	556-568
18	UG Open Electives-II 2016 Batch onwards	569-583
19	UG Open Electives-III 2016 Batch onwards	584-591

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

ITEM NO. 02.03 APPROVAL OF SYLLABI OF POST GRADUATE PROGRAMMES

Syllabi of Post Graduate Programmes have been prepared **(ANNEXURE-III: Pages 591-745)**.

TABLE-II

S. N.	**ITEM**	**PAGE NO.**
1	M.Tech. CSE (Sem 1-2) 2018 Batch onwards	592-623
2	M.Tech ECE (Micro Electronics Engg.) (Sem 1-4) Syllabus 2016 Batch onwards	624-647
3	M.Tech. Electronics & Communication Engg. (Sem 1-4) Syllabus 2016 Batch onwards	648-672
4	M.Tech. Production Engg. (Sem 1-4) Syllabus 2016 Batch onwards	673-693
5	PG Open Electives-I 2016 Batch onwards	694-722
6	PG Open Electives-II 2016 Batch onwards	723-746
7	M.Tech. Electrical Engg. (Power System) (Sem 1) 2018 Batch onwards	747-760

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

ITEM NO. 02.04 APPROVAL OF CRITERIA FOR EVALUATION OF PG THESIS, PROJECT, SEMINAR

Criteria for evaluation of PG thesis, project, seminar have been proposed:

1. Thesis will carry 24 credits and will be evaluated as under:

S. N.	Subject	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 Marks	**60**	**40**

Paper accepted in UGC approved Journals will attract additional 10 Marks in Internal assessment as special incentive subject to the maximum 60 marks in Internal assessment. It is desired that the student should publish one paper in conference/journal.

2. Seminar will carry 4 credits. It will be done on any topic within/outside the curriculum. Its evaluation will be done as under:

S. N.	Subject	Internal Marks	External Marks
1.	Depth & Coverage of Topic	40	---
2.	Report	20	---
3.	PPT Presentation	20	---
4.	Q/A in PPT Presentation	20	---
Total Marks		**100**	**---**

3. Project will carry 10 credits. Its evaluation will be done as under:

S. N.	Subject	Internal Marks	External Marks	
1.	Formulation of Problem	10	Formulation of Problem	10
2.	Testing & Analysis	20	Result & Analysis	10
3.	Report	10	Report	10
4.	PPT Presentation and Q/A	20	Viva-Voca	10
Total Marks		**60**	**Total Marks**	**40**

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

ITEM NO. 02.05 CRITERIA FOR ALLOCATION OF M.TECH. THESIS SUPERVISORS AND CO-SUPERVISORS

1. Ph.D. degree holder regular faculty member and M.Tech. faculty members working as Associate Professor will act as supervisors. Only M. Tech. degree holder will act as co-supervisor. In case there is no any Ph.D. degree holder in the department then M. Tech. degree holder faculty member, working as assistant professor will be eligible to act as M. Tech. thesis supervisor.
2. The department will put up the following information on the notice board of the department.
   a) Specialization wise faculty members.
   b) Specialization wise students.
3. The students of a particular specialization will be allotted based upon his/her merit to M.Tech. thesis supervisor of respective specialization strictly.
4. After equal distribution of students in each specialization, the remaining students will be allocated in a particular specialization, depending upon the seniority of the faculty member equally.
5. Slot wise allotment of best, medium and poor students, the basis of merit on equal basis shall be done to ensure uniform distribution. If DRC (Departmental Research Committee) of concerned department feels, students may be given their preferred choice(s) of supervisor among each slot may be exercised, limiting to maximum no. of students to be allotted to each supervisor.
6. For any further clarification, concerned DRC may decide on case to case basis and put up the same to Dean Academic Affairs, MRSPTU for approval.
7. It is recommended to start the M.Tech. research project from commencement of third semester in place of fourth semester to ensure better quality of the research work.

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

ITEM NO. 02.06 APPROVAL OF ANTI-PLAGIARISM POLICY FOR M.TECH. THESIS AS APPLICABLE FOR Ph.D. THESIS

It is proposed that Anti-plagiarism policy as applicable to Ph.D. thesis may be applicable for M.Tech. Thesis from 2017 Batch onwards.

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

ITEM NO. 02.07 AUTHORIZATION OF VICE CHANCELLOR, MRSPTU BATHINDA TO TAKE DECISIONS IN CASE OF URGENT MATTERS TO BE RATIFIED LATER ON BY MRSPTU ACADEMIC COUNCIL.

It is proposed to authorize Vice Chancellor, MRSPTU Bathinda to take decisions in case of urgent matters to be ratified later on by Academic Council, MRSPTU, Bathinda.

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

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Ref. No.: DAA/MRSPTU/1457 **Date: 05.3.2018**

MINUTES OF 2nd MEETING OF STANDING COMMITTEE OF ACADEMIC COUNCIL HELD ON 26.02.2018

2nd Meeting of Standing Committee of Academic Council of Maharaja Ranjit Singh Punjab Technical University, Bathinda was held on 26.02.2018 at 11:00 AM in the Committee Room of MRSPTU, Bathinda with Hon'ble Vice Chancellor, MRSPTU in the Chair. The following members were present:

1. **Dr. (Prof.) Mohan Paul Singh Ishar,** — **Chairperson**
   Vice-Chancellor, MRSPTU, Bathinda,
   vcmrsstu@gmail.com
2. **Dr. (Prof.) Paramjeet Singh,** — **Member**
   Dean Faculty (Engineering & Technology),
   Former Professor of Chemical Engineering & Former Registrar,
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4. **Dr. (Prof.) Parikshat Singh Manhas,** — **Member**
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At the outset the Chairman informed the members present about the grant of 12(b) status by UGC to MRSPTU within three years of its inception. After that agenda items were taken up one by one and the following decisions were arrived at unanimously after due deliberations in the meeting:

Item No.	Description	Decision Taken
02.01	**TO INFORM CONSTITUTION OF ACADEMIC COUNCIL** Academic Council has been constituted by the Board of Governors of the MRSPTU vide Agenda Item no. 6.12 in its 6th meeting held on 25.07.2017 for a period of two years from 01.10.17 to 30.09.19. It has been notified vide notification no. Reg/Notification/73/57 dated 05.01.2018 (**ANNEXURE-I: Pages 16-17**). **The Item is placed before the Standing Committee of Academic Council for information please**	Noted.

02.02	**TO INFORM ABOUT DEANS OF FACULTIES** Seven Deans of Faculties have been approved by the BoG of MRSPTU for a period of two years from 01.10.17 to 30.09.19 (**ANNEXURE-II: Page 18**).	Noted.

S.N.	**Faculty**	**Name & Address**
1	Engg & Technology	Prof. (Dr.) Paramjit Singh H. No. 2921, Phase-7, Mohali
2	Pharmacy	Prof. (Dr.) Ashish Baldi, Deptt of Pharmaceutical Sc & Tech MRSPTU, Bathinda
3	Sciences	Prof. (Dr.) Geeta Hundal, Department of Chemistry Guru Nanak Dev University, Amritsar
4	Commerce & Business Management	Prof. (Dr.) Sanjeev Kumar Sharma, University Inst of Applied Mgt Scs, Panjab University, Chandigarh
5	Architecture & Planning	Prof. (Dr.) Karamjit Singh Chahal, Department of Architecture Guru Nanak Dev University, Amritsar
6	Hospitality & Tourism Management	Prof. (Dr.) Parikshat Singh Manhas, School of Hospitality & Tourism Mgt University of Jammu, Jammu
7	Humanities & Social Studies	Prof. (Dr.) Paramjit Singh Judge Department of Sociology Guru Nanak Dev University, Amritsar

The Item is placed before the Standing Committee of Academic Council for information please.

02.03	**TO APPROVE COMPOSITION OF FACULTIES** The composition of seven faculties has been proposed for a period of two years from 01.10.17 to 30.09.19. (**ANNEXURE-III: Pages 19-33**).	Approved.

S.N.	**Faculty**
1	Engineering & Technology
2	Pharmacy
3	Sciences
4	Commerce & Business Management

<table>
<tr><td></td><td>

5	Architecture & Planning
6	Hospitality & Tourism Management
7	Humanities & Social Studies

The Item is placed before the Standing Committee of Academic Council for approval please.
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<tr><td>**02.04**</td><td>

TO APPROVE COMPOSITION OF BOARDS OF STUDIES

24-Boards of Studies have been proposed for a period of two years from 01.10.17 to 30.09.19. (**ANNEXURE-IV: Pages 34-88)**.

S.N.	Board of Studies
1	Architecture & Planning
2	Agriculture Engineering
3	Agriculture Sciences
4	Biotechnology
5	Chemical Engineering
6	Chemistry
7	Civil Engineering
8	Commerce and Business Management
9	Computer Applications
10	Computer Science & Engineering
11	Electrical & Electronics Engineering
12	Electrical Engineering
13	Electronics Engineering
14	Environmental Science & Technology
15	Food Science & Technology
16	Hospitality & Tourism Management
17	Humanities & Social Studies
18	Information Technology
19	Marine Engineering
20	Mathematics
21	Mechanical Engineering
22	Pharmacy
23	Physics
24	Textile Engineering

The Item is placed before the Standing Committee of Academic Council for approval please.
</td><td>Approved.</td></tr>
</table>

02.05	**TO APPROVE UNDER GRADUATE SYLLABI** Under graduate syllabi as detailed below have been proposed (**ANNEXURE-V: Pages 89-771)**.	These syllabi be put up before the concerned Faculty for consideration and approval.

S.N.	Under Graduate Syllabi	Page No
1	B.Sc. (Agriculture) 4th Sem. 2016 Batch onwards	89-95
2	B.Sc. (Medical Lab. Science) 5th – 6th Sem. 2016 Batch onwards	96-104
3	B.Tech. (Civil Engg.) 5th – 8th Sem. 2016 Batch onwards	105-131
4	B.Tech. (Automobile Engg.) 3rd – 6th Sem. 2016 Batch onwards	132-162
5	B.Tech. (Electrical & Electronics Engg.) 5th – 6th Sem. 2016 Batch onwards	163-186
6	B.Tech. (Electronics & Communications Engg.) 3rd – 8th Sem. 2016 Batch onwards	187-246
7	B.Tech. (Electronics & Telecommunications Engg.) 3rd – 8th Sem. 2016 Batch onwards	247-306
8	B.Tech. (Electronics & Instrumentation Engg.) 3rd – 8th Sem. 2016 Batch onwards	307-359
9	B.Tech. (Information Technology) 5th – 6th Sem. 2016 Batch onwards	360-377
10	B.Tech. (Marine Engg.) 3rd – 6th Sem. 2016 Batch onwards	378-408
11	Bachelor of HMCT 3rd – 4th Sem. 2016 Batch onwards	409-426
12	Bachelor of Management Studies (Airlines, Tourism and Hospitality) Sem. 1st – 2nd 2017 Batch onwards	427-437
13	Bachelor of Management Studies (Airlines, Tourism and Hospitality) Sem. 1st – 6th2016 Batch	438-458
14	Bachelor of Management Studies (HMCT) Sem. 1st – 6th 2016 Batch onwards	459-522
15	Soft Skills I-IV	523-526
16	UG Open Electives-I 2016 Batch onwards	527-536
17	UG Open Electives-II 2016 Batch onwards	537-545
18	UG Open Electives-III 2016 Batch onwards	546-549
19	Bachelor of Hotel Management & Catering Technology Sem. 1st – 8th	550-620

<table>
<tr>
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<table>
<tr><td></td><td>updated on 17.2.18 for 2016 Batch onwards</td><td></td></tr>
<tr><td>20</td><td>B.Tech. (Electrical Engg.) 5^{th} – 6^{th} Sem. updated on 16.2.18 for 2016 Batch onwards</td><td>621-660</td></tr>
</table>
The Item is placed before the Standing Committee of Academic Council for approval please.
</td>
<td></td>
</tr>
<tr>
<td>02.06</td>
<td>
TO APPROVE POST GRADUATE SYLLABI
Post graduate syllabi have been proposed (ANNEXURE-VI: Pages 772-956).
<table>
<tr><th>S.N.</th><th>Post Graduate Syllabi</th><th>Page No</th></tr>
<tr><td>1</td><td>M.Sc. (Fashion Technology) Sem. 1^{st} – 4^{th} 2016 Batch</td><td>772-788</td></tr>
<tr><td>2</td><td>M.Sc. (Fashion Technology) Sem. 1^{st} – 4^{th} 2017 Batch onwards</td><td>789-813</td></tr>
<tr><td>3</td><td>M.Tech. ECE (Microelectronics) Sem. 1^{st} – 4^{th} 2016 Batch onwards</td><td>814-837</td></tr>
<tr><td>4</td><td>M.Tech ECE Sem. 1^{st} – 4^{th} 2016 Batch onwards</td><td>838-862</td></tr>
<tr><td>5</td><td>M.Tech. (Production Engineering) Sem. 1^{st} – 4^{th} 2016 Batch onwards</td><td>863-883</td></tr>
<tr><td>6</td><td>PG Open Electives-I 2016 Batch onwards</td><td>884-909</td></tr>
<tr><td>7</td><td>PG Open Electives-II 2016 Batch onwards</td><td>910-932</td></tr>
<tr><td>8</td><td>M.Sc. (Food Technology) 2018 Batch onwards</td><td>933-955</td></tr>
<tr><td>9</td><td>PG Open Electives 2018 Batch onwards</td><td>956-957</td></tr>
</table>
The Item is placed before the Standing Committee of Academic Council for approval please.
</td>
<td>These syllabi be put up before the concerned Faculty for consideration and approval.</td>
</tr>
<tr>
<td>02.07</td>
<td>
TO APPROVE B.TECH. 1^{ST} YEAR 2018 BATCH STUDY SCHEME & SYLLABUS AS PER GUIDELINES OF AICTE
It is proposed to adopt B.Tech. 1^{st} Year 2018 Batch Study Scheme & Syllabus as per guidelines of AICTE with small modifications, wherever necessary (ANNEXURE-VII: Pages 958-979).
The Item is placed before the Standing Committee of Academic Council for approval please.
</td>
<td>This syllabus be put up in the meeting of Chairpersons of the concerned Boards of Studies.</td>
</tr>
</table>

<table>
<tr>
<td>02.08</td>
<td>
TO APPROVE STARTING OF NEW PROGRAMMES IN DEPARTMENT OF PHARMACEUTICAL SCIENCES & TECHNOLOGY AT MRSPTU MAIN CAMPUS

It is proposed to start the following Programmes in Department of Pharmaceutical Science & Technology at MRSPTU Main Campus from the Academic Session 2018-19 (ANNEXURE-VIII: Page 980).

<table>
<tr><th>S. No.</th><th>Programmes</th><th>Annual Intake</th></tr>
<tr><td>1.</td><td>B.Pharm.</td><td>60</td></tr>
<tr><td>2.</td><td>M.Sc. Clinical Research</td><td>60</td></tr>
<tr><td>3.</td><td>M.Sc. Biotechnology</td><td>60</td></tr>
</table>
The Item is placed before the Standing Committee of Academic Council for approval please.
</td>
<td>
1. B.Pharm. was approved with effect from 2018-19 session for 60 seats
2. M.Sc. in Clinical Research was approved with effect from 2018-19 session for 15 seats
3. M.Sc. Biotechnology was approved with effect from 2019-20 session for 15 seats
</td>
</tr>
<tr>
<td>02.09</td>
<td>
TO APPROVE STARTING OF NEW PROGRAMMES IN DEPARTMENT OF FOOD SCIENCE & TECHNOLOGY AT MRSPTU MAIN CAMPUS

It is proposed to start the following Programmes in Department of Food Science & Technology at MRSPTU Main Campus from the Academic Session 2018-19 (ANNEXURE-IX: Page 981).

<table>
<tr><th>S. No.</th><th>Programmes</th><th>Annual Intake</th></tr>
<tr><td>1.</td><td>M.Sc. Food Technology</td><td>30</td></tr>
<tr><td>2.</td><td>B.Sc. Food Technology</td><td>30</td></tr>
<tr><td>3.</td><td>B.Sc. Home Science</td><td>30</td></tr>
</table>
The Item is placed before the Standing Committee of Academic Council for approval please.
</td>
<td>
MSc in Food Technology was approved with effect from 2018-19 session with 30 seats in Science faculty.
</td>
</tr>
<tr>
<td>02.10</td>
<td>
B.Sc. (Hons.) PHYSICS, B.Sc. (Hons.) CHEMISTRY & B.Sc. (Hons.) MATHEMATICS AT MRSPTU MAIN CAMPUS

It is proposed to start the following Programmes in Department of Physics, Chemistry & Mathematics at MRSPTU Main Campus from the Academic Session 2018-19 (ANNEXURE-X: Page 982).
<table>
<tr><th>S. No.</th><th>Programmes</th><th>Annual Intake</th></tr>
<tr><td>1.</td><td>B.Sc. (Hons.) in Physics</td><td>60</td></tr>
<tr><td>2.</td><td>B.Sc. (Hons.) in Chemistry</td><td>60</td></tr>
<tr><td>3.</td><td>B.Sc. (Hons.) in Mathematics</td><td>60</td></tr>
</table>
The Item is placed before the Standing Committee of Academic Council for approval please
</td>
<td>
1. B.Sc. (Hons. School) in Mathematics was approved with effect from 2018-19 session with 60 seats.
2. B.Sc. (Hons. School) in Physics and Chemistry were deferred.
</td>
</tr>
</table>

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<tr>
<td>02.11</td>
<td>TO APPROVE STARTING OF NEW PROGRAMMES AT ARCHITECTURE DEPARTMENT GZSCCET, BATHINDA

It is proposed to start the following Programmes at GZSCCET Bathinda from the Academic Session 2018-19 (ANNEXURE-XI: Pages 983-991).

<table>
<tr><th>S.N.</th><th>Programmes</th><th>Annual Intake</th></tr>
<tr><td>1.</td><td>B. Planning (4 Yrs.)</td><td>30</td></tr>
<tr><td>2.</td><td>M. Planning</td><td>18</td></tr>
<tr><td>3.</td><td>M.Arch. (Building Engg. & Management)</td><td>18</td></tr>
</table>

The Item is placed before the Standing Committee of Academic Council for approval please.</td>
<td>1. B.Planning (4 yrs) was approved w.e.f. 2018-19 session with 15 seats
2. M.Planning and M.Arch. (Building Engg. & Management) was approved w.e.f. 2018-19 session with 18 seats each
3. Head Archi shall take care of the modalities required</td>
</tr>
<tr>
<td>02.12</td>
<td>TO APPROVE STARTING OF NEW PROGRAMMES AT PIT RAJPURA

It is proposed to start the following Programmes at PIT Rajpura from the Academic Session 2018-19 (ANNEXURE-XII: Page 992).

<table>
<tr><th>S.N.</th><th>Programmes</th><th>Annual Intake</th></tr>
<tr><td>1.</td><td>B.Tech. Computer Science & Engineering</td><td>60</td></tr>
<tr><td>2.</td><td>Skill Certificate Course in Computer Maintenance and Programming Assistant</td><td>60</td></tr>
<tr><td>3.</td><td>B.Tech. Computer Science & Engineering (LEET) for 2018 Batch only</td><td>60</td></tr>
</table>

The Item is placed before the Standing Committee of Academic Council for approval please.</td>
<td>1. B.Tech. (CSE) along with LEET was approved w.e.f. 2018-19 session for 60 seats
2. Skill Certificate Course in Computer Maintenance and Programming Assistant was approved w.e.f. 2018-19 session for 60 seats.</td>
</tr>
<tr>
<td>02.13</td>
<td>TO APPROVE STARTING OF NEW PROGRAMMES AT PIT NANDGARH

It is proposed to start the following Programmes at PIT Nandgarh from the Academic Session 2018-19 (ANNEXURE-XIII: Page 993).
<table>
<tr><th>S.N.</th><th>Programmes</th><th>Annual Intake</th></tr>
<tr><td>1.</td><td>B.Sc. Agriculture (Hons.) (4 Yrs.)</td><td>60</td></tr>
<tr><td>2.</td><td>B.Sc. (Non-Medical)</td><td>60</td></tr>
<tr><td>3.</td><td>Skill Certificate Course in Welding</td><td>30</td></tr>
<tr><td>4.</td><td>Skill Certificate Course in Plumbing</td><td>30</td></tr>
<tr><td>5.</td><td>Skill Certificate Course in Computer Maintenance and Programming Assistant</td><td>60</td></tr>
</table></td>
<td>Approved for B.Sc. Non-Medical for 60-seats along with Skill Certificate Courses in Welding and Plumbing for 30-seats each along with Skill Certificate Course in Computer Maintenance & Programming Asstt for 60-seats w.e.f. 2018-19</td>
</tr>
</table>

<table>
<tr><td></td><td>The Item is placed before the Standing Committee of Academic Council for approval please.</td><td></td></tr>
<tr><td>02.14</td><td>TO APPROVE STARTING OF NEW PROGRAMMES AT PIT GTB GARH MOGA

It is proposed to start the following Programmes at PIT GTB Garh from the Academic Session 2018-19 (ANNEXURE-XIV: Page 994).
<table>
<tr><th>S.N.</th><th>Programmes</th><th>Annual Intake</th></tr>
<tr><td>1.</td><td>BBA</td><td>60</td></tr>
<tr><td>2.</td><td>BCA</td><td>60</td></tr>
<tr><td>3.</td><td>B.Sc. (Non-Medical)</td><td>60</td></tr>
<tr><td>4.</td><td>B.Sc. Agriculture (Hons.) (4 Yrs.)</td><td>60</td></tr>
<tr><td>5.</td><td>Skill Certificate Course in Computer Maintenance and Programming Assistant</td><td>60</td></tr>
<tr><td>6.</td><td>Skill Certificate Course in Electrician</td><td>30</td></tr>
</table>
The Item is placed before the Standing Committee of Academic Council for approval please.</td><td>Approved for BBA & BCA for 60 seats each along with Skill certificate Course in Computer Maintenance & Programming Asstt for 60-seats w.e.f. 2018-19</td></tr>
<tr><td>02.15</td><td>TO APPROVE ACADEMIC CALENDER-2018

The Academic Calendar-2018 has been proposed (ANNEX-XV: Page 995).

The Item is placed before the Standing Committee of Academic Council for approval please.</td><td>Approved.</td></tr>
<tr><td>02.16</td><td>TO APPROVE HOLIDAYCALENDER-2018

The Holiday Calendar-2018 has been proposed (Annexure-XVI: Pages 996-998).

The Item is placed before the Standing Committee of Academic Council for approval please.</td><td>Approved.</td></tr>
<tr><td>02.17</td><td>TO APPROVE SIGNING OF MoU/AGGREMENT BY MRSPTU

The University has entered into MoU/Agreement (Annexure-XVII A: Pages 999-1059) with following Universities/Organizations,
<table>
<tr><th>S.N.</th><th>MoU/Agreement</th><th>Page No.</th></tr>
<tr><td>1</td><td>Wayne State University Detroit, Michigan, USA, Part-1, 2, 3</td><td>999-1016</td></tr>
<tr><td>2</td><td>Thompson Rivers University, Kamloops, BC, Canada</td><td>1017-1026</td></tr>
<tr><td>3</td><td>CALYXPOD, Josh Technology Group, Gurgaon, India</td><td>1027-1032</td></tr>
</table></td><td>Noted.
It was further decided that for every MoU/Agreement there shall be a Nodal Officer who shall be responsible for its effective implementation. He/She shall communicate with the colleges the advantages & highlights of these MoU/</td></tr>
</table>

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<tr>
<td></td>
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<table>
<tr><td>4</td><td>Central Tool Room, Ludhiana, India</td><td>1033-1035</td></tr>
<tr><td>5</td><td>Red Hat India Private Limited, Mumbai</td><td>1036-1049</td></tr>
<tr><td>6</td><td>Skills Anytime, Chandigarh of bksb India Pvt. Limited, a Subsidiary of bksb Limited, United Kingdom</td><td>1050-1056</td></tr>
<tr><td>7</td><td>‘Truechip’ Solutions Pvt. Ltd., Noida, The Verification IP Specialist</td><td>1057-1059</td></tr>
<tr><td>8</td><td>TiE Chandigarh Fostering Entrepreneurship, Chandigarh (Annexure-XVII B: Pages 1060-1063)</td><td>1060-1063</td></tr>
<tr><td>9</td><td>Centex International Pvt. Limited (Annexure-XVII C: Pages 1064-65)</td><td>1064-1065</td></tr>
</table>

The Item is placed before the Standing Committee of Academic Council for approval please
</td>
<td>Agreements.</td>
</tr>
<tr>
<td>02.18</td>
<td>TO INFORM INCLUSION OF MRSPTU IN LIST OF UNIVERSITIES UNDER SECTION 12(B) OF UGC ACT 1956

UGC has granted 12(B) status to University vide letter no. 9-11/2015 (CPP-I/PU) dated 3.1.2018 (Annexure-XVIII: Page 1066).

The Item is placed before the Standing Committee of Academic Council for information please.</td>
<td>Noted. It was further decided that the constituted grant committee shall do the necessary presentation cum motivations to all the deptts of GZSCCET, and Univ Main Campus, regarding the benefits of 12(B) status and how to get financial assistance from Central Funding agencies in the 1st phase</td>
</tr>
<tr>
<td>02.19</td>
<td>TO INFORM Ph.D. CANDIDATES ENROLLED/REGISTERED WITH MRSPTU UP TO 31.12.2017

The detailed list of Ph.D. candidates enrolled/registered with MRSPTU, Bathinda up to 31.12.2017 under various Disciplines is appended (ANNEXURE-XIX: Pages 1067-1071). The same stands uploaded on MRSPTU web-site also as per the UGC format.

The Item is placed before the Standing Committee of Academic Council for information please.</td>
<td>Noted.</td>
</tr>
<tr>
<td>02.20</td>
<td>TO RATIFY MINUTES OF DDRC’S MEETINGS HELD IN VARIOUS DISCIPLINES

To address research related issues at Ph.D. level in various Disciplines under different Faculties of MRSPTU, Department Doctoral Research Committees have met from time to time. Minutes of these meetings are appended (ANNEXURE-XX: Pages 1072-1092).</td>
<td>Ratified.</td>
</tr>
</table>

	The Item is placed before the Standing Committee of Academic Council for information please.	
02.21	**TO INFORM MRSPTU Ph.D. REGULATIONS-2016 WITH AMENDMENT** As per the provisions contained in UGC (Minimum Standards and Procedures for Award of M.Phil./Ph.D. Degree) Regulations, 2016, MRSPTU has modified its Ph.D. Regulations-2015 and notified the modified MRSPTU Ph.D. Regulations-2016 vide DAA/MRSPTU/Notification/20 dated 23.11.2017 and Amendment in Ph.D. Regulation 2016 in Clause No. 4.1 (ii) vide DAA/MRSPTU/Notification/22 dated 22.1.2018 **(ANNEXURE-XXI: Pages 1093-1121)**. **The Item is placed before the Standing Committee of Academic Council for information please.**	Noted.
02.22	**TO APPROVE 'INFORMATION TECHNOLOGY' AS ONE OF THE SPECIALIZATIONS IN MBA FOR UNIVERSITY MAIN CAMPUS, CONSTITUENT & AFFILIATED COLLEGES** It is proposed to include 'Information Technology' as one of the specializations in MBA for University Main Campus, Constituent & Affiliated Colleges **(ANNEXURE-XXII: Pages 1122-1123)**. **The Item is placed before the Standing Committee of Academic Council for approval please.**	1. 'Information Technology' as one of the specialization in MBA was approved. 2. It was further decided to start MBA in Hospitality and Tourism Mgt (MBHT) with 30 seats. (For this purpose, the BOS in Commerce & Mgt and Hospitality & Tourism Mgt will work together.
02.23	**TO INCLUDE MATH-III, MATH-IV AS THE CORE SUBJECTS OF B. TECH., ESPECIALLY B.TECH. MECH., ELECTRICAL, ECE and CSE& TO INCLUDE NUMERICAL METHODS IN 5th SEMESTER OF B.TECH. MECHANICAL AND ELECTRICAL** It is proposed to include Math-III, Math-IV as the core subjects of B. Tech, especially B. Tech. Mechanical, Electrical, ECE and CSE from the Academic Session 2018-19. Further, it is proposed to include Numerical Methods in 5th semester of B. Tech. Mechanical and Electrical (**ANNEXURE-XXIII: Page 1124)**. **The Item is placed before the Standing Committee of Academic Council for approval please.**	It was decided that Math-III, Math-IV and Numerical Methods may be offered/included as departmental electives in B. Tech for batches admitted on or before 2017

<table>
<tr><td>02.24</td><td>PROPOSAL TO MAKE PUNJAB STATE AERONAUTICAL ENGINEERING COLLEGE (PSAEC), PATIALA, A CONSTITUENT COLLEGE OF THE UNIVERSITY

A proposal to make Punjab State Aeronautical Engineering College (PSAEC), Patiala, a Constituent College of the University has been received by the University from the Govt. of Punjab. Chief Principal Secretary to Hon'ble Chief Minister convened a meeting with Additional Chief Secretary, Department of Technical Education & Industrial Training, Secretary, Civil Aviation and CEO, PSCAC in this regard. It was proposed to make PSAEC a Constituent College of MRSPTU, Bathinda subject to the approval of the Hon'ble Chief Minister for being the Civil Aviation Minister and also Chairman, Punjab State Civil Aviation Council (ANNEXURE-XXIV: Pages 1125-1130).

<table><tr><th>S. N.</th><th>Programme</th><th>Annual Intake</th></tr><tr><td>1.</td><td>B.Tech. Aeronautical Engg.</td><td>60</td></tr><tr><td>2.</td><td>B.Sc. (Hons.) Aircraft Maintenance</td><td>60</td></tr></table>
The Item is placed before the Standing Committee of Academic Council for approval please.</td><td>Noted.</td></tr>
<tr><td>02.25</td><td>TO INFORM THE STARTING OF SWAYAM PRABHA DISH CHANNELS IN GZSCCET, BATHINDA DEPARTMENTS

It is to inform that SWAYAM Prabha Dish Channels in GZSCCET, Bathinda (Constituent College) Departments have been started in 11 Departments of GZSCCET, Bathinda (ANNEXURE-XXV: Page 1131). Students are being motivated and registered for self-paced SWAYAM MOOCS.

The Item is placed before the Standing Committee of Academic Council for information please.</td><td>Noted.</td></tr>
<tr><td>02.26</td><td>TO INFORM THE OFFER TO AFFILIATED COLLEGES FOR STARTING NEW NON-AICTE PROGRAMMES FROM SESSION 2018-19

It is proposed to offer new Programmes in Affiliated Colleges from the Academic Session 2018-19. Complete list including new Programmes is attached (ANNEXURE-XXVI: Pages 1132-1134).

The Item is placed before the Standing Committee of Academic Council for information please.</td><td>Noted.</td></tr>
</table>

02.27	**TO INFORM THE SIGNING OF SERVICE LEVEL AGREEMENT (SLA) AND REGISTRATION WITH CDSL VENTURES LIMITED (CVL) TO CHOOSE CVL NATIONAL ACADEMIC DEPOSITORY (CVL NAD) AS ITS ACADEMIC DEPOSITORY** It is to inform that Maharaja Ranjit Singh Punjab Technical University has signed Service Level Agreement on 25.1.2018 with CDSL Ventures Limited (CVL) and registered to choose CVL NAD as National Academic Depository of the University. University will keep the academic awards in the digital format and ensure the data integrity. It is a 24x7 online mode for making available academic awards and helps in validating its authenticity, safe storage and easy retrieval. This Agreement is as per directions of UGC (**ANNEX-XXVII: Page 1135)**. **The Item is placed before the Standing Committee of Academic Council for information please.**	Noted.
02.28	**TO APPROVE THE MANDATORY CONDITIONS TO QUALIFY THE APPLICATION & EVALUATION PROCESS FOR FINANCIAL ASSISTANCE TO TRAVEL ABROAD AND ATTEND INTER-NATIONAL CONFERENCE (FOR GZSCCET, BATHINDA AND OTHER PITS' OF MRSPTU, BATHINDA).** Mandatory conditions to qualify the application & evaluation process for financial assistance to travel abroad and attend International conference (for GZSCCET, Bathinda and other PITS' of MRSPTU, Bathinda) have been proposed (**ANNEX-XXVIII: Pages 1136-1141).** **The Item is placed before the Standing Committee of Academic Council for approval please.**	Approved for MRSPTU Univ Campus, GZSCCET and PITs
02.29	**TO APPROVE THE STUDY SCHEMES OF NEW NON-AICTE PROGRAMMES OFFERED TO AFFILIATED COLLEGES FOR 2018 BATCH** Some new Non-AICTE Programmes have been offered to Affiliated Colleges from 2018 Batch. It is proposed to follow Syllabi/Study Schemes of these Programmes of other Universities for 2018 Batch students or till their Syllabi/Study Schemes are not ready **(ANNEXURE-XXIX: Pages 1142-1182).**	It was decided that these schemes/syllabi be first put up before the concerned Board of Studies and then to Concerned Faculty for consideration and approval before bringing it to Academic Council

S.N.	Study Schemes	Page No.
1	B.Sc. (Food Technology) Sem. 1st – 6th 2018 Batch onwards	1142-1144
2	B.Sc. (Garment Design) Sem. 1st – 6th 2018 Batch onwards	1145-1147
3	B.Sc. (Home Science) Sem. 1st – 6th 2018 Batch onwards	1148-1151
4	Bachelor of Management Studies (Rural Development) Sem. 1st – 6th 2018 Batch onwards	1152-1154
5	M.Sc. (Mathematics & Computing) Sem. 1st – 4th 2018 Batch onwards	1155-1156
6	B.Sc. (Hons.) (Agronomy) Sem. 1st – 8th 2018 Batch onwards	1157-1160
7	B.Com. (E-Commerce) Sem. 1st – 2nd 2018 Batch onwards	1161
8	B.Sc. (Animation & Multimedia Technology) Sem. 1st – 6th 2018 Batch onwards	1162-1164
9	B.Sc. (Computer Science) Sem. 1st – 6th 2018 Batch onwards	1165-1168
10	B.Sc. (Non- Medical) Sem. 1st – 6th 2018 Batch onwards	1169-1173
11	M.Sc. (Clinical Research) Sem. 1st – 4th 2018 Batch onwards	1174-1175
12	M.Sc. (Computer Science) Sem. 1st – 4th 2018 Batch onwards	1176-1178
13	Skill Certificate Course in Computer Hardware and Networking Sem. 1st 2018 Batch onwards	1179
14	Skill Certificate Course in Computer Proficiency-I, Sem. 1st 2018 Batch onwards	1180
15	Skill Certificate Course in Computer Proficiency-II, Sem. 1st 2018 Batch onwards	1181
16	Skill Certificate Course in Medical Lab. Technology Sem. 1st – 2nd 2018 Batch onwards	1182

The Item is placed before the Standing Committee of Academic Council for approval please.

02.30	**TO APPROVE Ph.D. REGISTRATION OF BHARAT KHURANA AND ROHIT BHATIA IN FACULTY OF PHARMACY** After successful completion of prescribed Course Work and subsequent acceptance of Research Proposals by DDRC, Ph.D. Candidates Bharat Khurana and Rohit Bhatia under the Faculty of Pharmacy have been issued the provisional registration letters **(ANNEXURE-XXX: Pages 1183-1184).** The Research Work titles as recommended by DDRC are: 1. Design and Development of Novel Drug Delivery Systems of Resveratrol for Treatment of Psoriasis. 2. Design, Synthesis and Evaluation of Coumarin Fused/Tethered Nitrogen containing Heterocycles as Anticancer Agents. **The Item is placed before the Standing Committee of Academic Council for approval please.**	Approved.
02.31	**TO APPROVE THE REMOVAL OF NEGATIVE MARKING FOR EVALUATION OF Ph.D. ADMISSION TEST** A proposal has been received to remove negative marking for evaluation of Ph.D. Admission Test **(ANNEX-XXXI: Page 1185).** **The Item is placed before the Standing Committee of Academic Council for approval please.**	Approved.
02.32	**TO APPROVE THE STARTING OF NEW NON-AICTE COURSES IN THE SAME CAMPUS BY THE EXISTING AFFILIATED TECHNICAL INSTITUTIONS AS PER NORMS OF THE UNIVERSITY/STATUTORY BODY** Existing Technical Institutions affiliated with the University willing to start new Non-AICTE Courses may be allowed to start the Course in the same Campus provided it fulfils all the norms/regulations regarding the infrastructure/faculty and other norms of the University/Statutory Body, without sharing the essential facilities, such as, Class Rooms, Laboratories, etc. with the already approved Technical Institution. However, Common Amenities, such as, Canteen, Auditorium, Playgrounds, Parking, etc. may be shared, provided it caters to all the students of all the Programmes **(ANNEXURE-XXXII: 1186-1188 Pages).** **The Item is placed before the Standing Committee of Academic Council for approval please.**	Approved.

02.33	**TO DISCUSS AND APPROVE B.TECH. (AERONAUTICAL ENGG.) SYLLABUS AS RECEIVED FROM PSCAC, PATIALA FOR 2018 BATCH ONWARDS** Punjab State Civil Aviation Council, Patiala has got prepared B.Tech. (Aeronautical Engg.) syllabus from NITTTR, Chandigarh (**ANNEXURE-XXXIII: Pages 1189-1378)** to be applicable from 2018 Batch. B.Tech First Year. syllabus of all branches of B.Tech. is common as per prevalent practice. B.Tech. 1st year syllabus for 2018 Batch as per guidelines of AICTE is given in **ANNEXURE-VII (Pages 958-979).** It is recommended that 1st year syllabus as given in **ANNEXURE-VII (Pages 958-979)** be applicable to B. Tech. (Aeronautical Engg.) **The Item is placed before the Standing Committee of Academic Council for discussion and approval please.**	Same B.Tech. 1st year syllabus will be followed for all the B.Tech. programmes including B.Tech. (Aeronautical Engg.) programme proposed by Punjab State Council for Civil Aviation, Patiala.
02.34	**TO AUTHORISE VICE CHANCELLOR TO TAKE DECISIONS IN CASE OF ANY URGENT ACADEMIC MATTERS** It is proposed to authorize the Vice Chancellor to take decisions in case of urgent academic matters, to be ratified later on by BoG. **The Item is placed before the Standing Committee of Academic Council for approval please.**	Approved.
	TABLE AGENDA	
02.35	**MRSPTU Ph.D. ADMISSION RELATED MATTERS** In addition, it was deliberated and decided that, 1. Heads of Departments may get 3 sets of Question Papers prepared in their discipline from the experts of elite institutions/Universities, including IITs, NITs and shall hand over these Question Papers to office of Dean (R&D). One from the available shall be used as a Ph.D. Entrance Test of the MRSPTU. 2. It was also decided that Ph.D. admissions shall be held twice in a year at the start of each academic session, however Ph.D. Admission entrance test shall be conducted only once per year. 3. Furthermore, it was decided that for admission to Ph.D. in Computer Sc & Engg., the existing Ph.D. eligibility qualifications shall also include BE/B.Tech. in any stream of Engg & Tech. **The Item is placed before the Standing Committee of Academic Council for consideration and approval please.**	Discussed and approved

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

DEAN ACADEMIC AFFAIRS,
MRSPTU, BATHINDA

SEMESTER 5th		Contact Hrs			Marks			Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
BCIE1-517	Design of Steel Structures-I	3	1	0	40	60	100	4
BCIE1-518	Transportation Engineering-I	3	1	0	40	60	100	4
BCIE1-519	Environmental Engineering-II	3	1	0	40	60	100	4
BCIE1-520	Geomatics Engineering	3	1	0	40	60	100	4
BCIE1-521	Disaster Management	2	0	0	40	60	100	2
BHUM0-F93	Soft Skills-III	0	0	2	60	40	100	1
BCIE1-522	Environmental Engineering Lab.	0	0	2	60	40	100	1
BCIE1-523	Transportation Engineering Lab.	0	0	2	60	40	100	1
BCIE1-524	Training-II (Survey Camp)#	0	0	4	60	40	100	2
	Total	**14**	**4**	**10**	**440**	**460**	**900**	**23**

 # 6-Week Training during summer vacations after 4th semester

SEMESTER 6th		Contact Hrs			Marks			Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
BCIE1-625	Design of Concrete Structures-II	3	1	0	40	60	100	4
BCIE1-626	Geotechnical Engineering	3	1	0	40	60	100	4
BCIE1-627	Numerical Methods in Civil Engineering	3	1	0	40	60	100	4
BCIE1-628	Structural Analysis-II	3	1	0	40	60	100	4
BCIE1-629	Estimating and Costing	3	0	0	40	60	100	3
BHUM0-F94	Soft Skills-IV	0	0	2	60	40	100	1
BCIE1-630	Geotechnical Engineering Lab.	0	0	2	60	40	100	1
BCIE1-631	Concrete Structures Drawing	0	0	2	60	40	100	1
	Total	**15**	**4**	**6**	**380**	**420**	**800**	**22**

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SEMESTER 7th		Contact Hrs			Marks			Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
BCIE1-732	Design of Steel Structures-II	3	1	0	40	60	100	4
BCIE1-733	Foundation Engineering	3	1	0	40	60	100	4
BCIE1-734	Irrigation Engineering-II	3	1	0	40	60	100	4
Departmental Elective-I (select any one)		3	1	0	40	60	100	4
BCIE1-756	Pre-Stressed Concrete							
BCIE1-757	Bridge Engineering							
BCIE1-758	Solid Waste Management							
BCIE1-759	Ground Improvement Techniques							
BCIE1-735	Steel Structures Drawing	0	0	2	60	40	100	1
BCIE1-736	Hydraulic Structures Drawing	0	0	2	60	40	100	1
BCIE1-737	Training-III (Practical)#	0	0	4	60	40	100	2
Total		**12**	**4**	**8**	**340**	**360**	**700**	**20**

 # 8-Week In-House / Industrial Training during summer vacations after 6th semester

SEMESTER 8th		Contact Hrs			Marks			Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
BCIE1-838	Transportation Engineering-II	3	1	0	40	60	100	4
BCIE1-839	Earthquake Resistant Design of Structures	3	1	0	40	60	100	4
Departmental Elective-II (select any one)		3	1	0	40	60	100	4
BCIE1-860	Hydrology & Dams							
BCIE1-861	Pavement Engineering							
BCIE1-862	Advanced Structural Analysis							
BCIE1-863	Advanced Reinforcing Techniques in Soils							
Open Elective-I (select any one)		3	0	0	40	60	100	3
BCIE1-840	Software Lab.	0	0	2	60	40	100	1
BCIE1-841	Advanced Testing Lab.	0	0	2	60	40	100	1
BCIE1-842	Major Project	0	0	6	60	40	100	2
Total		**12**	**3**	**10**	**340**	**360**	**700**	**19**

MRSPTU

DESIGN OF STEEL STRUCTURES – I

Subject Code: BCIE1-517 **L T P C** **Contact Hrs.: 45**
3 1 0 4

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Note: IS 800:2007, General construction in Steel-Code of practice is permitted in examination.

Unit - I

Introduction: Properties of structural steel, I.S. rolled sections, I.S. specifications. **Connections**: Riveted, bolted and welded connections for axial and eccentric loads.

Unit - II

Tension Members: Design of members subjected to axial tension using bolts and welds

Compression Members: Design of axially loaded members, built-up columns, laced and battened columns including the design of lacing and battens using bolts and welds.

Unit - III

Flexural Members: Design of laterally restrained and un-restrained rolled, encased beams using bolts and welds and introduction of built up sections.

Foundation: Design of slab base, gusseted base and grillage foundation using bolts and welds.

Unit - IV

Roof Truss: Design of roof truss using bolts and welds.

Books & Codes Recommended

1. S.K. Duggal, 'Limit State Design of Steel Structures', McGraw Hill.
2. N. Subramanian, 'Design of Steel Structures', Oxford Higher Education.
3. 'Design of Steel Structures', Vol. -1, Ram Chandra Standard Book House – Rajsons.
4. S S Bhavikatti, 'Design of Steel Structures' (by limit state method as per IS: 800-2007)', I.K. International Publishing House.
5. 'IS 800: 2007 (General construction in Steel-Code of practice)'.

MRSPTU

TRANSPORTATION ENGINEERING–I

Subject Code: BCIE1-518 **L T P C** **Contact Hrs.: 45**
3 1 0 4

Unit-I

Introduction: Importance of Transportation, Different Modes of Transportation, Characteristics of Road Transport.

Highway Development & Planning: Principles of Highway Planning, Road Development in India, Classification of Roads, Road Patterns, Planning Surveys.

Highway Alignment: Requirements, Alignment of Hill Roads, Engineering Surveys.

Unit-II

Highway Geometric Design: Cross Section Elements, Carriageway, Camber, Sight Distances, Horizontal Curves, Extra-widening, Super-elevation, Vertical Curves.

Highway Materials: Properties of Sub-grade and Pavement Component Materials, Tests on Sub-Grade Soil, Aggregates and Bituminous Materials.

Highway Construction: Earthen/Gravel Road, Water Bound Macadam, Wet Mix Macadam, Bituminous Pavements, Cement Concrete Pavements.

Unit-III

Introduction to Pavements Design: Types and Introduction of pavements design.

Highway Drainage and Maintenance: Importance of drainage and maintenance, Surface Drainage and Subsoil Drainage, Construction in Water-logged areas, Pavement Failures, Pavement Evaluation, Maintenance and Strengthening Measures.
Highway Economics & Financing: Total Transportation Cost, Economic Analysis, Sources of Highway Financing.

Unit-IV

Traffic Characteristics: Road User Characteristics, Driver Characteristics, Vehicular Characteristics.
Traffic Studies: Volume Studies, Speed Studies, O-D Survey, Parking Study.
Traffic Safety and Control Measures: Traffic Signs, Markings, Islands, Signals, Cause and Type of Accidents, Use of Intelligent Transport System.
Traffic Environment Interaction: Noise Pollution, Vehicular Emission, Pollution Mitigation Measures.

Recommended Books

1. S.K. Khanna and C.E.G. Justo, 'Highway Engineering', Nem Chand and Brothers, Roorkee.
2. L.R. Kadiyali, 'Principles and Practice of Highway Engineering', Khanna Publishers, New Delhi.
3. S.K. Sharma, 'Principles, Practice & Design of Highway Engineering', S. Chand & Company Ltd., New Delhi.

Reference Books

1. C.A.O. Flaherty, 'Highway Engineering', Vol. 2, Edward Arnold, London.
2. Mannering, 'Principles of Highway Engineering & Traffic Analysis', Wiley Publishers, New Delhi.

MRSPTU

ENVIRONMENTAL ENGINEERING–II

Subject Code: BCIE1-519 **L T P C** **Contact Hrs.: 45**
3 1 0 4

UNIT -I

Introduction: Terms & definitions, systems of sanitation and their merits and demerits, system of sewerage, choice of sewerage system and suitability to Indian conditions.
Sewerage Systems: Generation and estimation of community Sewage, flow variations, storm water flow, types of sewers. Design of sewers and storm water sewers, construction & maintenance of sewers, sewer appurtenances, sewage pumping and pumping stations.

UNIT -II

House Drainage: Principles of house drainage, traps, sanitary fittings, systems of plumbing, drainage lay out for residences.
Characteristics of Sewage: Composition of domestic and industrial sewage, sampling, physical, chemical and microbiological analysis of sewage, biological decomposition of sewage, BOD and BOD kinetics, effluent disposal limits.

UNIT -III

Treatment of Sewage: Introduction to unit operations and processes - Primary treatment; screening (theory), grit chamber (theory and design), floatation units, sedimentation tanks(theory and design), Secondary treatment units; ASP (theory and design), Sequencing batch reactors (theory and design), Trickling filters (theory and design) Anaerobic systems; Anaerobic filters (theory), UASB (theory), Anaerobic lagoons, Sludge Handling and disposal; thickening, stabilization, dewatering, drying and disposal.

UNIT -IV

Introduction to Solid Waste Management Systems: Objective, Types and sources, Functional elements, Methods of solid waste management with their limitations.

Low Cost Sanitation Systems: Imhoff tanks (theory and design), septic tank (theory and design), soakage pit/soil absorption systems; stabilization ponds (theory and design); macrophyte ponds; oxidation ponds (theory and design); and constructed wetland systems.

Recommended Books

1. B.C. Punmia, Ashok Jain, 'Waste Water Engg. (Environmental Engg.-II)', Laxmi Publications, New Delhi.
2. Arcadio P. Sincero and Gregoria P. Sincero, 'Environmental Engg. - A Design Approach', Prentice Hall of India, New Delhi.
3. Metcalf & Eddy, 'Waste Water Engineering - Treatment and Reuse', TMH, New Delhi.
4. Howard S. Peavy, Donald R. Rowe & George Tchobanoglous, 'Environmental Engg.', International Edition, McGraw Hill.
5. S.K. Garg, 'Environmental Engineering (Vol. II)', Khanna Publishers, Delhi.

GEOMATICS ENGINEERING

Subject Code: BCIE1-520 **L T P C** **Contact Hrs.: 45**

3 1 0 4

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Unit-I

Photogrammetry: Introduction, Basic Principles, Photo-Theodolite, Elevation of a Point by Photographic Measurement, Aerial Camera, Vertical Photograph, Tilted Photograph, Scale, Crab and Drift, Flight Planning for Aerial Photography, Ground Control for Photogrammetry, Photomaps and Mosaics, Stereoscopic Vision, Stereoscopic parallax, Stereoscopic Plotting Instruments, Applications.

Unit-II

Remote Sensing: Introduction, Basic Principles, Electromagnetic (EM) Energy Spectrum, EM Radiations and the Atmosphere, Interaction of EM radiations with Earth's Surface, Types of remote sensing systems, Remote Sensing Observation Platforms, Satellites and their characteristics – Geostationary and sun-synchronous, Earth Resources Satellites, Meteorological satellites, Sensors, Types and their characteristics, Across track and Along track scanning, Applications of Remote Sensing.

Unit-III

Geographical Information System (GIS): Definition, GIS Objectives, Hardware and software requirements for GIS, Components of GIS, Coordinate System and Projections in GIS, Data structure and formats, Spatial data models – Raster and Vector, Data inputting in GIS, Data base design - editing and topology creation in GIS, Linkage between spatial and non-spatial data, Spatial data analysis – significance and type, Attribute Query, Spatial Query, Vector based spatial data analysis, Raster based spatial data analysis, Errors in GIS, Integration of RS and GIS data, GIS Applications, Introduction to GIS Software Packages.

Unit-IV

Global Positioning System (GPS): Introduction, Fundamental concepts, GPS system elements and signals, GPS measurements and accuracy of GPS, Satellite Movement, GPS Satellites, Co-ordinate systems - Geoids, Ellipsoid and Datum, Spheroid, Customized Local Reference

Ellipsoids, National Reference Systems, Worldwide Reference Ellipsoid, WGS 84, Differential-GPS, Classification of GPS receivers, GPS Applications.

Recommended Books

1. K.R. Arora, 'Surveying', Vol-III, Standard Book House, **2007**.
2. J.B. Campbell, 'Introduction to Remote Sensing', Taylor Publications, **2002.**
3. T.K. Chang, 'Geographic Information Systems', Tata McGraw Hill, **2002.**
4. Joseph George, 'Fundamentals of Remote Sensing', Universities Press, **2003**.
5. B.C. Punmia, A.K. Jain, 'Higher Surveying', Luxmi Publications, **2005**.
6. S.K. Duggal, 'Higher Surveying', Vol-III, Tata McGraw Hill.

Reference Books

1. I. Heywood, S. Cornelius, Steve Crver, 'An Introduction to Geographical Information Systems', Pearson Education, **2003**.
2. F.F. Sabbins, 'Remote Sensing Principles and Interpretation', W.H. Freeman and Company, **1985**.
3. E.D. Kaplan, 'Understanding GPS: Principles and Applications', Artec House.

DISASTER MANAGEMENT

Subject Code: BCIE1-521 **L T P C** **Contact Hrs.: 25**

2 0 0 2

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UNIT-I

Introduction to Disaster Management: Define and describe disaster, hazard, emergency, vulnerability, risk and disaster management; Identify and describe the types of natural and non-natural disasters. Important phases of Disaster Management Cycle.

Disaster Mitigation and Preparedness: *Natural Hazards*: causes, distribution pattern, consequences and mitigation measures for earth quake, tsunami, cyclone, flood, landslide drought etc. *Man-madehazards*: causes, consequences mitigation measures for various industrial hazards/disasters, Preparedness for natural disasters in urban areas.

UNIT-II

Hazard and Risk Assessment: Assessment of capacity, vulnerability and risk, vulnerability and risk mapping, stages in disaster recovery and associated problems.

Emergency Management Systems (EMS): Emergency medical and essential public health services, response and recovery operations, reconstruction and rehabilitation.

UNIT-III

Capacity Building: Gender sensitive disaster management approach and inculcate new skills and sharpen existing skills of government officials, voluntary activists, development of professional and elected representative for effective disaster management, role of media in effective disaster management, overview of disaster management in India, role of agencies like NDMA, SDMA and other International agencies, organizational structure, role of insurance sector, DM act and NDMA guidelines.

UNIT-IV

Application of Geoinformatics and Advanced Techniques: Use of Remote Sensing Systems (RSS) and GIS in disaster Management, early warning systems.

Case Studies: Lessons and experiences from various important disasters with specific reference to Civil Engineering.

Recommended/References Books

1. Iyengar, C.B.R.I., 'Natural Hazards in the Urban Habitat', Tata McGraw Hill Publications.
2. Jon Ingleton (Ed), 'Natural Disaster Management', Tudor Rose, Leicester.
3. R.B. Singh (Ed), 'Disaster Management', Rawat Publications.
4. ESCAP: 'Asian and the Pacific Report on Natural Hazards and Natural Disaster Reduction'.

SOFT SKILLS-III

Subject Code: BHUM0-F93 | **L T P C 0 0 2 1** | **Contact Hrs.: 25**

UNIT-1

Art of Writing: Introduction, Importance of Writing Creative Writing, Writing tips, Drawback of written communication.

Art of Business Writing: Introduction, Business Writing, Business Letter, Format and Styles, Types of business letters, Art of writing correct and precise mails, Understand netiquette.

UNIT-2

Body Language: Introduction- Body Talk, Forms of body language, uses of body language, Body language in understanding Intra and Inter-Personal Relations, Types of body language, Gender differences, Gaining confidence with knowledge of Kinesics.

UNIT-3

Team Building and Team Work: Introduction, Meaning, Characteristics of an effective team, Role of a Team Leader, Role of Team Members, inter group Collaboration Advantages, Difficulties faced, Group Exercises-Team Tasks and Role-Play, Importance of Group Dynamics.

UNIT-4

Time Management: Introduction, the 80-20 Rule, three secrets of Time Management, Time Management Matrix, Effective Scheduling, Time Wasters, Time Savers, Time Circle Planner, Difficulties in Time Management, Overcoming Procrastination.

Recommended Books

1. K. Alex, S. Chand Publishers.
2. R.C. Sharma and Krishna Mohan, 'Business Correspondence and Report Writing', TMH, New Delhi, **2016**.
3. N. Krishnaswami and T. Sriraman, 'Creative English for Communication', Macmillan.
4. Penrose, M. John, et al., 'Business Communication for Managers', Thomson South Western, New Delhi, **2007**.
5. Holtz, Shel, 'Corporate Conversations', PHI, New Delhi, **2007.**

ENVIRONMENTAL ENGINEERING LAB.

Subject Code: BCIE1-522 | **L T P C 0 0 2 1** | **Contact Hrs.: 24**

EXPERIMENTS

1. To measure the pH value of a water and waste water samples.
2. To determine optimum Alum dose for Coagulation.
3. To find MPN for the bacteriological examination of water.
4. To find the turbidity of a given waste water and water samples.
5. To find B.O.D. of a given waste water sample.

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6. To measure D.O. of a given sample of water.
7. Determination of Hardness of a given water sample.
8. Determination of total solids, dissolved solids, suspended solids of a given water sample.
9. To determine the concentration of sulphates in water and waste water samples.
10. To find chlorides in given samples of water and waste water.
11. To find acidity and alkalinity of water samples.
12. To determine the COD of a waste water sample.

Recommended Books

1. Sawyer & McCarty, 'Chemistry for Environmental Engg. and Science', TMH, New Delhi.

TRANSPORTATION ENGINEERING LAB.

Subject Code: BCIE1-523 **L T P C** **Contact Hrs.: 25**
0 0 2 1

Unit-I

Tests on Sub-Grade Soil

1. Proctor's Compaction Test
2. California Bearing Ratio Test

Unit-II

Tests on Road Aggregates

1. Crushing Value Test
2. Los Angles Abrasion Value Test
3. Impact Value Test
4. Shape Test (Flakiness and Elongation Index)

Unit-III

Tests on Bituminous Materials

1. Penetration Test
2. Ductility Test
3. Softening Point Test
4. Flash & Fire Point Test

Lab. Manuals

1. S.K. Khanna and C.E.G. Justo, 'Highway Material & Pavement Testing', Nem Chand and Brothers, Roorkee.

TRAINING-II (SURVEY CAMP)

Subject Code: BCIE1-524 **L T P C**
0 0 4 2

Survey Camp up to 4 weeks' duration, out of which 1 week will be spent at site covering 2 shifts per day which will be equivalent to 2 weeks of on-site field study and training. Rest of 2 weeks will be spent at the Institute for preparation of Survey sheet including of contour map.

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DESIGN OF CONCRETE STRUCTURES-II

Subject Code: BCIE1-625 **L T P C** **Contact Hrs.: 45**
3 1 0 4

Note: Indian Standards-IS 456, IS 3370 and Design Aid SP-16 are permitted in examination.

UNIT-I

1. Design of Foundations – Concept, Application, Types, Components of Footing, Design of Isolated Footing (Square, Rectangular), Combined Footing (Rectangular, Trapezoidal & Strap footing) and Raft Foundation.
2. Design of Stairs: Introduction, Elements of Stairs-Tread, Rise, Flight, Landing, Types of Stairs, Design and Reinforcement detail of Stairs.

UNIT-II

3. Design of Compression Members: Classifications (According to Shape, Length and loading conditions), Assumptions, Guidelines as per Indian Standards, Behavior of Compression Members, Short Compression Members under Axial Load with Uni-axial and Bi-axial Bending, Design of Slender (Long) Columns.

UNIT-III

4. Design of Beams (Continuous and Curved): Definition, Behavior, Design of Continuous beams and Curved beams, Reinforcement detailing.
5. Design of Retaining Walls: Classification, Elements-Stem, Base, Heel, Toe, Behavior and design of Cantilever and Counterfort type retaining wall.

UNIT-IV

6. Design of Domes: Types, Components, Design of Spherical and Conical Dome.
7. Water Tanks: Introduction, Types & uses of Underground water tanks, ground water tanks, Design of Circular and Rectangular water tanks resting on ground, Design of OHSR.

Recommended Books

1. N. Subramanian, 'Design of Reinforced Concrete Structures', Oxford University Press.
2. Pillai & Menon, 'Reinforced Concrete Design', Tata McGraw Hill Education.
3. P.C. Varghese, 'Limit State Design of Reinforced Concrete', Prentice Hall of India Pvt. Ltd.
4. Raju N. Krishna, 'Reinforced Concrete Elements'.
5. Mallick and Rangasamy, 'Reinforced Concrete', Oxford-IBH.

GEOTECHNICAL ENGINEERING

Subject Code: BCIE1-626 **L T P C** **Contact Hrs.: 45**
3 1 0 4

Unit-I

Basic Concepts: Definition of soil, Soil mechanics and its application in Civil Engineering, Major soil deposits in India, Weight volume relationship, Index and engineering properties of soil, Classification of soil (IS and Unified Soil Classification System).

Unit –II

Compaction: Compaction, Concept of O.M.C. and zero Air Void Line, Standard and Modified proctor test, Factors affecting compaction, Effect of compaction on engineering soil properties, Field compaction methods their comparison of performance and relative suitability, Field control of compaction by proctor needle.

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Permeability of Soil: Concept of effective stress principle, Critical hydraulic gradient and quick sand condition, Capillary phenomenon in soil, Darcy's law and its validity, Co-efficient of permeability and its determination by Constant Head Permeability test and Variable Head Permeability test, Average permeability of stratified soils, Factors affecting coefficient of permeability.

Unit-III

Consolidation: Consolidation, Difference between compaction and consolidation, Concept of various consolidation characteristics, Primary and secondary consolidation, Terzaghi's theory for one-dimensional consolidation, Consolidation test, Determination of coefficient of consolidation from curve fitting methods, Normally consolidated and over consolidated clays, Importance of consolidation settlement in the design of structures, e-logP curve.

Unit-IV

Shear Strength: Shear Strength, Stress analysis of a two - dimensional stress system by Mohr circle, Revised Mohr-Coulomb's law of shear strength, Relations between principle stresses at failure, Types of shear strength tests, Skempton's pore pressure parameters. .

Stability of Slopes: Slope failure, base failure and toe failure, Swedish circle and Frictional circle methods for c-φ-soils, Taylor's stability number, Stability charts.

Recommended Books

1. K.R. Arora, 'Soil Mech. & Foundation Engg', Standard Publishers Distributors.
2. P. Purshotama Raj, 'Geotechnical Engineering', Tata McGraw Hill.
3. V.N.S. Murthy, 'Soil Mech. & Foundation Engg', CBS Publishers & Distributors.
4. B.M. Das, 'Principle of Geotechnical Engineering', Cengage Publisher.
5. Gopal Ranjan and A.S.R. Rao, 'Basic and Applied Soil Mechanics', New Age International Publishers.
6. Joseph E. Bowle 'Physical & Geotechnical Properties of Soil'.

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NUMERICAL METHODS IN CIVIL ENGINEERING

Subject Code: BCIE1-627 **L T P C** **Contact Hrs.: 45**

3 1 0 4

UNIT-I

Equation: Roots of algebraic transcendental equation, Solution of linear simultaneous equations by different methods using Elimination, Iteration, Inversion, Gauss-Jordan and method, Homogeneous and Eigen Value problem, Non-linear equations.

UNIT-II

Finite Difference Technique: Initial and Boundary value problems of ordinary and partial differential equations, Solution of Various types of plates and other civil engineering related problems.

UNIT-III

Numerical Integration: Numerical Integration by trapezoidal and Simpson's rule.

Statistical Methods: Method of correlation and Regression analysis for fitting a polynomial equation by least square

UNIT-IV

Initial Value Problem: Galerkin's method of least square, Initial Value problem by collocation points, Runge-Kutta Method.

Interpolation: Newton's Backward, Forward and Lagrange's Interpolation methods.

Recommended Books

1. James B. Scarborough, 'Numerical Mathematical Analysis', Oxford and IBH Publishing,
2. S.S. Sastry, 'Introductory Methods of Numerical Analysis', PHI Learning, **2012**.
3. Xundong Jia and Shu Liu, Dubuque, Iowa, 'Introduction to Computer Programming and Numerical Methods', Kendall/Hunt Publishing Co.
4. J.B Dixit, 'Numerical Methods', USP, Laxmi Publication.
5. C.P. Gandhi, 'Numerical Methods'.

STRUCTURAL ANALYSIS-II

Subject Code: BCIE1-628 **L T P C** **Contact Hrs.: 45**
3 1 0 4

Unit-I

Analysis of Statically Indeterminate Structures: Degree of static and kinematic indeterminacies, analysis of indeterminate beams, rigid frames and trusses by method of consistent deformation, law of reciprocal deflections, method of least work, induced reactions on statically indeterminate beams & rigid frames due to yielding of supports.

Fixed & Continuous Beams: Introduction, Analysis of fixed beams by moment-area theorem and strain energy method, fixed end moments due to different types of loadings, sinking and rotation of supports, bending moment and shear force diagrams for fixed beams, slope and deflection of fixed beams, analysis of continuous beams by the Three moment equation (Clapeyron's theorem) due to different types of loadings, effect of sinking of supports, BMDs.

Unit-II

Slope-Deflection Method: Introduction, slope-deflection equations, analysis of statically indeterminate beams and rigid frames (sway and non-sway type) due to applied loads and uneven support settlements.

Moment-Distribution Method: Introduction, absolute and relative stiffness of members, stiffness and carry-over factors, distribution factors, analysis of statically indeterminate beams and rigid frames (sway and non-sway type) due to applied loads and uneven support settlements, symmetrical beams and frames with symmetrical, skew-symmetrical and general loading.

Unit-III

Rotation Contribution Method: Introduction, basic concept, analysis of statically indeterminate beams and rigid frames (sway and non-sway type) due to applied loadings and yielding of supports, symmetrical beams and frames, general case-storey columns unequal in height and bases fixed or hinged.

Approximate Methods of Structural Analysis: Introduction, Vertical and lateral load analysis of multistory frames, portal, cantilever and substitute-frame methods and their comparison.

Unit-IV

Two Hinged Arches: Introduction, Analysis of two hinged arches for Horizontal Thrust, Bending Moment, Normal Thrust, and Radial Shear, Settlement (Foundation Yielding) and Temperature Effects, Rib Shortening and Shrinkage, Influence Lines for Two Hinged Arches.

Influence Lines for Statically Indeterminate Structures: Muller- Breslau principle for statically determinate and indeterminate beams, trusses and rigid frames, influence lines for reactions, shear force and bending moment for statically indeterminate beams, trusses and rigid frames.

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Recommended Books

1. C.S. Reddy, 'Basic Structural Analysis'.
2. C.K. Wang, 'Intermediate Structural Analysis'.
3. J. Sterling Kinney, 'Indeterminate Structural Analysis'.
4. B.C. Punima, 'Theory of Structures'.

ESTIMATING AND COSTING

Subject Code: BCIE1-629 **L T P C** **Contact Hrs.: 36**

3 0 0 3

Unit-I

Estimating: Different types of estimates, methods of estimating and scheduling quantities for the following works: Building, culverts, bridges, irrigation works, steel structures, road works, canal works, sanitary and water supply works, roofs, R.C.C. work.

Analysis of Rates: Schedule of rates (As per CSR Punjab-2016), Analysis of rates: earth work, brick masonry, stone masonry, cement concrete, RCC work, iron work, plastering, flooring, white washing, painting, wood work, Road work.

Unit–II

Specifications: Detailed specifications of the following: earth work in foundation, lean concrete in foundation, lime concrete in roof terracing, cement concrete, RCC, brick work, plastering, painting, C.C. floor, mosaic floor, white washing, distempering, varnishing, painting, doors and windows, DPC, cantering and shuttering, stone masonry, cement mortar, lime mortar, brick ballast, surkhi, cinder and sand.

Unit–III

Accounts Procedures: Regular and work charged establishment, pay bill, ACR, classifications of works, contract, tender, tender notice, earnest money, security money, arranging contract, power of accepting tender, daily labour, muster roll, classification of contracts, penalty, measurement book, account procedures of stores, issue rate, stock accounting, Introduction to forms and bills, Advance payment, hand receipt, refund of security money, cash book, imprest, deposit works, temporary advances, treasury challan, inventory, administrative approval, competent authority, building bye laws.

Unit-IV

Valuation: Gross income, net income, outgoing, scrap value, salvage value, obsolescence, annuity, capitalized value, year's purchase, sinking fund, depreciation, valuation of building, determination of depreciation, method of valuation, life of various items of works, mortgage lease, fixation of rates, plinth area required for residential building., Arbitration.

Recommended Books

1. B.N. Dutta, 'Estimating & Costing in Civil Engg.: Theory & Practice', UBS Publishers Distributors Ltd.
2. G.S. Birdie, 'Estimation and Costing in Civil Engineering', Dhanpat Rai Publishing Co. Ltd, New Delhi, **2011**.

Reference Books

1. M. Chakraborti, 'Estimation, Costing, Specifications and Valuation in Civil Engineering', National Halftone Co. Calcutta.
2. George H. Cooper, 'Building Construction Estimating'.
3. P.L. Bhasin, 'Estimating and Costing for Building & Civil Engg. Works'.

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4. 'Standard Schedule of Rates and Standard Data Book', Public Works Department.
5. I. S. 1200 (Parts I to XXV – 1974/ method of measurement of building and Civil Engineering works – B.I.S.)

SOFT SKILLS-IV

Subject Code: BHUM0-F94 **L T P C** **Contact Hrs.: 25**
0 0 2 1

UNIT-1

Art of Speaking: Introduction. Communication process. Importance of communication, channels of communication. Formal and informal communication. Barriers to communication. Tips for effective communication. tips for conversation. Presentation skills. Effective multi-media presentation skills. Speeches and debates. Combating nervousness. Patterns and methods of presentation. Oral presentation, planning and preparation.

UNIT-2

Group Discussion: Introduction. Importance of GD. Characters tested in a GD. Tips on GD. Essential elements of GD. Traits tested in a GD .GD etiquette. Initiating a GD. Nonverbal communication in GD. Movement and gestures to be avoided in a GD. Some topics for GD.

UNIT-3

Preparing Cv/Resume: Introduction – meaning – difference among bio-data, CV and resume. CV writing tips. Do's and don'ts of resume preparation. Vocabulary for resume, common resume mistakes, cover letters, tips for writing cover letters.

UNIT-4

Interview Skills: Introduction. Types of interview. Types of question asked. Reasons for rejections. Post-interview etiquette. Telephonic interview. Dress code at interview. Mistakes during interview. Tips to crack on interview. Contextual questions in interview skills. Emotional crack an interview. Emotional intelligence and critical thinking during interview process.

Recommended Books

1. K. Alex, S. Chand Publishers.
2. Lucas, Stephen E., 'The Art of Public Speaking', 11th Edn., International Edn., McGraw Hill Book Co., **2014**.
3. Goleman, Daniel, 'Working with Emotional Intelligence', Banton Books, London, **1998**.
4. Thrope, Edgar and Showick Trope, 'Winning at Interviews', Pearson Education, **2004**.
5. Turk, Christopher, 'Effective Speaking', South Asia Division: Taylor & Francis, **1985**.

GEOTECHNICAL ENGINEERING LAB.

Subject Code: BCIE1-630 **L T P C** **Contact Hrs.: 25**
0 0 2 1

1. Determination of in-situ density by core cutter method and Sand replacement method.
2. Determination of Liquid Limit & Plastic Limit.
3. Determination of specific gravity of soil solids by Pycono-meter method.
4. Grain size analysis of sand and determination of uniformity coefficient (Cu) and coefficient of curvature (Cc).
5. Determination of coefficient of permeability by Constant Head and Variable Head methods.

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6. Determination of optimum moisture content and maximum dry unit weight by standard Proctor's test and Modified Proctor's Test.
7. Unconfined Compression Test for fine grained soil.
8. Determination of cohesion intercept and angle of shearing resistance by direct shear test.
9. Determination of cohesion intercept and angle of shearing resistance by tri-axial test.
10. Determination of co-efficient of consolidation.
11. Demonstration of Standard Penetration Test (SPT).

Recommended Books

1. Shamsher Prakash and P.K. Jain, 'Soil Testing Engineering, Manual', Nem Chand & Brother.

CONCRETE STRUCTURES DRAWING

Subject Code: BCIE1-631 **L T P C** **Contact Hrs.: 25**
0 0 2 1

Structural Drawings of concrete elements such as Beams, Columns, Slabs, Stair Cases as per Reinforced Concrete Elements as per BTCIE1-625.

DESIGN OF STEEL STRUCTURES-II

Subject Code: BCIE1-732 **L T P C** **Contact Hrs.: 45**
3 1 0 4

MRSPTU

Note: IS: 800, General construction in Steel-Code of practice is permitted in examination

Unit-I

Plastic Analysis: Introduction, Design of Beams.
Plate Girder: Elements of a plate girder, design of a plate girder, curtailment of flanges, various type of stiffeners using bolts and welds.

Unit-II

Foot Bridge: Design of steel foot bridge with welded joints.

Unit-III

Industrial Buildings: Design of elements of industrial buildings: Gantry girder, Column bracket.

Unit-IV

Railway Bridge: Design of single track Railway Bridge with lattice girders having parallel chords (for B.G.)- Stringer, Cross girder, Main girders with welded joints, Portal sway bracings, Rocker and rollers bearing.

Recommended Books & Codes

1. S.K. Duggal, 'Limit State Design of Steel Structures'.
2. N. Subramanian, 'Design of Steel Structures'.
3. Ram Chandra, 'Design of Steel Structures', Vol. 2.
4. L.S. Negi, 'Design of Steel Structures'.
5. S.S. Bhavikatti, 'Design of Steel Structures (by limit state method as per IS: 800-2007).
6. IS 800: 2007 (General Construction in Steel-Code of Practice) *
7. SP: 6(1) (Handbook for Structural Engineers-Structural Steel Sections) *

FOUNDATION ENGINEERING

Subject Code: BCIEI-733 **L T P C** **Contact Hrs.: 45**
3 1 0 4

Note: **Relevant data should provide by Paper Setter with respect to design problems; if any.**

Unit–I

Soil Investigation: Soil Investigation for new and existing structures. Depth of exploration for different structures, spacing of bore Holes, Methods of soil exploration and relative merits and demerits. Types of soil sample. Design features of sampler affecting sample disturbance, Essential features and application of various types of samplers, Geophysical exploration by seismic and electrical resistivity methods, Standard Penetration Test and Plate load test, Bore hole log.

Stresses in Soil: Boussinesq's equation for a point load, uniformly loaded circular and rectangular area, pressure distribution diagrams, Isobars, New mark's chart and its construction, Approximate method of load distribution, Comparison of Boussinesq's and Westergaard analysis for a point load.

Unit-II

Earth Pressure: Terms and symbols used for a retaining wall, Movement of all and the lateral earth pressure, Earth pressure at rest, Rankine states of plastic equilibrium, Coefficient of active and passive earth pressures for horizontal backfills, Rankine’s theory both for active and passive earth pressure for Cohesion-less and cohesive backfill with surcharge and fully submerged case, Coulomb's method for cohesion less backfill, Merits and demerits of Ranking and Coulomb's theories, Culmann’s graphical construction (without surcharge load).

Unit-III

Shallow Foundation: Type of shallow foundations, Factors affecting choice of foundation, Definition of ultimate bearing capacity, safe bearing capacity and allowable bearing capacity, Terzaghi’s analysis. Types of failures, Factors affecting bearing capacity, Skempton’s equation, B.I.S. recommendations for shape, depth, inclination factors and water table corrections, Causes of settlement of structures, Comparison of immediate and consolidation settlement, calculation of settlement by plate load Test and Static Cone penetration test data, Allowable settlement of various structures according to I.S. Code, Introduction of rafts and floating foundation.

Unit-IV

Pile Foundations: Types, Necessity and uses of piles, Classification of piles, Types of pile driving hammers & their comparison, Determination of load carrying capacity of driven piles by dynamic formulae, Cyclic Pile Load Test, Determination of point resistance and frictional resistance of a single pile by Static formulas in sand and clay, Spacing of piles in a group, Group action of piles, Calculation of settlement of friction pile group in clay, Settlement of pile groups in sand, Negative skin friction.

Caissons and Wells: Major areas of use of caissons, advantages and disadvantages of open box and pneumatic caissons, Essential part of a pneumatic caisson, Components of a well foundation, Calculation of allowable bearing pressure, Conditions for stability of a well, Forces acting on a well foundation, Computation of scour depth.

Recommended Books

1. K.R. Arora, ‘Soil Mech. & Foundation Engg,’, Standard Publishers Distributors.
2. V.N.S. Murthy, ‘Soil Mech. & Foundation Engg.’.
3. Gopal Ranjan and A.S.R. Rao, ‘Basic and Applied Soil Mechanics’, New Age International.

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4. Muni Budhu, 'Soil Mech. & Foundations', Wiley, John Wiley & Sons.
5. Gulhati and Datta, 'Geotechnical Engineering', Tata McGraw Hill Education.

IRRIGATION ENGINEERING-II

Subject Code: BCIE1-734 **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 non-modular, 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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PRESTRESSED CONCRETE

Subject Code: BCIE1-756 **L T P C** **Contact Hrs.: 45**
3 1 0 4

Note: IS 1343 Code of Practice is permitted in the examination.

UNIT-I

Materials for Pre-stressed Concrete and Pre-stressing Systems:
High strength concrete and high tensile steel, tensioning devices, pre-tensioning systems, post tensioning systems.

UNIT-II

Analysis of Pre-stress and Bending Stresses:
Analysis of pre-stress, resultant stresses at a sector, pressure line or thrust line and internal resisting couple, concept of load balancing, losses of pre-stress, deflection of beams.

UNIT-III

Strength of Pre-Stressed Concrete Sections in Flexure, Shear and Torsion:
Types of flexural failure, strain compatibility method, IS:1343 code procedure, design for limit state of shear and torsion.

UNIT-IV

Design of Pre-Stressed Concrete Beams and Slabs:
Transfer of prestress in pre tensioned and post tensioned members, design of anchorage zone reinforcement, design of simple beams, cable profiles, Design of slabs.

Recommended Books

1. N. Krishna Raju, 'Pre-stressed Concrete', Tata McGraw Hill.
2. T.Y. Lin, Ned H. Burns, 'Design of Pre-Stressed Concrete Structures', John Wiley & Sons.
3. P. Dayaratnam, 'Prestressed Concrete', Oxford & IBH.
4. R. Rajagopalan, 'Pre-stressed Concrete'.
5. IS 1343 2012 Code of Practice for Pre-Stressed Concrete.

MRSPTU

BRIDGE ENGINEERING

Subject Code: BCIE1-757 **L T P C** **Contact Hrs.: 45**
3 1 0 4

UNIT-I

Introduction: Definition and components of a bridge, Classification of bridges, Choice of a bridge type. Investigation for bridges, Selection of bridge site, Determination of design discharge for River Bridge, Linear waterway, Economical span, Vertical clearance, scour depth, Afflux, Traffic projection.

Standard Specifications for Road Bridges: IRC Bridge Codes, Width of carriageway, Clearances, Dead load, I.R.C. standard live loads, Impact effect, Wind load, Longitudinal forces, Centrifugal forces, Horizontal forces due to water current, Buoyancy effect, Earth pressure, Deformation stresses, Erection stresses, Temperature effects, and Seismic force.

UNIT-II

Reinforced Concrete Bridges: Types of RCC bridges; Culverts - Box Culvert, Pipe Culvert, Solid slab bridge, T-beam girder bridges, Hollow girder bridges, Balanced cantilever bridges, Continuous girder bridges, Rigid frame bridges, Arch bridges, Pre-stressed concrete bridges.

Steel Bridges: Types of Steel bridges; Beam bridges, Plate girder bridges, Box girder bridges, Truss bridges, Arch bridges, Cantilever bridges, Cable stayed bridges, Suspension bridges.

UNIT-III

Sub-structure and Foundation: Piers and abutments, materials for piers and abutments, Types of foundations; Shallow, Pile, and Well foundations. Relative merits of piles and well foundations, Pneumatic Caissons, Box Caissons.

Bearings, Joints & Appurtenances: Importance of Bearings, Different types of bearings-Expansion Bearings, Fixed Bearings, Elastomeric Bearings, Expansion joints, Wearing Course, Approach Slab, Footpath, Handrails.

UNIT-IV

Construction and Maintenance of Bridges: Methods of construction of concrete and steel bridges. Formwork and false work for concrete bridges, Causes of Bridge failures, Inspection and maintenance, Bridge Management System.

Recommended Books

1. Johnson, Victor, 'Essentials of Bridge Engineering', Oxford University Press.
2. C.H. Khadilkar, 'A Text book of Bridge Construction', Allied Publishers.
3. S.C. Rangwala, 'Bridge Engineering', Charotar Publishing House Pvt. Ltd.
4. V.K. Raina, 'Concrete Bridges Handbook, Shroff Publishers and Distributors.
5. S. Ponnuswamy, 'Bridge Engineering', McGraw Hill Education.

MRSPTU

SOLID WASTE MANAGEMENT

Subject Code: BCIE1-758 **L T P C** **Contact Hrs.: 45**
3 1 0 4

UNIT-I

Sources and Composition of Municipal: Solid Waste Introduction, Sources of solid waste, Types of solid waste, Composition of solid waste and its determination, Types of materials recovered from MSW.

Properties of Municipal Solid Wastes: Physical properties of Municipal Solid Waste, Chemical properties of Municipal Solid Waste, Biological properties of Municipal Solid Waste, Transformation of Municipal Solid Waste.

UNIT-II

Solid Waste Generation and Collection: Quantities of Solid Waste, Measurements and methods to measure solid waste quantities, Solid waste generation and collection, Factors affecting solid waste generation rate, Quantities of materials recovered from MSW.

Handling, Separation and Storage of Solid Waste: Handling and separation of solid waste At site, Material separation by pick in, screens, float and separator magnets and electromechanical separator and other latest devices for material separation, Waste handling and separation at Commercial and industrial facilities, Storage of solid waste at the sources.

UNIT-III

Processing of Solid Waste: Processing of solid waste at residence e.g. Storage, conveying, compacting, Shredding, pulping, granulating etc., Processing of solid waste at Commercial and industrial site.

Disposal of Municipal Solid Waste: Combustion and energy recovery of municipal solid waste, effects of combustion, Landfill: Classification, planning, sitting, permitting, landfill processes, landfill design, landfill operation, Differentiate sanitary land fill and incineration as final disposal system for solid waste

UNIT-IV

Solid Waste Management: Municipal solid waste (management and handling) rules, hazardous waste (management and handling) rules, biomedical waste handling rules, Fly ash rules, recycled plastics usage rules, batteries (management and handling) rules.

Recommended Books

1. P.A. Vesilind, W. Worrell and D.R. Reinhart, ‘Solid Waste Engineering’, Thomson Books.
2. A.D. Bhide and B.B. Sundaresan, ‘Solid Waste Management, Collection, Processing and Disposal’, Nagpur.
3. G. Tchobanoglous, H. Theisen and S.A. Vigil, ‘Integrated Solid Waste Management’, McGraw Hill International Editions.
4. ‘Manual on Municipal Solid Waste Management’, CPHEEO, Ministry of Urban Development, Government of India.
5. ‘Management and Handling Rules for: Municipal Solid Waste, Biomedical Waste, Hazardous Waste and Radioactive Wastes’, Government of India Publications.

GROUND IMPROVEMENT TECHNIQUES

Subject Code: BCIE1-759 **L T P C** **Contact Hrs.: 45**
3 1 0 4

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UNIT-I

Introduction to Soil Improvement without the addition of Materials: Dynamic compaction equipment used - application to granular soils - cohesive soils - depth of improvement – environmental considerations - induced settlements - compaction using vibratory probes - vibro techniques vibro equipment - the vibro compaction and replacement process - control of verification of vibro techniques

- vibro systems and liquefaction - soil improvement by thermal treatment - preloading techniques - surface compaction introduction to bio technical stabilization

UNIT-II

Introduction to Soil Improvement with the addition of Materials: Lime stabilization - lime column method - stabilization of soft clay or silt with lime - bearing capacity of lime treated soils – settlement of lime treated soils - improvement in slope stability - control methods - chemical grouting – commonly used chemicals - grouting systems - grouting operations - applications - compaction grouting - introduction - application and limitations - plant for preparing grouting materials - jet grouting – jet grouting process - geometry and properties of treated soils - applications - slab jacking - gravel - sand - stone columns.

UNIT-III

Soil Improvement using Reinforcing Elements: Introduction to reinforced earth - load transfer mechanism and strength development - soil types and reinforced earth - anchored earth nailing reticulated micro piles - soil dowels - soil anchors - reinforced earth retaining walls.

UNIT-IV

Geotextiles: Behavior of soils on reinforcing with geotextiles - effect on strength, bearing capacity, compaction and permeability - design aspects - slopes - clay embankments - retaining walls – pavements.

Recommended Books

1. Moseley, 'Text Book on Ground Improvement', Blackie Academic Professional, Chapman & Hall.
2. R. Boweven, 'Text Book on Grouting in Engineering Practice', Applied Science Publishers Ltd.
3. R.A. Jewell, 'Text Book on Soil Reinforcement with Geotextiles', CIRIA Special Publication, Thomas Telford.
4. W.E. Van Impe, 'Text Book on Soil Improvement Technique & their Evolution', Balkema Publishers.
5. Donald. H. Gray & Robbin B. Sotir, 'Text Book On Bio Technical & Soil Engineering Slope Stabilization', John Wiley.
6. G.V. Rao & G.V.S. Rao, 'Text Book on Engineering with Geotextiles', Tata McGraw Hill.
7. Korener, 'Construction & Geotechnical Methods in Foundation Engineering', McGraw Hill.
8. S.K. Shukla and J.H. Yin, 'Fundamental of Geosynthetic Engineering', Taylor & Francis.
9. Swamisaran, 'Reinforced Soil and its Engineering Application', New Age Publication.
10. S.K. Gulati and M. Datta, 'Geotechnical Engineering', TMH.

STEEL STRUCTURES DRAWING

Subject Code: BCIEI-735 | **L T P C** **0 0 2 1** | **Contact Hrs.: 24**

MRSPTU

Structural Drawings of Steel Elements such as Connections, Tension Members, Compression Members, Beams, Foundations and Roof Trusses as BCIE1-732.

HYDRAULIC STRUCTURES DRAWING

Subject Code: BCIEI-736 | **L T P C** **0 0 2 1** | **Contact Hrs.: 24**

1. Unlined canal sections
2. Lined canal sections
3. Guide Bank
4. Weir/Barrage
5. Head/ Cross regulator
6. Canal Fall (Sarda/Inglis/Straight Glacis/Baffle Type)
7. Syphon Aqueduct
8. APM Outlet

TRAINING-III (PRACTICAL)

Subject Code: BCIEI-737 | **L T P C** **0 0 0 2**

Software Training or Industrial Training as per the interest of students. Field to be covered during;
Software Training: Relevant to Civil Engineering Fields.
Industrial Training: All type of Construction Projects of Civil Engineering
Note: Minimum period for training is 6-8 weeks.

TRANSPORTATION ENGINEERING-II

Subject code: BCIE1-838 **L T P C** **Contact hrs.: 45**
3 1 0 4

UNIT-I

Introduction to Railway Engineering: History of Railways, Development of Indian Railway, Organization of Indian Railway, Important Statistics of Indian Railways. Railway Gauge, Gauges on World Railways, Choice of Gauge, Uniformity of Gauge, Loading Gauge, Construction Gauge.

Railway Track: Requirements of a Good Track, Components of Railway Track: Rails, Sleepers, Ballast, Sub-grade and Formation, Track Fixtures & Fastenings, Coning of Wheels, Tilting of Rails, Adzing of Sleepers, Rail Joints, Creep of Rails.

UNIT-II

Geometric Design of Railway Track: Track Specifications on Indian Railways, Cross-Section of Single/Double Track, Alignment, Gradients, Horizontal Curve, Cant, Equilibrium Cant, Cant Deficiency, Cant Excess, Transition Curves.

Points and Crossings: Necessity, Functions, Layout and Working of a Turnout, Various types of Track Junctions and their layouts, Level-crossing.

UNIT-III

Railway Stations & Yards: Site Selection, Classification & Layout of Stations, Marshalling Yard, Locomotive Yard, Equipment at Railway Stations & Yards.

Signaling and Interlocking: Objectives, Classification of Signals, Types of Signals in Stations and Yards, Automatic Signaling, Principal of Interlocking.

Modernization of Railway Tracks: High Speed Tracks, Improvement in existing track for high speed, Ballast less Track, MAGLEV, TACV.

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UNIT-IV

Airport Planning: Aircraft Characteristics, Factors for Site Selection, Airport Classification, General Layout of an Airport, Approach Zones and Turning Zones,

Runway Orientation and Design: Head Wind, Cross Wind, Wind Rose Diagram, Basic Runway Length, Corrections, Geometric Design Elements, Runway Configuration.

Taxiway and Aircraft Parking: Aircraft Parking System. Main Taxiway, Exit Taxiway, Separation Clearance, Holding Aprons.

Visual Aids: Marking and Lighting of Runway and Taxiway, Landing Direction Indicator, and Wind Direction Indicator, IFR/VFR.

Recommended Books

1. S. Chandra and Aggarwal, 'Railway Engineering', M.M. Oxford University Press, New Delhi, **2007**.
2. S.C. Saxena and S.P. Arora, 'A Text Book of Railway Engineering', Dhanpat Rai and Sons, Delhi, **1997**.
3. J.S. Mundrey, 'Railway Track Engineering', McGraw Hill Publishing Co., **2009.**
4. S.K. Khanna, M.G. Arora and S.S. Jain, 'Airport Planning and Design', Nem Chand & Bros., Roorkee, **1999**.
5. R. Horenjeff, and F. McKelvey, 'Planning and Design of Airports', McGraw Hill Company, New York, **1994**.
6. Norman J. Ashford, Saleh Mumayiz, Paul H. Wright, 'Airport Engineering: Planning, Design and Development of 21st Century', Wiley Publishers, **2011.**

EARTHQUAKE RESISTANT DESIGN OF STRUCTURES

Subject code -BCIE1-839 **L T P C** **Contact Hrs.: 45**
3 1 0 4

Note: IS: 1893, IS: 4326 and IS: 13920 Code of practice is permitted in examination.

UNIT–I

Introduction to Structural Dynamics: – Theory of vibrations – Lumped mass and continuous mass systems – Single Degree of Freedom (SDOF) Systems – Formulation of equations of motion – Undamped and damped free vibration – Damping – Response to harmonic excitation – Concept of response spectrum. Multi-Degree of Freedom (MDOF) Systems: - Formulation of equations of motion – Free vibration – Determination of natural frequencies of vibration and mode shapes – Orthogonal properties of normal modes – Mode superposition method of obtaining response.

UNIT–II

Earthquake Analysis: - Introduction – Rigid base excitation – Formulation of equations of motion for SDOF and MDOF Systems – Earthquake response analysis of single and multistoried buildings – Use of response spectra. Codal Design Provisions: Review of the latest Indian seismic code IS:1893 – 2002 (Part-I) provisions for buildings – Earthquake design philosophy – Assumptions – Design by seismic coefficient and response spectrum methods – Displacements and drift requirements – Provisions for torsion.

UNIT–III

Earthquake Engineering: - Engineering Seismology – Earthquake phenomenon – Causes and effects of earthquakes – Faults – Structure of earth – Plate Tectonics – Elastic Rebound Theory – Earthquake Terminology –Source, Focus, Epicentre etc - Earthquake size – Magnitude and intensity of earthquakes – Classification of earthquakes– Seismic waves – Seismic zones – Seismic Zoning Map of India – Seismograms and Accelegrams. Codal Detailing Provisions: - Review of the latest Indian Seismic codes IS: 4326 and IS: 13920 provisions for ductile detailing of R.C buildings – Beam, column and joints

UNIT–IV

Aseismic Planning: - Plan Configurations – Torsion Irregularities – Re-entrant corners – Nonparallel systems – Diaphragm Discontinuity – Vertical Discontinuities in load path – Irregularity in strength and stiffness – Mass Irregularities – Vertical Geometric Irregularity – Proximity of Adjacent Buildings. Shear walls: Types – Design of Shear walls as per IS:13920 – Detailing of reinforcements**.**

Recommended Books

1. Clough & Penzien, 'Dynamics of Structures', International Edition, McGraw Hill.
2. Pankaj Agarwal & Manish Shrikhande, 'Earthquake Resistant Design of Structures', Prentice Hall of India, New Delhi.

Reference Books

1. A.K. Chopra, 'Dynamics of Structures', Pearson Education, Indian Branch, Delhi.
2. C.V.R. Murty, 'Earthquake Tips', I.I.T. Kanpur.
3. Mario Paaz, 'Structural Dynamics', IS Codes: IS:1893, IS:4326 and IS:13920.

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HYDROLOGY & DAMS

Subject Code: BCIE1-860 **L T P C** **Contact Hrs.: 45**
3 1 0 4

UNIT -I

Precipitation: Importance of hydrological data in water resources planning. The hydrologic cycle. Mechanics of precipitation, types and causes, measurement by rain gauges, Gauge net-works, hyetograph, averaging depth of precipitation over the basin, mass-rainfall curves, intensity duration frequency curves and depth area-duration curves.

UNIT -II

Interception, Evapotranspiration and Infiltration: Factors affecting interception, evaporation from free water surfaces and from land surfaces, transpiration, Evapotranspiration. Infiltration Factors affecting infiltration, rate, Infiltration capacity and its determination.

UNIT -III

Runoff: Factors affecting runoff, run-off hydrograph, unit hydrograph theory, S-curve hydrograph, Synder's synthetic unit hydrograph.

Peak Flows: Estimation of Peak flow-rational formula, use of unit hydrograph, frequency analysis, Gumbel's method, design flood and its hydrograph.

UNIT -IV

Gravity Dams-Non Overflow Section: Forces acting, Stability factors, stresses on the faces of dam, Design of profile by the method of zoning, elementary profile of a dam.

Arch and Buttress Dams: Classification of arch dam- constant radius, constant angle and variable radius, Cylinder theory, Expression relating central angle and Cross-Sectional area of arch. Types of buttress dams, Advantages of buttress dams.

Earth Dams: Components of earth dams and their functions, Phreatic line determination by analytical and graphical methods.

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Recommended Books

1. J. Nemec, 'Engineering Hydrology', Prentice Hall.
2. 'Engineering Hydrology', Stanley Buttler, John. Wiley.
3. TODD, 'Ground Water Hydrology', John Wiley.
4. Creager Justin & Hinds, 'Engineering for Dams', Vol. -II, -III, John Wiley.
5. S.K. Garg, 'Hydrology', Khanna Publishers.
6. H.M. Raghunath, 'Hydrology Principles, Analysis and Design', New Age Int. Publishers.

PAVEMENT DESIGN

Subject Code: BCIE1-861 **L T P C** **Contact Hrs.: 45**
3 1 0 4

Note: Use of IRC: 37-2012 and IRC: 58-2011 shall be allowed in the examination.

UNIT-I

Introduction: Types of pavement structure. Functions of pavement components, Factors affecting pavement design, Design wheel load, Strength characteristics of pavement materials. Comparison of flexible and rigid pavements.

UNIT-II

Design of Flexible Pavements: General design considerations, Methods for design of flexible pavements – Group Index Method, Triaxial Test Method, Hveem Stabilometer Method, McLeod's Method, Indian Roads Congress Method.

Design of Bituminous Mixes: Mix Design Approaches, Marshall Method of Bituminous Mix Design, Super pave.

UNIT-III

Design of Rigid Pavements: General design considerations, Wester Gard's Analysis, Methods for design of rigid pavements - PCA method, AASHTO Method, Indian Roads Congress Method, Types and design of Joints in cement concrete pavements.

UNIT-IV

Modern Design Concepts: Reinforced Concrete Pavement, Airport Pavement Design, Bituminous Pavement with Cemented Base, Interlocking Concrete Block Pavement, Full Depth Bituminous Pavement, Ultrathin White Topping, Perpetual Pavement, Pavement Overlays.

Recommended Books

1. E.J. Yoder and M.W. Witczak, 'Principals of Pavement Design', Wiley Publication.
2. S.K. Khanna and C.E.G. Justo, 'Highway Engineering', Nem Chand & Bros., Roorkee.
3. S.K. Sharma, 'Principles, Practice and Design of Highway Engineering', S. Chand & Co.
4. P. Chakraborty and A. Das, "Principles of Transportation Engineering", Prentice Hall India.
5. Yang H. Huang, 'Pavement Analysis and Design', Prentice Hall.

MRSPTU

ADVANCED STRUCTURAL ANALYSIS

Subject Code: BCIE1-862 **L T P C** **Contact Hrs.: 45**
3 1 0 4

UNIT-I

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.

UNIT-II

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-III

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-IV

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.

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. G.S. Pandit and S.P. Gupta, 'Structural Analysis, A Matrix Approach'.
2. William Weaver, Jr. James M. Gere, 'Matrix Analysis of Framed Structures'.
3. C.S. Reddy, 'Basic Structural Analysis'.
4. C.S. Krishnamurthy, 'Finite Element Analysis'.
5. O.C. Zeincwicz, 'Finite Element Methods'.

ADVANCED REINFORCING TECHNIQUES IN SOILS

Subject Code: BCIE1-863 | **L T P C** **3 1 0 4** | **Contact Hrs.: 45**

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UNIT-I

Geosynthetics: An overview of Geosynthetics, Description of Geotextiles – Geogrids – Geonets – Geomembranes –Geocomposites – Geocells – Designing with Geotextiles – Geotextile properties and test methods –Functions of Geotextile – Design methods for separation – stabilization – filtration – Drainage, Soil anchors.

UNIT-II

Reinforced Earth: The mechanisms of the reinforced earth techniques – Design principles – Materials used for construction – Advantages of reinforced earth – Reinforced earth construction with GI sheets and strips.

UNIT-III

Soil Anchors: Inclusions and Installation Techniques, Design of Soil Anchors, Application Criteria: Advantages and Limitations, Soil Nailing- concept, uses, applications and design methodology.

UNIT-IV

Coffer Dam: Braced cuts, Arching action of soil and its application, coffer dam's 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.

6. Robert M. Koerner, Designing with Geosynthetics, Prentice Hall – 1989
7. G.V. Rao & G.V.S. Suryanarayana Raju, Engineering with Geosynthetics, Tata McGraw Hill Publishing Co. New Delhi.
8. Korener, 'Construction & Geotechnical Methods in Foundation Engineering', McGraw Hill.
9. S.K. Shukla and J.H. Yin, 'Fundamental of Geosynthetic Engineering', Taylor & Francis.
10. Swamisaran, 'Reinforced Soil and its Engineering Application', New Age Publication.

SOFTWARE LAB.

Subject code -BCIE1-840	L T P C 0 0 2 1	Contact Hrs.: 24

Student can choose anyone software according to their choice.
1. STAAD-PRO
2. E-TAB
3. ARC VIEW GIS
4. MX ROAD
5. PLAXIS
6. PRIMA VERA

ADVANCED TESTING LAB.

Subject Code: BCIEI-841	L T P C 0 0 2 1	Contact Hrs.: 24

MRSPTU

1. Rebound Hammer Test
2. Ultrasonic Pulse Velocity Test
3. Reinforced Bar Locator Test
4. Cut and Pull Out (CAPO) Test
5. Fifth Wheel Bump Integrator Test
6. Benkelman Beam Deflection Test
7. Vehicular Speed Radar Test
8. Static Cone Penetration Test (SCPT).

Lab Manuals

1. M.L. Gambhir, 'Concrete Manual', Dhanpat Rai & Sons, Delhi.
2. M.S. Shetty, 'Concrete Technology, Theory & Practice', S. Chand & Company.
3. S.K. Khanna and C.E.G. Justo, 'Highway Material & Pavement Testing', Nem Chand.

MAJOR PROJECT

Subject code -BCIE1-842	L T P C 0 0 6 2	Contact Hrs.: 45

Students are required to work on practical projects in the field of Civil Engineering. The students have to work for 6 hrs per week with his / her supervisor(s).

SEMESTER 3rd		Contact Hrs			Marks			Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
BMEE3- 301	Mechanics of Materials	3	1	0	40	60	100	4
BMEE3-302	Applied Thermodynamics	3	1	0	40	60	100	4
BMEE3-303	Internal Combustion Engines	3	0	0	40	60	100	3
BMEE3-304	Manufacturing Processes	3	1	0	40	60	100	4
BMEE3-305	Automotive Materials	3	0	0	40	60	100	3
BHUM0-F91	Soft Skill - I	0	0	2	60	40	100	1
BMEE3-306	Machine Drawing	1	0	4	60	40	100	3
BMEE3-307	Mechanics of Materials Lab.	0	0	2	60	40	100	1
BMEE3-308	Internal Combustion Engine Lab.	0	0	2	60	40	100	1
BMEE3-309	Manufacturing Processes Lab.	0	0	2	60	40	100	1
BMEE3-310	*Workshop Training	0	0	4	60	40	100	2
Total		**16**	**3**	**16**	**560**	**540**	**1100**	**27**

*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.

SEMESTER 4th		Contact Hrs			Marks			Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
BMEE3- 411	Automotive Chassis Systems	3	1	0	40	60	100	4
BMEE3- 412	Mechanics of Machines	3	1	0	40	60	100	4
BMEE3- 413	Fluid Mechanics and Machinery	3	1	0	40	60	100	4
BMEE3- 414	Automotive Electrical Systems	3	1	0	40	60	100	4
BMEE3- 415	Automotive Fuels & Emissions	3	1	0	40	60	100	4
BHUM0 – F92	Soft Skill – II	0	0	2	60	40	100	1
BMEE3- 416	Automotive Chassis Systems Lab.	0	0	2	60	40	100	1
BMEE3- 417	Fluid Mechanics and Machinery Lab	0	0	2	60	40	100	1
BMEE3- 418	Automotive Electrical Systems Lab.	0	0	2	60	40	100	1
Total		**15**	**5**	**8**	**540**	**560**	**1100**	**24**

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SEMESTER 5th		Contact Hrs			Marks			Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
BMEE3- 519	Vehicle Body Engineering	3	1	0	40	60	100	4
BMEE3- 520	Automotive Transmissions	3	1	0	40	60	100	4
BMEE3- 521	Heat Transfer	3	1	0	40	60	100	4
BMEE3- 522	Design of Automotive Components	3	1	0	40	60	100	4
BMEE3- 523	Measurements and Instrumentation	3	1	0	40	60	100	4
BHUM0 –F93	Soft Skill – III	0	0	2	60	40	100	1
BMEE1- 524	Measurements and Instrumentation Lab.	0	0	2	60	40	100	1
BMEE1- 525	Automotive Transmissions Lab.	0	0	2	60	40	100	1
BMEE1- 526	Vehicle Body Engineering Lab.	0	0	2	60	40	100	1
BMEE1- 527	*Industrial Training	0	0	0	60	40	100	2
Total		**15**	**5**	**8**	**500**	**500**	**1000**	**26**

*Industrial training to be imparted at the end of 4th semester for six weeks

SEMESTER 6th		Contact Hrs			Marks			Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
BMEE3- 628	Computer Aided Automotive Design	3	1	0	40	60	100	4
BMEE3- 629	Automotive Heating, Ventilation & Air Conditioning	3	1	0	40	60	100	4
BMEE3- 630	Vehicle Dynamics	3	1	0	40	60	100	4
BMEE3- 631	Automotive Aerodynamics	3	1	0	40	60	100	4
BMEE3- 632	Vehicle Safety Engineering	3	1	0	40	60	100	4
BHUM0 – F94	Soft Skill - IV	0	0	2	60	40	100	1
BMEE3- 633	Computer Aided Automotive Design Lab.	0	0	2	60	40	100	1
BMEE3- 634	Automotive Heating, Ventilation & Air Conditioning Lab.	0	0	2	60	40	100	1
BMEE3- 635	Minor Project*	0	0	2	60	40	100	1
Department Elective – I (Select any one)		3	1	0	40	60	100	4
BMEE3-656	Servo Mechanism and Automatic Controls							
BMEE3-657	Design of Energy Systems							
BMEE3-658	Special Purpose Vehicles							
BMEE3-659	Tractor and Earth Moving Machinery							
BMEE3-660	Finite Element Analysis							
Total		**18**	**6**	**8**	**480**	**520**	**1000**	**28**

MECHANICS OF MATERIALS

Subject Code: BMEE3-301 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

UNIT-I

Simple, Compound Stresses and Strains: Stress and Strain and their types, Hook's law, longitudinal and lateral strain, Poisson's ratio, stress-strain diagram for ductile and brittle materials, Stress in a bar, Analysis of bars of varying sections, composite section, elastic constants and their significance, Temperature stress and strain calculation due to axial load and variation of temperature 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.

UNIT-II

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) Uniformity distributed loads over the whole span or part of span c) Combination of concentrated and uniformly distributed load.

Bending Stresses in Beams: Pure Bending or simple bending, Neutral axis and moment of resistance, Assumptions in the simple bending theory; derivation of formula and its application to beams of rectangular and circular section. Section modulus, section modulus for circular and rectangular section beam, combined direct and bending stresses, bending stress of composite / flitched beams.

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UNIT-III

Shear Stresses in Beams: Shear stress at a section, Shear stress distribution in rectangular and circular sections.

Torsion: Derivation of torsion equation, assumptions and its application to the hollow and solid circular shafts, Torsional rigidity, Power transmitted by the shaft, Modulus of rupture, comparison of solid and hollow shafts, principal stress and maximum shear stresses under combined loading of bending and torsion of circular shaft.

UNIT-IV

Columns and Struts: Introduction, failure of columns, Euler's formula and assumptions, different end conditions, Limitations of Euler's formula. Rankine-Gordon's formula. Theories of failure: Strain energy in tension, compression, shear, bending and torsion 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 to problems related to two dimensional stress systems.

Thin Cylinders: Calculation of Hoop stress, longitudinal stress in a thin cylinder, effect of internal pressure on the change in diameter, length and internal volume.

Recommended Books

1. R.K. Bansal, 'A text Book of Strength of Materials', Laxmi Publications.
2. Kirpal Singh, 'Mechanics of Materials', Standard Publishers and Distributors.
3. D.S. Bedi, 'Strength of Materials', Khanna Book Publishing Company.
4. E.P. Popov, 'Mechanics of Materials', Prentice Hall India.
5. S.S. Rattan, 'Strength of Materials', Tata McGraw Hill.

APPLIED THERMODYNAMICS

Subject Code: BMEE3-302 **L T P C** **Duration: 45 Hrs.**

3 1 0 4

UNIT-I

Air Compressors: Introduction; Classification; 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 extra flow work on T-s coordinates for un-cooled and cooled compression; Definitions of isentropic, polytropic and isothermal efficiencies and their representation in terms of ratio of areas representing various energy transfers on T-s coordinates.

UNIT-II

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, and 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 efficiency.

Positive Displacement Rotary Compressors: Introduction; Classification; Comparison of rotary compressors with reciprocating compressors; Construction, operation, work input and efficiency of rotary compressors like roots blower, Lysholm compressor and Vane Type Blower.

UNIT-III

Centrifugal Compressors: Construction and operation; Applications of Steady Flow Energy Equation and thermodynamics of dynamic compressors; Stagnation and static values of pressure, Temperature and enthalpy for flow through dynamic machines; Complete thermodynamic analysis of centrifugal compressor stage; Polytropic, isentropic and isothermal efficiencies; Complete representation of compression process starting from ambient air flow through 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 impeller and diffuser; 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; Working; 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 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; Comparison of axial flow compressor with centrifugal compressor; Field of application of axial flow compressors.

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UNIT-IV

Gas Turbines: Classification on the basis of system of operation (open and closed cycles) and on the basis of combustion (at constant volume or constant pressure); Comparison of open and closed cycles; Comparison of gas turbine with 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; Multistage compression and expansion; Dual Turbine system; Series and parallel arrangements; Closed and semi-closed gas turbine cycle; Requirements of a gas turbine combustion chamber; Gas turbine fuels.

Jet Propulsion: Principle of jet propulsion; Description of different types of jet propulsion system like rockets and thermal jet engines like (i) Athodyds (ramjet and pulsejet), (ii) Turbojet engine, (iii) Turboprop engine. Thermodynamics of turbojet engine components; Types of rocket motors (e.g. solid propellant and liquid propellant systems); Various common propellant combinations (i.e. fuels) used in rocket motors; Cooling of rockets; Advantages and disadvantages of jet propulsion over propulsion systems.

Recommended Books

1. R. Yadav and Rajay, 'Applied Thermodynamics', Central Publishing House.
2. P.K. Nag, 'Basic and Applied Thermodynamics', Tata McGraw Hill.
3. D.S. Kumar and V.P. Vasandani, 'Heat Engineering', Metropolitan Book Co. Pvt. Ltd.
4. D.G. Shephered, 'Principles of Turbo machinery', Macmillan.
5. G.F.C. Rogers and M. Sarvan, 'Gas Turbine Theory', Longmans.
6. S.M. Yahya, 'Elementary Gas Dynamics', Satya Prakashan.

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INTERNAL COMBUSTION ENGINES

Subject Code: BMEE3-303 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

UNIT-I

Fundamentals: Engine terminology, classification. Working principle of two stroke and four stroke engine, scavenging, scavenging processes. Thermodynamic cycles for automobile engine- Air standard cycle, Otto cycle, Diesel cycle, Dual cycle, Comparison between different cycles, Valve timing diagram for engine under different conditions, firing order, Factors affecting on selection of firing order, Square Engine, Wankel engine, Engine Mountings.

Constructional Details: Cylinder block, Engine cylinder, Cylinder liner, Cylinder Head and cover, Piston for C.I. and S.I. engine, Piston rings, Piston pin, connecting rod, Crank shaft, Main bearings, Cam shaft, Oil pan, Engine mountings and Engine balancing, Vibration Damper, Cam shafts & drives, Inlet and exhaust valves, Valve actuating mechanism including variable control system, Air cleaner, Manifold & gasket – intake and exhaust, silencer, tail pipe.

UNIT-II

Combustion in S.I. Engine: Ignition limits, Stages of combustion in petrol engine, Ignition lag, Effect of engine variables on ignition lag, Effect of engine variables on flame propagation, Abnormal combustion, Detonation, Effects of detonation, Theories of detonation, Effects of engine variables on knock, Control of knock. Surface ignition, Pre ignition, Post ignition, S.I. engine combustion chamber design, Types of combustion chambers for S.I. engine, Very high output combustion chamber engines.

Combustion in C.I. Engine: Air fuel ratio in C.I. engine, Stages of combustion in C.I. engine, Delay period, Variables affecting on delay period, Diesel knock, Methods of controlling diesel knock, C.I. engine combustion chamber, Direct injection type, Open type, Turbulent type, Pre chamber, M combustion chamber, Cold starting of C.I. engine- decompression devices, heater plug, inlet manifold heater, Chemical spray.

UNIT-III

Petrol Engine Fuel Supply System: Methods of fuel supply system- gravity system, pressure system, Vacuum system, pump system, Components of fuel supply system –Fuel tank, fuel pump (Mechanical and Electrical) Vapor return line, Air cleaner, Fuel filters, Carburetion, Functions of carburetor, simple carburetor, Limitations of simple carburetor, Types of Carburetor-Solex and SU carburetor, Special features of modern carburetor. Benefits of electronic fuel injection system.

Diesel Engine Fuel Supply System: Comparison of diesel engine with petrol engine, Requirements of diesel injection system, Fuel feed pump, Types of injection system, fuel injection pump, and fuel injectors. Fuel filter, air cleaner, Phasing and calibration of fuel injection pump, Injector Testing (pressure test, leak test) Electronic control of fuel injection system

Engine Friction, Lubrication and Lubricants: Total engine friction, Effects of engine variables on engine friction, Lubrication- Objectives of lubrication, Lubricants used, Requirements & selection of lubricants, Viscosity rating, Multi grade oil, Additives used in lubricant, Effects of engine variables on lubricating oil, Oil consumption, Different parts of engine to be lubricated, Types of lubrication system- petrol system, Wet sump method, Dry sump method, fully and partially pressurized lubrication system, Components of lubrication system- oil strainer, Oil filter and its types.

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UNIT-IV

Engine Cooling System: Distribution of heat supplied to engine, Necessity of engine cooling, Piston and engine Cylinder temperatures, Factors affecting on piston temperature, Types of cooling system, Air cooling system, Water cooling system, Thermosiphon cooling, Cooling with thermostatic regulator. Components of water cooling System-Radiator, Pressure Cap, Expansion Reservoir, Coolants, Thermostat, Water Pump, Viscous coupling, Comparison between water cooling and air cooling. Effects of over and under cooling.

Supercharging: Objects of supercharging, Relative power with and without supercharging, supercharging of spark ignition engine, Supercharging of C.I. engine, Effects of supercharging on performance of engine, Supercharging limits for S.I. and C.I. engine, Methods of super charging, Supercharges, Turbo charging, Comparison with supercharging, Methods of turbo charging, Limitations of turbo charging.

Performance Testing of Engine: Losses in the engine, Performance parameters, Performance curves, Methods of improving performance of engine, testing of engine, Classification of testing, Basic measurement- Speed, Fuel consumption, Air consumption, mean effective pressure, Brake power, Indicated power, Frictional power (with different methods), Mechanical efficiency, Thermal efficiency, volumetric efficiency, Heat balance sheet, Engine analyzer.

Recommended Books

1. V. Ganesan, 'Internal Combustion Engines ', Tata McGraw Hill.
2. K.K. Ramalingam, 'Internal Combustion Engines Theory and Practice', Scitech Publications, India.
3. H.N. Gupta, 'Fundamentals of Internal Combustion Engines', PHI Learning.

4. Willard W. Pulkrabek, 'Engineering Fundamentals of the Internal Combustion Engine', Pearson Prentice Hall.
5. V.M. Maleev, 'Diesel Engine Operation and Maintenance', McGraw Hill.
6. William H. Crouse, 'Automotive Engines', McGraw Hill.

MANUFACTURING PROCESSES

Subject Code: BMEE3-304 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

UNIT-I

Casting: Introduction to metal casting, types of patterns, their materials and allowances. Moulding materials: Moulding sand compositions and moulding sand properties, types of moulds, moulding machines cores, core sands, types of cores, core banking, elements of gating system, and risers. Casting processes: sand casting, shell mould casting, investment casting, permanent mould casting, full mould casting, and vacuum casting. Die casting, Centrifugal casting and continuous casting. Casting defects, their causes and remedies.

UNIT-II

Welding: Introduction and classification of welding processes, welding terminology, welding positions, filler metals. Flame cutting. Electric arc welding. Principle, equipment, types- MIG, TIG, submerged arc welding. Welding electrodes, classification and selection of electrodes, welding arc and its characteristics. Thermal effects on weldment Resistance welding- principle and their types i.e. spot, seam, projection, upset and flash thermit welding, electro slag welding, friction welding, plasma arc welding, electron beam welding. Welding defects, their causes and remedies.

UNIT-III

Metal Forming: Classification, Process Principles, Description, Applications and Products of the Following: Rolling, Drawing, Forging, Extrusion, Sheet Metal, Spinning, Deep Drawing, Bending, Press working, Plastic moulding machines and extruders.

Metal Cutting and Machine Tools: Cutting tool materials and geometry, Coolants: Classification, purpose and their effects, Introduction to broaching machine, milling machine and its classification, indexing: Simple compound and differential, Boring Operation and their machines, Jig Boring, Slotting Machine, Grinding: Cylindrical, surface and centreless grinding.

UNIT-IV

Introduction to Non Traditional Machining: Working Principle and applications of the following: Electric Discharge Machining, Laser Beam Machining, Abrasive Water Jet Machining, Abrasive Flow Machining, Electro Chemical Machining, Chemical Machining.

Recommended Books

1. R.W. Heine and P.C. Rosenthal, 'Principles of Metal Casting', McGraw Hill.
2. R.S. Parmar, 'Welding Technology', Khanna Publishers.
3. J.S. Campbell, 'Principles of Manufacturing Materials and Processes', Tata McGraw Hill.
4. T. Alton, 'Metal Forming Fundamentals and Applications', Addison-Wesley.
5. P.C. Sharma, 'Production Technology', S. Chand Publisher.

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AUTOMOTIVE MATERIALS

Subject Code: BMEE3-305 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

UNIT-I

Introduction: Engineering materials, material classifications, mechanical, thermal, electrical, magnetic, chemical, optical and physical properties of materials, effects of alloying elements on properties of steel, carbon steel, low alloy steels, stainless steel, tool steels and die steels. Alloys of Ni, Al, Cu, Mg; properties and their applications. Recrystallization temperature, their effect on the properties of materials.

Ceramic Materials: Introduction, nature of ceramic materials, types, products, properties developments in ceramics.

Glass: Introduction, composition, structure, types of glass and their properties, use of glass, fracture in glass.

Rubber: Introduction, characteristics of rubbers, structure of elastomers, types of elastomers, vulcanization of rubber, uses of rubber and applications.

Plastics Materials: Introduction, definition and concept, properties of plastics, thermoplastics, thermosetting plastics, deformation of plastics, plastic alloys.

UNIT-II

Fundamentals of Composites: Need for composites – Enhancement of properties -classification of composites – Matrix-Polymer matrix composites (PMC), Metal matrix composites (MMC), Fibre reinforced composites, Applications of various types of composites.

Polymer Matrix Composites: Polymer matrix resins – Thermosetting resins, thermoplastic resins – Reinforcement fibres – various types of fibres. Fibre reinforced plastics (FRP), Glass fibre reinforced plastics (GRP).

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- fibreswhiskers. Sintering - Hot pressing – Cold isostatic pressing (CIPing) – Hot isostatic pressing (HIPing).

UNIT-III

Advances in Composites: Carbon / carbon composites – Advantages of carbon matrix – limitations of carbon matrix Carbon f ibre.

Heat Treatment and Surface Treatment: Heat treatment of steel – Annealing, Normalizing, Hardening and tempering with their types and application to automotive components.

Surface Hardening Techniques: Induction, flame and chemical hardening, coating of wear and corrosion resistance, Electroplating, Phosphating, Anodizing, hot dipping, thermal spraying, hard facing and thin film coatings.

UNIT-IV

Selection of Materials: Factors affecting the selection of materials, Cryogenic wear, corrosion, fatigue, creep and oxidation resistance application. Criteria of selecting materials for automotive components viz. cylinder block, Cylinder head, piston, piston ring, Gudgeon pin, connecting rod, crank shaft, crank case, cam, cam shaft, engine valve, gear wheel, clutch plate, axle, bearings, chassis, spring, body panel - radiator, brake lining etc. Materials for heavy duty vehicles: special alloys, plastics, seat fabrics and materials for bumpers.

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Recommended Books

1. O.P. Khanna, 'Material Science and Metallurgy', Dhanpat Rai and Sons.
2. B.K. Agarwal, 'Introduction to Engineering Materials', Tata McGraw Hill.
3. Rakesh Dogra, 'Advances in Material Science', Katson Books.
4. F.L. Mathews and R.D. Rawlings, 'Composite Materials', 1st Edn., Chapman and Hall, London, England, **1994**.
5. K.K. Chawla, 'Composite Materials', Springer – Verlag, **1987**.
6. A.B. Strong, 'Fundamentals of Composite Manufacturing', SME, **1989**.
7. S.C. Sharma, 'Composite Materials', Narosa Publications, **2000**.

SOFT SKILLS-I

Subject Code: BHUM0-F91 | **L T P C 0 0 2 1** | **Duration: 26 Hrs.**

Course Objectives

The course aims to cause a basic awareness about the significance of soft skills in professional and interpersonal communications and facilitate an all-round development of personality.

Course Outcomes

At the end of the course, the student will be able to develop his/her personal traits and expose their personality effectively.

UNIT-1

SOFT SKILLS- Introduction to Soft Skills, Aspects of Soft Skills, Identifying your Soft Skills, Negotiation skills, Importance of Soft Skills, Concept of effective communication.

SELF-DISCOVERY- Self-Assessment, Process, Identifying strengths and limitations, SWOT Analysis Grid.

UNIT-2

FORMING VALUES- Values and Attitudes, Importance of Values, Self-Discipline, Personal Values - Cultural Values-Social Values-some examples, Recognition of one's own limits and deficiencies.

UNIT-3

ART OF LISTENING- Proxemics, Haptics: The Language of Touch, Meta Communication, Listening Skills, Types of Listening, Listening tips.

UNIT-4

ETIQUETTE AND MANNERS- ETIQUETTE- Introduction, Modern Etiquette, Benefits of Etiquette, Taboo topics, Do's and Don'ts for Men and Women. MANNERS- Introduction, Importance of manners at various occasions, Professional manners, Mobile manners. CORPORATE GROOMING TIPS- Dressing for Office: Do's and Don'ts for Men and Women, Annoying Office Habits.

Recommended Books

1. K. Alex, S. Chand Publishers.
2. Butterfield, Jeff, 'Soft Skills for Everyone', Cengage Course, New Delhi, **2010**.
3. G.S. Chauhan and Sangeeta Sharma, 'Soft Skills', Wiley, New Delhi, **2016**.
4. Klaus, Peggy, Jane Rohman & Molly Hamaker, 'The Hard Truth About Soft Skills', Harper Collins E-books, London, **2007**.
5. S.J. Petes, Francis, 'Soft Skills and Professional Communication', Tata McGraw Hill Education, New Delhi, **2011**.

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MACHINE DRAWING

Subject Code: BMEE3-306 **L T P C**
1 0 4 3

Principles of Drawing: Requirements of production drawing, sectioning and conventional representation, dimensioning, symbols of standard tolerances, machining symbols, Introduction and familiarization of the code IS: 296.
Fasteners: Various types of screw threads, types of nuts and bolts, screwed fasteners, welding joints and riveted joints.
Assembly and Disassembly of the following manually and using computer aided drafting:
a) **Couplings:** Solid or rigid Coupling, protected type flange coupling, Pin type flexible coupling, muff coupling, Oldham, universal coupling, claw coupling, cone friction clutch, free hand sketch of single plate friction clutch.
b) **Knuckle and Cotter Joints.**
c) **Pipe and Pipe Fittings:** Flanged joints, spigot a socket joint, union joint, hydraulic an expansion joint.
d) **IC Engine Parts:** Piston, connecting rod.
e) **Boiler Mountings:** Steam stop valve, feed check valve, safety valve, blow off cock.
f) **Bearings:** Swivel bearing, thrust bearing, Plummer and angular plumber block.
g) **Miscellaneous:** Screw Jack, Drill Press Vice, Crane hook. Drafting of simple mechanical components on computer.

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NOTE: Drawing Practice is to be done as per IS: 296 code. First angle projection to be used. Drawings should contain bill of materials and should illustrate finish. The syllabus given above indicates the broad outlines and the scope of the subject to be covered. It is not necessary to cover all the drawing exercises of the types of machine tools mentioned above.

Recommended Books

1. Ajit Singh, 'Machine Drawing', Tata McGraw Hill.
2. N.D. Bhatt, 'Machine Drawing', Charotar Publications.
3. N. Sidheshwar, 'Machine Drawing', Tata McGraw Hill.
4. P.S. Gill, 'Machine Drawing', B.D. Kataria and Sons.
5. V. Lakshmi Narayanan and Mathur, 'Text-Book of Machine Drawing', Jain Brothers.
6. R.K. Dhawan, 'Machine Drawing', S. Chand.

MECHANICS OF MATERIALS LAB.

Subject Code: BMEE3-307 **L T P C**
0 0 2 1

EXPERIMENTS

1. To perform tensile test in ductile and brittle materials and to draw stress-strain curve and to determine various mechanical properties.
2. To perform compression test on C.I. and to determine ultimate compressive strength.
3. To perform shear test on different materials and determine ultimate shear strength.
4. To perform any one hardness test (Rockwell, Brinell & Vicker's test) and determine hardness of materials.
5. To perform impact test to determine impact strength.

6. To perform torsion test and to determine various mechanical properties.
7. Study of performance of Fatigue & Creep tests.
8. To perform bending test on beam (wooden or any other material) and to determine the Young's modulus and Modulus of rupture.
9. To perform Torsion test on helical springs in tension and compression and to determine modulus of rigidity/stiffness.

INTERNAL COMBUSTION ENGINES LAB.

Subject Code: BMEE3-308 **L T P C**
0 0 2 1

EXPERIMENTS

1. Study of layout of different components in an IC Engine.
2. Study and draw a valve timing diagram for a 4-stroke multi cylinder engine.
3. Study of valve actuating mechanisms of a multi cylinder engine.
4. Study of different carburetors in Indian make of vehicles.
5. Study of different fuel injection system in Indian make of vehicles.
6. Trouble shooting in an IC engine.
7. Morse test on petrol and diesel engines.
8. Heat balance test on an automotive engine.
9. Performance study of IC engine at full throttle and part throttle conditions with alternative fuels and their comparisons.
10. Exhaust emission analysis of an SI and CI engine.
11. Study of emission control systems on a vehicle.

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MANUFACTURING PROCESSES LAB.

Subject Code: BMEE3-309 **L T P C**
0 0 2 1

EXPERIMENTS

Welding Practicals:

1. Study of Arc welding equipment and making a weld joint by this process.
2. Study of MIG welding equipment and making a weld joint by this process.
3. Study of Spot welding and preparing a weld joint by this process.

Machining Practicals:

1. Study of constructional features of following machines through drawings/ sketches and an exercise based on them:
   a) Universal milling machine.
   b) Grinding machines (Surface, cylindrical)
   c) c) Hydraulic Press.

Industrial Visit to demonstration of Machines.

AUTOMOTIVE CHASSIS SYSTEMS

Subject Code: BMEE3-411 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

UNIT-I

Introduction: Types of chassis layout with reference to power plant locations and drive, Vehicle frames. Load acting on vehicle frame due to different systems.

Front Axle & Steering System: Types of front axles, Constructional details, materials. Front wheel geometry viz. Castor, Camber, King pin inclination, Toe. Wheel Alignment. Steering geometry. Ackerman and Davis steering system. Different types of steering gear boxes. Steering linkages and their layouts. Power and power assisted steering. Steering of crawler tractors. Multi axle steering systems.

UNIT-II

Driveline and Differential: Effects of driving thrust and torque reactions. Hotch kiss drive, torque tube drive and radius rods. Transverse rods. Propeller shaft, Universal joints. Constant velocity universal joints. Drive Shaft. Front wheel drive. Different types of final drives. Spiral bevel gear and hypoid gear final drives. Double reduction and twin speed final drives. Differential principles. Constructional details of a differential gear unit. Non-slip and Limited slip differential. Differential locks - Differential housings. Comparison of front wheel, rear wheel and all-wheel drive arrangement.

Drive Axles: Construction of rear axles. Types of loads acting on rear axles. Fully floating, three quarter floating and semi floating rear axles. Rear axle housing. Construction of different types of axle housing, multi axled vehicles. Construction details of multi drive axle vehicles. Dead axles.

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UNIT-III

Suspension System: Need of suspension system, Types of suspension, Suspension springs, Constructional details and characteristics of leaf, coil and torsion bar springs, Independent suspension, Types: Mc Pherson strut, Double wishbone, Five link type, etc, Rubber suspension, Pneumatic suspension, Shock absorbers.

Wheels and Tires: Types of wheels – wire spoke, disc – solid and split type, alloy type, offset, onset & zero set, denomination of rim. Tires, materials, construction, structure, denomination and function of tires, types of tires, comparison of radial and bias ply tires. Tubes – construction and types, Tubeless tires. Tire inflation, effects of tire pressure on tire performance. Tire wears patterns and their causes. Rolling Resistance and self-aligning torque, Wheel Balancing – need, procedure. All-season tires, tire quality grading, changing tire sizes. Run flat tires (RFT), new heat resistant tires for better mileage, fuel efficient handling and safety.

UNIT-IV

Braking System: Weight transfer during braking and stopping distances. Classification of brakes - drum brakes and disc brakes. Constructional details. Theory of braking, Brake split and proportioning. Mechanical, hydraulic and pneumatic brakes - Servo brake, power and power-assisted brakes -Different types of brake retarders like eddy current and hydraulic retarder. Skidding of wheels on braking and remedies, Anti-lock braking systems: types, system components, operations, fluids. Power Brakes and Parking Brakes, Additive, self-energizing brakes, regenerative and emergency braking system.

Recommended Books
1. Reimpell and Betzler, 'The Automotive Chassis: Engineering Principles', 2nd Edn., Butterworth Heinemann, London.
2. Giancarlo Genta, 'The Automotive Chassis', vol. I and II, Springer.
3. Heinz Heisler, 'Advanced Vehicle Technology', 2nd Edn., Butterworth Heinemann, London.
4. T. Gilles, 'Automotive Chassis Brakes Steering and Suspension', Thomson USA.
5. Newton Steeds and Garrot, 'Motor Vehicles', Butterworths, London.
6. A.W. Judge, 'Mechanism of the Car', Chapman and Halls Ltd., London.

MECHANICS OF MACHINES

Subject Code: BMEE3-412 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

UNIT-I

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. 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

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

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).

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.

UNIT-IV

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 governors, Governor Effort and power controlling force curve, effect of sleeve friction.

Balancing: Classifications, need for balancing, balancing of single and multiple rotating masses, static and dynamic balancing, primary and secondary balancing for reciprocating masses, partial balancing of locomotives, swaying couple, hammer blow, variation in tractive effort, balancing of V-engine, concept of direct and reverse crank, balancing of machines, rotors, reversible rotors.

Recommended Books
1. Jagdish Lal, 'Theory of Mechanisms and Machines', Metropolitan Book Co. Pvt. Ltd. New Delhi.

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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 and Sons, London.
5. I.E. Shigley and J.R. Uicker, 'Theory of Machines', McGraw Hill, New York.

FLUID MECHANICS AND MACHINERY

Subject Code: BMEE3-413 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

UNIT-I

Fluid and their Properties: Concept of fluid, difference between solids, liquids and gases; ideal and real fluids; capillarity, vapors pressure, 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.

UNIT-II

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, flow rate and discharge mean velocity, continuity equation in Cartesian and cylindrical, polar coordinates. Rotational flows, rotation velocity and circulation, stream and velocity potential functions, 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, flow along a curved streamline.

UNIT-III

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.

Introduction to Laminar and Turbulent Flows: Flow in circular cross- section pipes. Turbulent flows and flow losses in pipes, Darcy equation, minor head losses in pipes and pipe fittings, hydraulic and energy gradient lines.

UNIT-IV

Fluid Flow Measurements: Manometers, pitot tubes, ventui meter and orifice meters, orifice, mouthpieces, notches and weirs, rotameter.

Fluid Machinery: 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. Classification, Principle of operation of centrifugal and axial pumps, Construction, operation and utility of simple accumulator, intensifier, gear, vane and piston pumps.

Recommended Books

1. D.S. Kumar, 'Fluid Mechanics and Fluid Power Engineering', Kataria and Sons Publishers.
2. B.S. Massey, 'Mechanics of Fluids', Van Nostrand Reinhold Co.
3. J.F. Douglas, 'Fluid Mechanics', Pitman.

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4. V.L. Streetes and E.B. Wylie, 'Fluid Mechanics', McGraw Hill Book Co.
5. Jagdish Lal, 'Hydraulic Machines', Metropolitan Book Co Pvt. Ltd.

AUTOMOTIVE ELECTRICAL SYSTEMS

Subject Code: BMEE3-414 **L T P C 3 1 0 4** **Duration: 45 Hrs.**

UNIT-I

Introduction: Earth returns and insulated return systems, 6, 12, and 24-volt systems. Positive & negative earth systems, fusing of circuits, relays, switches, low and high voltage automotive cables, wiring diagram for typical automotive wiring systems, maintenance and servicing.
Batteries: Principles of lead acid cells and their characteristics - construction and working of lead acid battery, types of batteries, testing of batteries, effect of temperature on: capacity and voltage, battery capacity, voltage, efficiency, charging of batteries, sulphation and desulphation, maintenance and servicing, Battery failures & checking, Maintenance free Batteries, High energy and power density batteries for electric vehicles.

UNIT-II

Charging System: Principle of generation of direct current. Shunt generator characteristics. Armature reaction. Third brush regulation. Cut-out. Voltage & current regulators, compensated voltage regulator. Alternators - principle, constructional and working aspects, bridge rectifiers. Principle of Magneto, Flywheel Magneto, Maintenance and servicing. Trouble shooting in charging systems.
Starting System: Condition at Starting – starting torque and power requirements, behavior of starter during starting. Series motor and its characteristics. Principle & construction of starter motor. Working of different starter drive units, care & maintenance of starter motor. Starter switches. Safety mechanism. Maintenance, servicing and trouble shooting.

UNIT-III

Ignition System: Types, construction & working of battery & coil and magneto ignition systems. Relative merits, Ballast Resistor, Ignition coil, Distributor, Contact breaker Point, centrifugal and vacuum advance mechanisms, Limitations of conventional ignition systems, Transistorized Ignition systems, Spark plugs - construction, different types, plug fouling, maintenance, servicing and fault diagnosis, Electronic Ignition system. Programmed ignition, distributor less ignition.
Lighting System: Principle of automobile illumination, headlamp construction and wiring, reflectors – types, signaling devices flashers, stop lights, fog lamps, auxiliary lighting-engine, passenger, reading lamp. Regn-plate lamps. Automatic illumination system. Head light levelling devices. Study of a modern headlight system with improved night vision.
Electrical Equipment and Accessories: Oil pressure gauge, fuel level gauge, engine temperature gauge, electrical fuel pump, speedometer, odometer, trip meter, engine rpm meter, Headlamp & Windshield washer and wiper, heaters and defrosters, horns, stereo/radio, power antennae. Central locking, power window winding. Sun/Moon Roof. Motorized rear view mirrors, reverse warning, Bumper collision warning. Other accessories in modern vehicles.

UNIT-IV

Fuel Cells: Thermodynamic aspects; types-hydrogen and methanol, power rating and performance. Various components and working of fuel cell, Heat dissipation.

Drive Motors and Controllers: Drive arrangements in Hybrid and Electric vehicles. Drive motors: types and construction. Controlling of motor operations. Motor-generator in hybrid vehicles and its controls.

Recommended Books

1. P.L. Kohli, 'Automotive Electrical Equipment', Tata McGraw Hill.
2. Chapman, 'Principles of Electricity and Electronics for the Automotive Technician', Thomson Asia, **2000**.
3. A.W. Judge, 'Modern Electrical Equipment of Automobiles', Chapman & Hall, London.
4. G.W. Vinal, 'Storage Batteries', John Wiley & Sons Inc.
5. W.H. Crouse, 'Automobile Electrical Equipment', McGraw Hill Book Co. Inc.
6. F.G. Spreadbury, 'Electrical Ignition Equipment', Constable & Co Ltd.

AUTOMOTIVE FUELS & EMISSIONS

Subject Code: BMEE3-415 **L T P C** **Duration: 45 Hrs.**

3 1 0 4

UNIT-I

Introduction to Fuels: Classification of automotive fuels and drivetrains, Scenario of conventional auto fuels, Oil reserves of the world fuel quality aspects related to emissions, technological up gradations required, Need for alternate fuel, business driving factors for alternative fuels, roadmap for alternative fuels, alternate fuel development worldwide. Automotive Fuels: Properties, production, storage, handling, performance and safety aspects, advantages and disadvantages, Emissions, Engine modifications of the following o Gaseous Automotive Fuels: Hydrogen, compressed natural gas, Liquefied petroleum gas: o Bio –Fuels o Biogas, Biodiesel: o Alcohols o Methanol, Ethanol, DEE, DME: o Synthetic alternate Fuels o Wood Gas, Tire Pyrolysis Oil: o Reformulated Conventional Fuels o Emulsified Fuels:

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UNIT-II

Future Alternative Fuels: Ammonia: properties, ammonia in nature, hazards, carrier for hydrogen, storage, stationary engine application, ammonia for fuel cell vehicles. Boron: properties, overview of the boron – water process, features, analysis. Water: Japanese water car, water fuel cell, hydrogen boosters, water to gas technology.

UNIT-III

Introduction to Emission: Pollutants, sources, formation of HC and CO in SI engines, NO formation in SI and CI engines, Particulate emission from SI and CI engines, Smoke Emission in CI engines. Effect of operating variables on Emission formation, Transient operational effects on pollution SI Engine & CI Engines Combustion and Pollutant Formation Basic Chemistry combustion - HC and CO formation in 4-stoke and 2-stroke SI engines - NO formation, - Particulate emissions, - Effects of operating variables on emission formation. Smoke emissions, Color and aldehyde emissions. Photochemical smog, Sulphur, Phosphorus emissions.

UNIT-IV

Post Combustion Treatment: Introduction, physical conditions and exhaust gas compositions before treatment, catalytic mechanism. Thermal reactions, installation of catalyst in exhaust lines, NOx treatment in diesel engines. Diesel trap oxidizers Control Techniques Engine Emission Reduction Design changes - Optimization of operating factors - Exhaust gas recirculation - Fumigation - Air injection PCV system - Exhaust treatment in SI engines - Thermal reactors - Catalytic converters - Catalysts - Use of unleaded petrol. Test Procedure &

Instrumentation for Emission Measurement Test procedures, NDIR analyzer, thermal conductivity and flame ionization detectors, Chemiluminescent analyzer, analyzers for NOx, Gas chromatograph - Orsat apparatus -Smoke meters, spot sampling and continuous indication types like Bosch, Hart ridge.

Recommended Books

1. S.S. Thipse, 'Alternative Fuels', Jaico Publications.
2. B.P. Pundir, 'Engine Emissions: Pollutant Formation and Advances in Control Technology', Narosa Publications.
3. E.F. Oberts, 'Internal Combustion Engine and Air Pollution', Harper and Row Publisher.
4. H.H. Willard, 'Instrumental Method of Analysis', CBS Publishers and Distributors.
5. J.B. Heywood, 'Internal Combustion Engine Fundamentals', McGraw Hill.
6. 'Motor Vehicles Act / Emission Norms', Govt of India Publications.

AUTOMOTIVE CHASSIS SYSTEMS LAB.

Subject Code: BMEE3-416 **L T P C**
0 0 2 1

EXPERIMENTS

1. Study of layout of a chassis and its different components, of a vehicle.
2. Trouble shooting in different types of steering systems - mechanical and power and various steering linkages.
3. Measurement of steering geometry angles – Wheel Alignment.
4. Study of impact of steering geometry angles on vehicle.
5. Study of different types of wheels (rims) and tires and their defects.
6. Conducting Wheel balancing of a given wheel assy.
7. Trouble shooting in Propeller Shafts and Drive shafts including constant velocity joints.
8. Trouble shooting in different types of dead axles (front or rear).
9. Trouble shooting in different types of live axles and Differential systems.
10. Trouble shooting in suspensions of following types:
    a) Leaf Spring
    b) Double Wishbone with Torsion Bar or Coil Spring
    c) McPherson Strut Type
    d) Five Bar Link type
    e) Air Suspension system
    f) A shock absorber (damper).

Trouble shooting in braking system in master and wheel cylinder, drum and disc brakes, overhauling and adjusting of system and its testing on brake tester.

FLUID MECHANICS AND MACHINERY LAB.

Subject Code: BMEE3-417 **L T P C**
0 0 2 1

EXPERIMENTS

1. To study the flow through a variable area duct and verify Bernoulli's energy equation.
2. To determine the coefficient of discharge for an obstruction flow meter (venturi meter/ orifice meter).

3. To study the transition from laminar to turbulent flow and to ascertain the lower critical Reynolds number.
4. To determine the hydraulic coefficients for flow through an orifice.
5. To determine the friction coefficients for pipes of different diameters.
6. To determine the head loss in a pipe line due to sudden expansion/ sudden contraction/ bend.
7. To determine the velocity distribution for pipeline flow with a pitot static probe.
8. To study the constructional features of reciprocating pump and to perform test on it for determination of pump performance.
9. To draw the various characteristics of Centrifugal pump.

AUTOMOTIVE ELECTRICAL SYSTEMS LAB.

Subject Code: BMEE3-418 **L T P C**
0 0 2 1

EXPERIMENTS

1. To understand the layout of complete wiring system of an automobile.
2. Perform the various tests for checking the battery condition.
3. To understand and test the charging circuit and charging motor.
4. To conduct performance test on a dynamo, alternator & starter motor.
5. To understand & test the starting circuit and trouble shooting in it.
6. Understand and test the conventional ignition system, setting of contact breaker points and spark plug gap.
7. Understand the working and testing of an Electronic Ignition system.
8. Understand and test the lighting circuit of a car.
9. Conduct headlamp focusing as per the procedure.
10. Study the working of different accessories of a modern car.
11. To study the layout / working of a Fuel Cell powered electric car.

VEHICLE BODY ENGINEERING

Subject Code: BMEE3-519 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

UNIT-I

Introduction: Classification of automobiles on different basis, Types of vehicle bodies, requirements of automobile body, constructional details.

Car Body Details: Types: Saloon, hatchback, convertibles, Limousine, Estate Van, racing and sports car, etc. Car body construction types – frame and unitary (monocoque), various body panels and their constructional details.

UNIT-II

Bus Body Details: Types: Mini bus, single and double Decker, split level and articulated bus, Bus body lay out, Floor height, Engine location, Entrance and exit location, Seating dimensions, Constructional details: Frame construction, Double skin construction, Types of metal section used, Regulations, Conventional and integral type construction.

Commercial Vehicle Details: Types of commercial vehicles. Commercial vehicle body details, flat platform, drop side, fixed side, tipper body, tanker body, tractor trailer.

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UNIT-III

Body Loads: Idealized structure, structural surface, shear panel method, symmetric and asymmetric vertical loads in a car, longitudinal load, and different loading situations.

Body Materials, Trim and Mechanisms: Carbon fibers, plastics, timber, GRP; ferrous and non-ferrous materials used in vehicle. Corrosion and anticorrosion method. Paint and painting process, Corrosion, Anticorrosion methods, Body trim items, Body mechanisms.

UNIT-IV

Special Purpose Vehicle Details: Various types, Needs and constructional details - Fire station vehicle, tankers, pumping vehicles, ladder vehicle, Concrete mixer transport vehicles; Ambulance, Towing vehicle, Road trains, Off road vehicles, cement trucks.

Safety in Vehicle Design: Basics of impacts protection, design for crashworthiness, front impact and side impact analysis, bumper system, energy absorbent forms. Indian Motor acts and its application- The motors vehicle acts 1988, Driving license, Registration of vehicles, Rules of the road, Motor Insurance.

Recommended Books

1. J. Powloski, 'Vehicle Body Engineering', Business Books Ltd., London.
2. Kirpal Singh, 'Automobile Engineering', Vol-1., Standard Publishers Distributor's.
3. J.B. Braithwaite, 'Vehicle Body Building and Drawing', Heinemann Educational Books Ltd., London.
4. Sydney F. Page, 'Body Engineering', Chapman & Hill Ltd., London.
5. John Fenton, 'Handbook of Automotive Body and Systems Design', Wiley.
6. Heinz Hezler, 'Advance Vehicle Technology'.

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AUTOMOTIVE TRANSMISSIONS

Subject Code: BMEE3-520 | **L T P C** **3 1 0 4** | **Duration: 45 Hrs.**

UNIT-I

Introduction: Need for Transmission system, Tractive effort and resistances to Motion of a Vehicle, Requirements of transmission system, Classification of Transmission systems, Different Wheel drive systems (Single, Two and Four), Drives (Belt, Chain, Shaft, Hydraulic and Electric drives), Multi-axle drives, Location of transmission system, Different Transmissions units in scooter, car, MUVs and different transport vehicles of Indian make.

UNIT-II

Clutch: Principle of operation, Constructional details, torque capacity and design aspects of different types of clutches, Operation of single plate: helical spring and diaphragm type, and multi-plate clutch, Centrifugal and Automatic Clutches, Dry and Wet type of clutch, Friction lining materials, Over-running clutches, Modes of Operating clutch – mechanical, hydraulic and electric, Dual Clutch transmission.

Gear Box: Determination of gear ratios for vehicles, Different types of gearboxes – sliding, constant and synchromesh type, need for double declutching and working of synchronizing unit, Power and economy modes in gearbox, transfer box, Transaxles, Overdrives, Gear shifting mechanisms – mechanical link and wire types, Paddle shift.

UNIT-III

Hydrodynamic Drive: Fluid coupling- principle of operation, constructional details, Torque capacity, Performance characteristics, Reduction of drag torque, Torque converter, converter coupling- Principle of operation, constructional details & performance characteristics.

Hydrostatic Drive: Hydrostatic drive, various types of hydrostatic systems, Principles of hydrostatic drive system, Advantages and limitations, Comparison of hydrostatic drive with hydrodynamic drive, Construction and working of typical Janny hydrostatic drive.

UNIT-IV

Electric Drive: Electric drive, Principle of early and modified Ward Leonard Control system, Advantage & limitations, Performance characteristics.

Automatic Transmission & Applications: Block diagrams of- Chevrolet "Turbo-glide" Transmission, Power-glide Transmission & Clutch Hydraulic Actuation system, Introduction to Toyota "ECT-i" Automatic Transmission with Intelligent Electronic controls system.

Recommended Books

1. Kirpal Singh, 'Automobile Engineering', Vol-1., Standard Publishers Distributor's.
2. S. Jaiganesh, 'Automotive Transmissions', (moallemy.persiangig.com/.../AUTOMOTIVE TRANSMISSION.pdf).
3. Newton and Steeds, 'Motor vehicles', llliffe Publishers.
4. A.W. Judge, 'Modern Transmission Systems', Chapman and Hall Ltd.
5. W.H. Crouse, D.L. Anglin, 'Automotive Transmission and Power Trains Construction', McGraw Hill.

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HEAT TRANSFER

Subject Code: BMEE3-521 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

UNIT-I

Introduction: Concept of heat transfer, Difference between the subject of "Heat Transfer" and its parent subject "Thermodynamics", Different modes of heat transfer - conduction, convection, radiation and Combine mode, Basic laws of conduction, convection & radiation, Effect of temperature and pressure on thermal conductivity of solids, liquids and gases and its measurement, Thermal diffusivity and its significance, Newtonian heating and cooling of solids.

UNIT-II

Conduction: Fourier's law of heat conduction, 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 and spherical shells (simple and composite), critical thickness of insulation layers on pipes carrying hot fluids. Internal generation cases along with some practical cases of heat conduction. Influence of variable thermal conductivity on conduction through simple cases of walls / cylinders and spheres.

UNIT-III

Theory of Fins: Fins, Types of Fins, Straight rod type of fins of uniform cross-section e.g. circular, rectangular or any other cross-section. Heat dissipation from an infinitely long fin, heat dissipation from a fin insulated at tip and loosing at tip. Optimum design of straight find of rectangular and triangular profile cross-sections; fin effectiveness and fin efficiency for straight rod fins of rectangular and circular cross-section.

Heat Exchanger: Function of heat Exchanger, Classification, types and applications of heat Exchangers, elements of heat exchanger and Overall coefficient of heat transfer, Different design criterion for heat exchangers, Log mean temperature difference for evaporator and condenser tubes, Parallel and counter flow heat exchangers, NTU, Calculation of number and length of tubes in a heat exchanger.

UNIT-IV

Radiation: Process of heat flow in radiation, Definition of Emissivity, Absorptivity, reflectivity and transmissivity, Concept of black and grey bodies, Kirchoff's law and Stefan Boltzmann's law.

Convection Process and Properties: Free and forced convection, laminar and turbulent flow, Newton Rikhman Law, Nusselt Number, significance of dimensionless numbers.

Heat Transfer in IC Engines: Heat transfer and Engine energy balance, Temperature distribution and thermal stresses in piston, cylinder linear, cylinder head, and valves.

Recommended Books

1. D.S. Kumar, 'Fundamentals of Heat and Mass Transfer', S.K. Kataria and Sons.
2. S. Domkundwar, 'A Course in Heat and Mass Transfer', Dhanpat Rai and Sons.
3. J.P. Holmans, 'Heat Transfer', Tata McGraw Hill Publishing Company Ltd.
4. Vijay Gupta, 'Elements of Heat and Mass Transfer', New Age International Ltd.
5. J. Heywood, 'Fundamental of I.C. Engine', Tata McGraw Hill.
6. V. Ganesan, 'Internal Combustion Engines', Tata McGraw Hill.

MRSPTU

DESIGN OF AUTOMOTIVE COMPONENTS

Subject Code: BMEE3-522 | **L T P C 3 1 0 4** | **Duration: 45 Hrs.**

UNIT-I

Meaning of Design: Definition and understanding of various types of design, Elaborated Design process.

Design and Creativity: Systematic design conceptualization, product design definition & manufacturing considerations in design, underlying principles of design in Aesthetics and ergonomics, free body diagram for components design.

UNIT-II

General Design Considerations: Theory of Failure, Selection of materials, Basic criteria of selection of material for automotive parts like piston, cylinder, connecting rod, crankshaft and camshaft, mechanical properties of those materials in brief. Study of Stress concentration, factor of safety under different loading conditions,

UNIT-III

Design Against Static Loading: Bolted Joints- Understanding the various stresses/ failure in bolted joints, basic and eccentrically loaded bolts, Welded Joints- Design for various loading conditions in torsion, shear or direct loads.

Design Against Fluctuating Loading: Design of automobile coupling & Springs, Flywheel, Braking Systems, self-energizing brakes, shoe brakes - internal & external expanding, band brakes and disc brakes.

UNIT-IV

Transmission: Clutch-Design considerations for single plate clutch, centrifugal clutch, cone clutch, energy dissipated, torque transmission capacity of clutch. Gears - Design of spur, helical and straight bevel gears, Final Drive- Design consideration for different types of propeller shafts & rear axles. Bearing - Basics of bearings, their types, nomenclature and Selection criteria.

Recommended Books

1. Kirpal Singh, 'Automobile Engineering', Vol-1', Standard Publishers Distributor's.
2. N.K. Giri, 'Automotive Mechanics', Khanna Publisher.
3. R.C. Juvenal, 'Fundamental of Machine Component Design', John Wiley.
4. 'PSG Design Data', PSG College of Technology.
5. J.A. Charles, 'Selection & Use of Engineering Materials', Butterworth – Heinemann.
6. V.B. Bhandari, 'Design of Machine Elements', McGraw Hill, ED.
7. Joseph Edward, 'Mechanical Engg. Design', Shigley.

MEASUREMENTS AND INSTRUMENTATION

Subject Code: BMEE3-523 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

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UNIT-I

Basic Statistical Concepts: Types of Measured Quantities (Discrete and Continuous), Central Tendency of Data, Mode, Median, Arithmetic Mean, Range, Deviation, Variance, Standard Deviation.

Instruments and their Representation: Introduction, Typical Applications of Instrument Systems, Functional Elements of a Measurement System, Classification of Instruments, Standards and Calibration Static and Dynamic Characteristics of Instruments: Range and span, accuracy and precision, calibration, hysteresis and dead zone, sensitivity and linearity, threshold and resolution; speed of response, lag, fidelity and dynamic error, dead time and dead zone. Zero, ramp and sinusoidal input signals.

UNIT-II

Errors in Measurement: Sources of errors, systematic and random errors; statistical analysis of test-data, probable error and probability tables, ejection of test data; curve fitting, error propagation; Design and planning of experiments and report writing.

Sensors and Transducers: Introduction, Analog and Digital Transducers, Electromechanical; Potentiometric, Inductive and reluctance type, Electromagnetic, Electrodynamics, Eddy Current, Magnetostrictive, Variable Inductance, Linearly Variable Differential Transformer, Variable Capacitance, Piezo-Electric Transducer and Associated Circuits, Unbonded and Bonded Resistance Strain Gages. Strain Gage Bridge circuits, Temperature Compensation, Balancing and Calibration, Opto-Electrical Transducers, Photo Conductive Transducers, Photovoltaic Transducers, Digital Transducers, Frequency domain transducer, Vibrating string transducer, Data, Acquisition Systems, Data processing, Data Display and Storage, Modern Automotive Instrumentation, Study of automotive sensors and actuators.

UNIT-III

Position, Displacement, and Velocity Measurement: Introduction, Relative motion Measuring Devices, Electromechanical, Optical, Photo Electric, Moire-Fringe, Pneumatic, Absolute Motion Devices.

Force, Acceleration and Torque Measurement: Seismic Devices, Spring Mass & Force Balance Type, Calibration, Hydraulic Load Cell, Pneumatic Load Cell, Elastic Force Devices, Separation of Force Components, Electro Mechanical Methods, Strain Gage, Torque Transducer, Toque Meter.

Pressure Measurement: Moderate Pressure Measurement, Monometers, Piezo Transducer, Dynamic Effects of Connecting Tubing, High Pressure Transducer, Low Pressure Measurement, Calibration and Testing.

UNIT-IV

Flow Measurement: Quantity Meters, Positive Displacement Meters, Flow Rate Meters, Variable Head Meters, Variable Area Meters, Rotameters, Pitot - static tube Meter, Drag Force Flow Meter, Turbine Flow Meter, Electronic Flow Meter, Electro Magnetic Flow meter. Hot-Wire Anemometer.

Temperature Measurement: Introduction, Measurement of Temperature, Non Electrical Methods, Solid Rod Thermometer, Bimetallic Thermometer, Liquid-in -Glass thermometer, Pressure Thermometer, Electrical Methods, Electrical Resistance Thermometers, Semiconductor Resistance Sensors (Thermistors), Thermo–Electric Sensors, Thermocouple Materials, Radiation Methods (Pyrometry), Total Radiation Pyrometer, Selective Radiation Pyrometer.

Recommended Books

1. D.S. Kumar, 'Mechanical Measurements', Kataria & Sons.
2. Doebelin, 'Measurement Systems Application and Design', Tata McGraw Hill, **2002**.
3. Francis S. Tse, Ivan E. Morse and Marcel Dekker, 'Measurement and Instrumentation in Engineering', CRC Publishers.
4. Alan S. Morris, 'Principles of Measurement and Instrumentation', Prentice Hall of India.
5. B.C. Nakra and K.K. Chaudhary, 'Instrumentation, Measurement and Analysis', Tata McGraw Hill.
6. 'Mechanical Measurements and Control', 4^{th} Revised & Englarged Edn., Metropolitan Book Co. Pvt. Ltd., **2009**.

MRSPTU

SOFT SKILLS-III

Subject Code: **BHUM0-F93** | **L T P C 0 0 2 1** | **Duration: 26 Hrs.**

Course Objectives

The course aims to equip the students with effective writing skills in English. Also, to make the students understand their role as team players in organizations.

Course Outcomes

At the completion of the course, the student will become well –versed with the behavioural skills. They will also understand the role of body language and non-verbal communication during the interview process.

UNIT-1

ART OF WRITING - Introduction, Importance of Writing Creative Writing, Writing tips, Drawback of written communication.

ART OF BUSINESS WRITING - Introduction, Business Writing, Business Letter, Format and Styles, Types of business letters, Art of writing correct and precise mails, Understand netiquette.

UNIT-2

BODY LANGUAGE - Introduction- Body Talk, Forms of body language, uses of body language, Body language in understanding Intra and Inter-Personal Relations, Types of body language, Gender differences, Gaining confidence with knowledge of Kinesics.

UNIT-3

TEAM BUILDING AND TEAM WORK - Introduction, Meaning, Characteristics of an effective team, Role of a Team Leader, Role of Team Members, inter group Collaboration-Advantages, Difficulties faced, Group Exercises-Team Tasks and Role-Play, Importance of Group Dynamics.

UNIT-4

TIME MANAGEMENT - Introduction, the 80-20 Rule, three secrets of Time Management, Time Management Matrix, Effective Scheduling, Time Wasters, Time Savers, Time Circle Planner, Difficulties in Time Management, Overcoming Procastination.

RECOMMENDED BOOKS

1. K. Alex, S. Chand Publishers.
2. R.C. Sharma and Krishna Mohan, 'Business Correspondence and Report Writing', TMH, New Delhi, **2016.**
3. N. Krishnaswami and T. Sriraman, 'Creative English for Communication', Macmillan.
4. Penrose, John M., et al., 'Business Communication for Managers', Thomson South Western, New Delhi, **2007**.
5. Holtz, Shel, 'Corporate Conversations', PHI, New Delhi, **2007**.

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MEASUREMENTS AND INSTRUMENTATION LAB.

Subject Code: BMEE3-524 **L T P C**
0 0 2 1

EXPERIMENTS

1. Measurement with the help of Vernier caliper and micrometer.
2. Measurement of an angle with the help of sine bar.
3. Measurement of surface roughness.
4. Measurement of speed and torque of an engine.
5. Measurement of acceleration and vibrations of the vehicle.
6. Calibration of a pressure gauge with the help of a dead weight gauge tester.
7. Measurement of temperature using RTD / thermocouple.
8. Determination of frequency & phase angle using C.R.O.
9. Measurement of Inductance by Maxwell's Bridge.
10. Measurement of flow rate and quantity of air passing in the petrol.

AUTOMOTIVE TRANSMISSIONS LAB.

Subject Code: BMEE3-525 **L T P C**
0 0 2 1

EXPERIMENTS

1. Study of a layout of transmission system for a front wheel drive, rear wheel drive and a four-wheel drive arrangement.
2. Trouble shooting in different types of friction clutches.

3. Study of layout of gears and shafts in a manual type gearbox and a transaxle & their troubleshooting.
4. Study of layout in a manual & automatic gearbox for a two wheeler & its troubleshooting.
5. Study of layout of an automatic gearbox.
6. Study of gear shifting controls in an automatic gearbox & its troubleshooting.
7. Study of a manual and electric transfer case & its troubleshooting.
8. Study of an electric drive in an Electric vehicle.

VEHICLE BODY ENGINEERING LAB.

Subject Code: BMEE3-526 **L T P C**
0 0 2 1

EXPERIMENTS

1. Study of typical car body construction and propose new design sketches.
2. Study driver's seat position, passenger seat position, its requirement and construction of typical truck/bus body and propose new design sketches.
3. To prepare the analysis of the vehicle body weight and the weight distribution in different conditions and its effect on tractive performance.
4. Measurement of drag, lift force of a scaled model in wind tunnel.
5. Study the anti-corrosion and body painting and repainting procedures.
6. Study the construction of a special purpose vehicle.
7. To prepare the analysis of the vehicle body weight and the weight distribution in different conditions and its effect on steering performance.

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COMPUTER AIDED AUTOMOTIVE DESIGN

Subject Code: BMEE3-628 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

UNIT-I

Introduction: Study and selection of vehicle specifications - Choice of Cycle, fuel, speed, cylinder arrangement, number of cylinders, method of cooling, material, design variables and operating variables affecting performance and emission.
Bearing, Belts and Chains Systems: Design of sliding and rolling type of bearings, Details of design of bearing housings, Design for the selection of V-belt, toothed belt and chains, Design of pulley for belt, sprocket for chain.

UNIT-II

Engine Design: Design of Engine Components, Cylinder and Cylinder Liner, Piston, Piston Head or Crown, Piston Rings, Piston Skirt, Piston Pin, Connecting Rod, Crankshaft, Bearing Pressure and Stresses in Crankshafts, Design for Centre Crankshaft, Valve Gear Mechanism, Valves, Rocker Arm.

UNIT-III

Axle and Steering System: Study of loads, moments & stresses in different sections of front axle, king pin bearing and wheel spindle bearing, optimizing sizes of steering linkages, final drive design considerations in different types of propeller shafts, final drive & rear axle.

Resistance to Vehicle Motion: Calculation and plotting the curves of air, rolling and gradient resistances, driving force – Engine power, speed, rear axle ratio, Torque and mechanical efficiency at different vehicle speeds.

UNIT-IV

Performance Curves: Resistance, Power and torque curve, driving force against vehicle speed – Acceleration and grad-ability in different gears for a typical car or truck plotted from specifications.

Gear Ratios: Determination of Gear Ratios, Acceleration and grad-ability - typical problems.

Recommended Books

1. N.K. Giri, 'Automobile Mechanics', Khanna Publishers, New Delhi.
2. P.M. Heldt, 'High Speed Combustion Engine', Oxford & IBH Publishing Co., Calcutta.
3. 'Design Data Book', PSG College of Technology, Coimbatore.
4. R.C. Juvenal, 'Fundamental of Machine Component Design', John Wiley.
5. Kevin L. Hoag, 'Vehicular Engine Design', SAE Publication.
6. J.E. Shigley, 'Mechanical Engg. Design', McGraw Hill.

AUTOMOTIVE HEATING, VENTILATION AND AIR CONDITIONING

Subject Code: BMEE3-629 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

MRSPTU

UNIT-I

Air Conditioning Fundamentals: Fundamentals of refrigeration, basics of vehicle air conditioning system, location of air conditioning component in a car – schematic layout of a refrigeration system, component like compressor, condenser, fan blower, expansion device – expansion valve calibration, evaporator pressure regulator, low and high pressure switch.

UNIT-II

Air Conditioning Heating System: Automotive heaters – manually controlled air conditioner – heater system –automatically control air conditioner – air conditioning protection with heater diagnosis chart.

Refrigerants: Introduction, classification, properties, selection criteria, commonly used refrigerants, eco-friendly refrigerants, global warming and ozone forming potential of refrigerants, containers, handling of refrigerants.

UNIT-III

Psychometry: Introduction, Psychometric properties, Inside and outside design conditions of air conditioning system. Air distribution: introduction, factors affecting design of air distribution system, types of air distribution system, air flow through the dashboard recalculating unit, duct system, ventilation, vacuum reserve.

UNIT-IV

Air Conditioning Maintenance and Service: Cause of air conditioner failure, trouble shooting of air conditioning system, servicing heater system, removing and replacing components, leak testing, compressor service, charging and discharging, performance testing.

Recommended Books

1. William H. Crouse, 'Automotive Air Conditioning', Tata McGraw Hill Publication.
2. 'Automotive Air Conditioning', Mitchell Information Service, PHI.
3. W.H. Hucho, 'Aerodynamic of Road Vehicles, Butterworths Co.

VEHICLE DYNAMICS

Subject Code: BMEE3-630 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

UNIT-I

Introduction: Fundamental of vibration, Mechanical vibrating systems, Modeling and Simulation - Model of an automobile -Single, two and multi degrees of freedom systems – Free, forced and damped vibrations, Magnification factor -Transmissibility - Vibration absorber.

UNIT-II

Multi Degree of Freedom Systems: Closed coupled system - Eigen valve problems - Far coupled Systems - Orthogonality of mode shapes – Modal analysis - Forced vibration by matrix inversion. Approximate methods for fundamental frequency - Dunkerley's lower bound - Rayleigh's upper bound - Hozler method for close coupled and branched systems.

UNIT-III

Suspension and Tires: Requirements, Sprung mass frequency, Wheel hop, wheel wobble, wheel shimmy, Choice of suspension spring rate, Calculation of effective spring rate, Vehicle suspension in fore and apt directions. Ride characteristics of tire - Effect of driving and braking torque - Gough's tire characteristics.

UNIT-IV

Vehicle Handling: Over steer, under steer, steady state cornering, Effect of braking, driving torques on steering, Effect of camber, transient effects in cornering, Directional stability of vehicles.

Stability of Vehicles: Load distribution, Calculation of Tractive effort and reactions for different drives - Stability of a vehicle on a slope, on a curve and a banked road.

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Recommended Books

1. T.D. Gillespie, 'Fundamental of Vehicle Dynamics', Society of Automotive Engineers, USA.
2. P.M. Heldt, 'Automotive Chassis', Chilton Co., New York.
3. Giles J.G. Steering, 'Suspension and Tires', llliffe Books Ltd., London.
4. N.K. Giri, 'Automobile Mechanics', Khanna Publishers, New Delhi.
5. J.S. Rao & K. Gupta, 'Theory and Practice of Mechanical Vibrations', Wiley Eastern Ltd., New Delhi.

AUTOMOTVE AERODYNAMICS

Subject Code: BMEE3-631 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

UNIT-I

Introduction: Scope, historical developments, fundamental of fluid mechanics, flow phenomenon related to vehicles, external and Internal flow problem, resistance to vehicle motion, performance, fuel consumption and performance potential of vehicle aerodynamics, engine cooling requirement, air flow to passenger compartment, duct for air conditioning, cooling of transverse engine and rear engine.

UNIT-II

Aerodynamic Drag of Cars: Cars as a bluff body, flow field around car, drag force, types of drag force, analysis of aerodynamic drag, drag coefficient of cars, strategies for aerodynamic development, low drag profiles.

Shape Optimization of Cars: Front end modification, front and rear wind shield angle, boat tailing, hatch back, fast back and square back, dust flow patterns at the rear, effects of gap configuration, effect of fasteners.

UNIT-III

Vehicle Handling: The origin of forces and moments on a vehicle, lateral stability problems, methods to calculate forces and moments – vehicle dynamics under side winds, the effects of forces and moments, characteristics of forces and moments, dirt accumulation on the vehicle, wind noise, drag reduction in commercial vehicles.

UNIT-IV

Wind Tunnels for Automotive Aerodynamics: Introduction, principle of wind tunnel technology, limitation of simulation, stress with scale models, full scale wind tunnels, measurement techniques, equipment and transducers, road testing methods, numerical methods.

Recommended Books

1. W.H. Hucho, 'Aerodynamic of Road Vehicles', Butterworths Co., Ltd.
2. A. Pope, 'Wind Tunnel Testing', 2nd Edn., John Wiley & Sons, New York.
3. 'Automotive Aerodynamic: Update SP-706', SAE.
4. Vehicle Aerodynamics - SP-1145', SAE.

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VEHICLE SAFETY ENGINEERING

Subject Code: BMEE3-632 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

UNIT-I

Introduction: Design of the body for safety, engine location, deceleration of vehicle inside passenger compartment, deceleration on impact with stationary and movable obstacle, concept of crumple zone, safety sandwich construction, monocoque chassis construction.

UNIT-II

Safety Concepts: Active safety: driving safety, conditional safety, perceptibility safety, operating safety, passive safety: exterior safety, interior safety, deformation behavior of vehicle body, and speed, stopping distance.

Safety Equipment: Seat belt, regulations, automatic seat belt tightening system, collapsible steering column, tilt-able steering wheel, air bags, electronic system for activating air bags, bumper design for safety, Anti-lock Braking System (ABS), introduction to Electronic Stability Programme (ESP) & Electronic Brake Force Distribution (EBD).

UNIT-III

Collision Warning and Avoidance: Collision warning system, causes of rear end collision, frontal object d etection, rear vehicle object detection system, object detection system with braking system interactions, pedestrian detection.

UNIT-IV

Comfort and Convenience System: Steering and mirror adjustment, central locking system, Garage door opening system, tire pressure control system, rain sensor system, environment information system.

Recommended Books

1. Bosch, ‘Automotive Handbook’. 5^{th} Edn., SAE Publication, **2000**.
2. J. Powloski, ‘Vehicle Body Engineering’, Business books Ltd., London, **1969**.
3. Ronald. K. Jurgen, ‘Automotive Electronics Handbook’, 2^{nd} Edn., McGraw Hill Inc., **1999**.
4. W.H. Hucho, ‘Aerodynamic of Road Vehicles’, Butterworths Co., Ltd., **1997**.

SOFT SKILLS-IV

Subject Code: **BHUM0-F94**	**L T P C** **0 0 2 1**	**Duration: 26 Hrs.**

Course Objectives

The course aims at the key areas like conversation skills, group skills and persuasion skills required during the interview process in an organization.

Course Outcomes

At the end of the course, the student will be able to:

1. Demonstrate soft skills required for business situations.
2. Analyze the value of soft skills for career enhancement.
3. Apply soft skills to workplace environment.
4. Confidently participate in GD and interview process.

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UNIT-1

ART OF SPEAKING- Introduction. Communication process. Importance of communication, channels of communication. Formal and informal communication. Barriers to communication. Tips for effective communication. tips for conversation. Presentation skills. Effective multi-media presentation skills. Speeches and debates. Combating nervousness. Patterns and methods of presentation. Oral presentation, planning and preparation.

UNIT-2

GROUP DISCUSSION- Introduction. Importance of GD. Characters tested in a GD. Tips on GD. Essential elements of GD. Traits tested in a GD .GD etiquette. Initiating a GD. Non-verbal communication in GD. Movement and gestures to be avoided in a GD. Some topics for GD.

UNIT-3

PREPARING CV/RESUME-Introduction – meaning – difference among bio-data, CV and resume. CV writing tips. Do’s and don’ts of resume preparation. Vocabulary for resume, common resume mistakes, cover letters, tips for writing cover letters.

UNIT-4

INTERVIEW SKILLS - Introduction. Types of interview. Types of question asked. Reasons for rejections. Post-interview etiquette. Telephonic interview. Dress code at interview. Mistakes during interview. Tips to crack on interview. Contextual questions in interview skills. Emotional crack an interview. Emotional intelligence and critical thinking during interview process.

RECOMMENDED BOOKS

1. K. Alex, S. Chand Publishers.
2. Lucas, Stephen E., ‘The Art of Public Speaking’, 11^{th} Edn., International Edn., McGraw Hill Book Co., **2014**.
3. Goleman, Daniel, ‘Working with Emotional Intelligence’, Banton Books, London, **1998**.
4. Thrope, Edgar and Showick Trope, ’Winning at Interviews’, Pearson Education, **2004.**
5. Turk, Christopher, ‘Effective Speaking’, South Asia Division: Taylor & Francis, 1**985**.

COMPUTER AIDED DESIGN AND MANUFACTURING LAB.

Subject Code: **BMEE3-633** **L T P C**
0 0 2 1

EXPERIMENTS

A: Introduction to Modeling (using any CAD software):

1. 2D drawing using sketcher – 2 Drawings 2 Hrs.
2. 3D modeling using 3D features (Modeling of Screw Jack, Brake Pedal, Clutch, Steering Linkage, Carburettor, F. I. P., any four components) 6 Hrs.
3. Assembling and drafting (any 2 above mentioned assemblies) with proper mating conditions and interference checking. 6 Hrs.
4. Surface modeling – (Any two of above assemblies) 4 Hrs.

B: Computer Aided Manufacturing:

1. Manual part programming on CNC Lathe and CNC Milling – (4 programs, 2 for each) 4 hrs.
2. Computer Aided part programming for CNC Lathe and CNC Milling to generate tool path, NC code, and Optimization of tool path (to reduce machining time) using any CAM software. 4 Hrs.

AUTOMOTIVE HEATING, VENTILATION AND AIR CONDITIONING LAB.

Subject Code: **BMEE3-634** **L T P C**
0 0 2 1

MRSPTU

EXPERIMENTS

1. Study of various elements of a vapour compression refrigeration system.
2. Study and performance testing of an automobile refrigerator system.
3. Study and performance testing of an automobile heating system.
4. Calculation/ Estimation of cooling load for a Vehicle.
5. Calculation/ Estimation of heating load for a Vehicle.
6. Study the performance of air-conditioning, heating and ventilation of two vehicles.

TRACTORS & EARTH MOVING MACHINERY

Subject Code: BMEE3-659 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

UNIT-I

Introduction: Classification of special purpose vehicles, wheel type, track type & their applications.

Working Principles: Study of working principles & design considerations of different systems like power system, lubrication, electrical, braking, steering system.

UNIT-II

Transmissions & Final Drive: Auxiliary transmission, compound transmission, twin & triple countershaft transmissions and planetary transmission, Final drives: types of reductions like single reduction, double reduction final drives and planetary final drives, PTO shaft. Earth Moving Machinery: Constructional & working features of Bull Dozer, Front end loader, ripper, shovel, excavator, dumper, forklift, scraper, compactors.

UNIT-III

Tractors & Agricultural Implements: Classification of tractors, main tractor assemblies, functions of farm tractors, types of engine & transmissions used, braking system, Specifications of wheels and tires, dual versus tandem tires, applications of tractors, forces acting on a tractor on move, parallel pull and rolling resistance, tractor stability and weight distribution, maintenance and operation of tractors, differential lock.

UNIT-IV

Mobile Cranes: Basic characteristics of truck cranes, stability & design features, control systems & safety devices.

Miscellaneous Topics: Tracked vehicles, articulated vehicles, multi-axle vehicles.

Recommended Books

1. C.P. Nakra, 'Farm Machines and Equipment', Dhanpat Rai Publications, New Delhi.
2. J. Konard, 'Manual of Tractors', Asia Publishing House.
3. Jain and Roy, 'Tractors and Agriculture Equipment'.
4. David A. Day, Neal B.H. Benjamin, 'Construction Equipment Guide', Wiley.

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SEMESTER 5th		Contact Hrs.			Marks			Credits
Subject Code	**Subject 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 and interfacing	3	1	0	40	60	100	4
BEEE1- 519	Microprocessors Lab	0	0	2	60	40	100	1
BEEE1-520	Training#	0	0	4	60	40	100	2
BHUM0-F93	Soft Skills-III	0	0	2	60	40	100	1
Department Elective – I (Select any one)		3	0	0	40	60	100	3
BEEE1-556	Sensors & Transducers							
BEEE1-557	Electrical Engineering Materials							
BEEE1-558	Generation and Economics of Electrical Power							
BEEE1-559	Modern Optimization Techniques							
Open Elective – I		3	0	0	40	60	100	3
Total		**15**	**3**	**8**	**380**	**420**	**800**	**22**

#Industrial training to be imparted at the end of 4th semester for six weeks

SEMESTER 6th		Contact Hrs.			Marks			Credits
Subject Code	**Subject 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
BEEE1- 623	Power System Lab	0	0	2	60	40	100	1
BEEE1- 624	Power Electronics Lab	0	0	2	60	40	100	1
BHUM0-F94	Soft Skills-IV	0	0	2	60	40	100	1
Department Elective – II		3	0	0	40	60	100	3
BEEE1-660	Fuzzy Logic Systems							
BEEE1-661	VLSI Design							
BEEE1-662	Energy auditing & Management							
BEEE1-663	Micro-controller and Embedded Systems							
Department Elective – III		3	0	0	40	60	100	3
BEEE1-664	Digital Signal Processing							
BEEE1-665	Remote control & Telemetry							
BEEE1-666	Non-Conventional Energy Resources							
BEEE1-667	Neural Networks							
Open Elective – II		3	0	0	40	60	100	3
Total		**15**	**2**	**6**	**380**	**420**	**800**	**20**

Students will undergo 8-week industrial training after end semester examinations after 6th semester and present a seminar along with submission of report in 7th semester

SEMESTER 7th		Contact Hrs.			Marks			Credits
Subject Code	**Subject 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- 727	Computer Applications in Power System Analysis Lab.	0	0	2	60	40	100	1
BEEE1- 728	Communication System Lab.	0	0	2	60	40	100	1
BEEE1-729	Minor Project*	0	0	8	60	40	100	4
BEEE1-730	Industrial Training	0	0	8	60	40	100	4
Department Elective – IV		3	0	0	40	60	100	3
BEEE1-768	Industrial Automation							
BEEE1-769	Image Processing							
BEEE1-770	High Voltage Engineering							
BEEE1-771	HVDC & EHVAC Systems							
Open Elective – III		3	0	0	40	60	100	3
Total		**12**	**2**	**20**	**400**	**400**	**800**	**24**

***** *In this semester, the candidate shall submit a Minor Project (Hardware/ Software) based on area of interest in consultation with his/her supervisor. Student has to deliver the seminar associated with the same work. The same work of minor project can be extended to Major Project in the next semester.*

SEMESTER 8th		Contact Hrs.			Marks			Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
BEEE1- 831	Pulse Wave shaping & Switching	3	1	0	40	60	100	4
BEEE1- 832	Software Lab.	0	0	2	60	40	100	1
BEEE1- 833	Major Project	0	0	12	60	40	100	6
Department Elective – V		3	0	0	40	60	100	3
BEEE1-872	Electrical Machine Design							
BEEE1-873	Biomedical Instrumentation							
BEEE1-874	Flexible AC Transmission Systems							
BEEE1-875	Substation Equipment & Design							
BEEE1-876	Linear Integrated Circuits							
Total		**6**	**1**	**14**	**200**	**200**	**400**	**14**

MATHEMATICS-III

Subject Code: BMAT0-F91 **L T P C** **Duration: 55 Hrs.**
3 2 0 5

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.

NETWORK ANALYSIS AND SYNTHESIS

Subject Code: BEEE1-301 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

Course Objectives:
1. To aware the students about the basics of networks.
2. To provide them basic concepts of different types of network theorems and their applications.
3. To impart knowledge about different circuits, analysing and synthesizing the circuits.

Course Outcomes:
1. Students will be having skills to design, analyse and synthesize the circuits.
2. Knowledge of mathematical forms such as Laplace transforms and designing of filters circuits.

UNIT-I (10 Hrs.)

Circuits Concepts: Independent and dependent sources, Standard test signals: Step, ramp, impulse, and doublet. Mesh and nodal analysis. Network Theorems: Superposition, Thevenin's, Norton's, Maximum Power Transfer, Millman's, Tellegen's 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, transient and steady response, transfer function, poles and zeros, pole zero diagram, time domain behaviors from poles and zeros, Convolution Theorem.

UNIT-III (12 Hrs.)

Network Synthesis: Network functions, Impedance and admittance function, Transfer functions. Network function for two port network, Sinusoidal network in terms of poles and zeros, Real liability condition for impedance synthesis of RL, LCand RC circuits, network synthesis techniques for 2-terminal network, foster and cauer forms.

UNIT-IV (11 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. Bird John, 'Electrical Circuit Theory and Technology'.
2. Abhijit Chakraborty, 'Circuit Theory', Dhanpat Rai, **2001.**
3. D. Roy Chaudhury, 'Networks and Synthesis', New Age International.
4. T.S.K.V. Iyer, 'Circuit Theory', Tata McGraw Hill, **2006.**
5. Mohan, Sudhakar Sham, 'Circuits and Networks Analysis and Synthesis TMH, **2005.**
6. Van Valkenberg, 'Network Analysis and Synthesis', PHI Course, **2009.**

ELECTRICAL MEASUREMENTS & INSTRUMENTATION

Subject Code: BEEE1-302 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

Course Objectives:
1. To aware the students about the basics of measurements and instrumentation systems.
2. To impart knowledge about different instruments for electrical measurements.
3. To provide them basic concepts of different types of sensors and transducers.

Course Outcomes:
1. The students will be having skills to design, analyse and instruments.

2. To gain the skill knowledge of bridges and CRO operations.

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 and derived units. Instrument characteristics; accuracy, precision, repeatability and sensitivity. Different types of errors in measurement. Principle of operation and constructional features; D'Arsonval galvanometer, Moving Coil PMMC and Moving Iron instrument (Repulsion and Attraction type), Electrodynamics instruments.

UNIT-II (11 Hrs.)

Measurement of Resistance: Low, Medium and High resistance measurement using Kelvin Double Bridge, Ammeter-Voltmeter 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 (11 Hrs.)

Oscilloscope: Basic principle and 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.

UNIT-IV (11 Hrs.)

Transducers: 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. H. Cooper, 'Modern electronic instrumentation and measurement techniques', PHI
2. A.K. Sawhney, 'Electronic Instrumentation and Measurement', Dhanpat Rai & Sons, **2011.**
3. Jones and Chin, 'Electronic Instruments and Measurement'.
4. J. Toppin, 'Theory of Errors', Wessely Publishing., **2000.**

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ELECTRICAL MACHINES-I

Subject Code: BEEE1-303	**L T P C** **3 1 0 4**	**Duration: 45 Hrs.**

Course Objectives:

1. To aware the students about the basics of electromechanical energy conversion.
2. To impart knowledge about different construction operation of Transformers.
3. To study characteristics speed control methods and testing of different types of DC Generators and motors.

Course Outcomes:

1. After the completion of course, students will be having skills to analyse the transformer.
2. Gain the skill knowledge of experimental performance and testing of Electrical DC Machines.

UNIT-I (11 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-II (12 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-III (11 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-IV (12 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.

Recommended Books

1. P.S. Bhimra, 'Electrical Machinery', Khanna Publisher.
2. I.J. Nagrath& D.P. Kothari, 'Electric Machines', TMH.
3. P.K. Mukherjee & S Chakrabarty, 'Electrical Machines', Dhanpat Rai.
4. S.K. Sen, 'Electrical Machinery', Khanna Publishers.

ELECTRONIC DEVICES & CIRCUITS

Subject Code: BEEE1-304 **L T P C** **3 1 0 4** **Duration: 45 Hrs.**

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Course 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.

Course Outcomes:

1. The students could have skills about the basic electronic circuits, their operational characteristics and their applications.
2. 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, different types of diodes, Drift current, diffusion current. Rectifiers.

UNIT-II (11 Hrs.)

Bipolar Junction Transistor: Working action of NPN and PNP. CE, CB and 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: 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,

Concept of Feedback in Amplifiers: Positive and negative feedback, effect of negative feedback.
Oscillators: Principle of operation of different oscillator circuits-RC Phase shift, Wien Bridge, Hartley Bridge, Colpits and Crystal oscillators.

UNIT-IV (12 Hrs.)

Field Effect Transistors: FET construction and working, P-channel and N-channel JFETs. Comparison with BJT, Characteristics of JFET, JFET parameters- AC drain resistance, trans-conductance, amplification factor, dc drain resistance. Construction, working and characteristics of MOSFET. Comparison of BJT, JFET and MOSFET.

Recommended Books

1. Boylstad and Nashelsky, 'Electronic Devices and Circuits', Prentice Hall.
2. Millman and Halkias, 'Integrated Electronics', McGraw Hill, **2001.**
3. Malvino, 'Electronic Principles', McGraw Hill, **2007**.
4. V.K. Mehta, 'Principles of Electronics', S. Chand, **2006.**
5. Donald L. Shilling and Charles Belowl, 'Electronic Circuits', TMH, **2009.**

MEASUREMENT & INSTRUMENTATION LAB.

Subject Code: BEEE1-305 **L T P C**
0 0 2 1

Course Objectives:

1. To understand the working principal and construction of the measuring instruments and recorders.
2. To measure various electrical parameters using meters and transducers.
3. To calibrate the measuring devices such as meters and transducers.

Course Outcomes:

1. The students could have skills about the basic measurement circuits.
2. Ability to use the techniques and skills to operate CRO.

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 measure 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 readings.
6. To study and calibrate single phase 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.

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ELECTRICAL MACHINES-I LAB.

Subject Code: BEEE1-306 **L T P C**
0 0 2 1

Course Objectives:
1. To understand the working principal and construction of the Transformer.
2. To carry out laboratory experiments on electrical DC machines to find out parameters.
3. To perform the experiments to draw the characteristics of DC machines.

Course Outcomes:
1. After the completion of the course, the students could have skills about the basics of testing of Transformer and DC machines.
2. An ability to analyse possible causes of discrepancy in comparison to theory.

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.

Note: At least ten experiments should be performed in semester

ELECTRONIC DEVICES AND CIRCUITS LAB.

Subject Code: BEEE1-307 **L T P C**
0 0 2 1

Course Objectives:
1. To understand the characteristics of various semiconductor devices.
2. To understand identification and selection of various electronic components.

Course Outcomes:
1. Ability to understand all types of electronics devices and circuits.
2. Ability to analyse and interpret data.

EXPERIMENTS

1. To analyse the response of Zener diode as regulator
2. To analyse the response of half wave, full wave and Bridge rectifiers.
3. To plot the input and output characteristics of CE configuration.
4. To plot the input and output characteristics of CB configuration.
5. To examine the characteristics of a Class-A amplifier.
6. To examine the characteristics of Class-B amplifier.
7. To analyse the characteristics of Class-B push-pull amplifier.

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8. To analyse the characteristics of complementary symmetry amplifier.
9. To discuss the response of RC phase shift oscillator and determine frequency of oscillation.
10. To discuss the response of Hartley oscillator and determine frequency of oscillation.
11. To analyse the response of Colpitt's oscillator and determine frequency of oscillation.
12. To analyse the response of Wien Bridge oscillator and determine frequency of oscillation.
13. To study the characteristics and response of crystal oscillator.
14. To plot the characteristics of FET.
15. To plot the characteristics of MOSFET.

Note: At least ten experiments should be performed in semester

SOFT SKILLS-I

Subject Code: **BHUM0-F91** **L T P C**
0 0 2 1

Course Objectives:
The course aims to cause a basic awareness about the significance of soft skills in professional and interpersonal communications and facilitate an all-round development of personality.

Course Outcomes:
At the end of the course, the student will be able to develop his/her personal traits and expose their personality effectively.

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UNIT-1

SOFT SKILLS: Introduction to Soft Skills, Aspects of Soft Skills, Identifying your Soft Skills, Negotiation skills, Importance of Soft Skills, Concept of effective communication.
SELF-DISCOVERY: Self-Assessment, Process, Identifying strengths and limitations, SWOT Analysis Grid.

UNIT-2

FORMING VALUES: Values and Attitudes, Importance of Values, Self-Discipline, Personal Values - Cultural Values-Social Values-some examples, Recognition of one's own limits and deficiencies.

UNIT-3

ART OF LISTENING: Proxemics, Haptics: The Language of Touch, Meta Communication, Listening Skills, Types of Listening, Listening tips.

UNIT-4

ETIQUETTE AND MANNERS: ETIQUETTE- Introduction, Modern Etiquette, Benefits of Etiquette, Taboo topics, Do's and Don'ts for Men and Women. MANNERS- Introduction, Importance of manners at various occasions, Professional manners, Mobile manners. CORPORATE GROOMING TIPS- Dressing for Office: Do's and Don'ts for Men and Women, Annoying Office Habits.

Recommended Books

1. K. Alex, S. Chand Publishers.
2. Butterfield, Jeff, 'Soft Skills for Everyone', Cengage Learning, New Delhi, **2010**.
3. G.S. Chauhan and Sangeeta Sharma, 'Soft Skills', Wiley, New Delhi, **2016**.
4. Klaus, Peggy, Jane Rohman & Molly Hamaker, 'The Hard Truth About Soft Skills', Harper Collins E-books, London, **2007**.
5. S.J. Petes, Francis, 'Soft Skills and Professional Communication', Tata McGraw Hill Education, New Delhi, **2011**.

ELECTRICAL MACHINES-II

Subject Code: BEEE1-409 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

Course Objectives:

1. To aware the students about basics of working principles of machines.
2. To update the knowledge about illustrate starting and control of induction motors.
3. To analyse the performance of induction motors

Course Outcomes:

1. The students will gain teaching skills in this domain.
2. An ability to use the speed control schemes of machines.

UNIT-I (10 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 (12 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 (11 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 (12 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', Khanna Publishers, **2011.**
2. Nagrath & Kothari, 'Electric Machines', TMH, **2010.**
3. Fitzerald & Kingsley, 'Electric Machinery', MGH, **2007.**

LINEAR CONTROL SYSTEM

Subject Code: BEEE1-410 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

Course 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.

Course Outcomes:

1. The students will have skills to model the control systems.
2. Ability to analyse the stability of designed systems.

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UNIT-I (10 Hrs.)

Introductory Concepts: Plant, Systems, Servomechanism, regulating systems, Open loop control system, closed loop control systems, linear and non-linear systems, time variant and invariant, Block diagrams, some illustrative examples.

UNIT-II (12 Hrs.)

Modelling: Force voltage analogy, force current analogy, Transfer function, Block diagram reduction technique, signal flow graphs and Mason's gain formula, characteristics equation.

Time Domain Analysis: Transient response of the first and second order systems, Time domain specifications, Steady state error and coefficients, Absolute and relative stability, Routh-Hurwitz Criterion.

UNIT-III (12 Hrs.)

Stability Analysis: Root locus technique, sketch of the root locus plot, Frequency domain analysis: Closed loop frequency response, bode plots, relative stability using bode plot. Frequency response specifications, relation between time and frequency response for second order systems. Nyquist criterion for stability.

UNIT-IV (11 Hrs.)

State Space Analysis: State space representations, transfer function from state model, 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 and Bishop Robert, 'Modern Control System', Addison-Wesley, Pearson, **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.**

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DIGITAL ELECTRONICS

Subject Code: BEEE1-411 | **L T P C** **3 1 0 4** | **Duration: 45 Hrs.**

Course 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 inthe creation of solutions to design problems.

Course Outcomes:
1. An ability to understand all types of combinational and sequential digital circuits and their designing.
2. 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 numbers, binary operations: Addition, Subtraction. Multiplication and division. Subtractions using 1's and 2's compliment. ASCII code. Excess 3 codes and Gray code. Logic gates: OR, AND, NOT, NOR, NAND, Ex-OR gates, Basic theorems of Boolean algebra, sum of products and product of sums. Minimisation using theorems, minimisation using K-map up to 4 variables.

UNIT-II (10 Hrs.)

Combinational Logic Circuits: Combinational circuit design, multiplexer, demultiplexer, encoders, decoders, adders, subtractors, code converters, parity checkers, 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 flops, Registers: Types of Registers, series and parallel shift: circuit diagram, timing wave form and operations. Counters: synchronous and asynchronous, Johnson counter.

UNIT-IV (11 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. D.P. Kothari and J.S. Dhillon, 'Digital Circuits and Design', Pearson, **2015**.
2. R.P. Jain, 'Modern Digital Electronics', TMH, **2011.**
3. Malvino and Leach, 'Digital Principles and Applications', TMH, **1991.**
4. Fletcher, 'An Engg. Approach to Digital Design', PHI, Indian Edn., **2011**.
5. Sanjay Sharma, 'Digital Electronics', Kataria Sons, 1st Edn., **2011**.

POWER SYSTEM-I

Subject Code: BEEE1-412 | **L T P C 3 1 0 4** | **Duration: 45 Hrs.**

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Course Objectives:

1. To provide knowledge about basics of transmission systems.
2. To impart knowledge about representation of different power system components and loading capability of a generator.
3. Students will learn the basic concepts of mechanical and electrical design of transmission lines HVDC/EHVAC systems.

Course Outcomes:

1. An ability to understand all types of different power system components
2. Students will have skills to differentiate transmission and distribution systems

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 (11 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 (12 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. Grainger John, J. and Stevenson, Jr. W.D, 'Power System Analysis', McGraw Hill, **1994.** Harder Edwin, 'Fundamentals of Energy Production' John Wiley and Sons, **1982.**
2. C.L. Wadhwa, 'Electric Power Systems', Wiley Eastern Limited, **1985.**
3. I.J. Nagrath and D.P. Kothari, 'Power System Engineering', Tata McGraw Hill, **1995.**

ELECTROMAGNETIC FIELD THEORY

Subject Code: BEEE1-413 | **L T P C 3 1 0 4** | **Duration: 45 Hrs.**

Course Objectives:

1. To provide the knowledge about the time varying fields and Maxwell's equations.
2. To provide knowledge about the propagation of electromagnetic wave along different mediums.
3. Study of physical concept and all the important fundamental parameters of waveguides.

Course Outcomes:

1. The students will learn the concepts of electromagnetic field theory and fundamental field equations.
2. The students will have skills to identify, formulate and solve engineering problems related to electromagnetic fields.

UNIT-I (10 Hrs.)

Review of Electrostatic and Magnetostatic fields: Review of vector algebra, Review of Cartesian, Cylindrical and spherical coordinate systems, Introduction to del operator, Use of del operator as gradient, divergence, curl. Introduction to coulomb's law, Gaussian law. Laplace's and Poission's equation in various coordinate systems. Introduction to Ampere's law, Magnetic vector potential.

UNIT-II (12 Hrs.)

Time Varying Fields and Maxwell's Equations: Equation of continuity, Inconsistency of Ampere's law for time varying fields, Concept of displacement current, Maxwell's equation in integral and differential form (for static fields, time varying fields, free space, good conductors, harmonically varying fields), Poynting theorem.

UNIT-III (11 Hrs.)

Uniform Plane Waves: Introduction, Uniform plane wave propagation, Wave equations: Wave equations for free space, Wave equations for conductors. Transverse nature of uniform plane waves, Reflection of electromagnetic waves by perfect conductor and perfect dielectric, wave impedance and propagation constant, depth of penetration, surface impedance.

UNIT-IV (12 Hrs.)

Wave Guides: Introduction, simple waveguides between two infinite and parallel conducting plates, Transverse Electric (TE) Waves or H-Waves, Transverse magnetic (TM) Waves or E-Waves, Characteristics of TE and TM waves, Transverse Electromagnetic (TEM) waves and its characteristics.

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Recommended Book

1. Jordan and Balmain, Electromagnetic Wave', PHI and Radiation System, **2010.**
2. Kraus, 'Electromagnetics', TMH, **2003.**
3. W.H. Hayt and J.A. Buck, 'Problem and solutions in Electromagnetics', TMH, **1999.**
4. W.H. Hayt, 'Engineering Electromagnetic', TMH, **2012.**

CONTROL SYSTEM LAB.

Subject Code: BEEE1-414 **L T P C**
0 0 2 1

Course Objectives:
1. To understand the basics concepts of MATLAB software.
2. To introduce variety of control system strategies.
3. To comment about the stability of designed systems.

Course Outcomes:
1. To acquire skills to understand all types of control components.
2. Ability to analyse the stability of control systems.

EXPERIMENTS

1. Familiarization with MATLAB control system toolbox, MATLAB Simulink toolbox and PSPICE.
2. Determination of step response for first order and 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 and impulseresponsefortype-0, type-1and type-2 systems with unity feedback using MATLAB and PSPICE.
4. Determination of RootLocus, Bode-Plot, Nyquist Plot using MATLAB-Control system toolbox for 2nd order system. Determination of different control system performance indices from the plots.
5. Experimental determination of approximate transfer function from Bode plot.
6. Evaluation of steady state error, settling time, percentage peak overshoot, gain margin, phase margin, with addition of lead compensator and by compensator in forward path transfer function for unity feedback control system using PSPICE.
7. Design of a second order linear time invariant control system and study of system response with unit step input.
8. To study the characteristics of potentiometers and to use 2-potentiometers as an error detector in a control system.
9. To study the synchro Transmitter-Receiver set and to use it as an error detector.
10. To study the Speed-Torque characteristics of an AC Servo Motor and to explore its applications.
11. To study the Speed-Torque characteristics of a DC Servo Motor and explore its applications.
12. To study various electro-mechanical transducers i.e. resistive, capacitive and inductive transducers.
13. To study the speed control of an A.C. Servo Motor using a closed loop and an open loop system.
14. To study the operation of a position sensor and study the conversion of position in to corresponding voltage

Note: At least ten experiments should be performed in semester.

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DIGITAL ELECTRONICS LAB.

Subject Code: BEEE1-415 **L T P C**
0 0 2 1

Course Objectives:
1. To give students a practical knowledge about all types of digital circuits.
2. To give students a working knowledge to connect digital circuits and verify their truth tables.
3. To give students knowledge of different combinational and sequential circuits.

Course Outcomes:
1. An ability to test and verify working and truth tables of combinational and sequential circuits.
2. To give knowledge of various logic families.

EXPERIMENTS

1. To Study Logic Gates: Truth-table verification of OR, AND, NOT, XOR, NAND and NOR
2. gates and realization of OR, AND, NOT and XOR functions using universal gates.
3. To design Half Adder using Logic gates on bread board.
4. To design Full Adder using Logic gates on bread board.
5. To design Half Subtractor using Logic gates on bread board.
6. To design Full Subtractor using Logic gates on bread board.
7. To design 4-Bit Binary-to-Gray Code Converter on bread board.
8. To design 4-Bit Gray-to-Binary Code Converter on bread board.
9. To study and design 4-Bit magnitude comparator using logic gates on bread board.
10. Design and verification of Truth-table of multiplexer.
11. Realization of Half adder and Full adder using MUX.
12. Design and verification of Truth-table of Demultiplexer.
13. Realization of half subtractor and full subtractor using DEMUX.
14. To study and verify Truth-table of RS, JK, D, JK Master Slave Flip Flops.
15. To design MOD-7 Synchronous up-counter using JK/RS/D Flip Flops.
16. To Study different shift registers: SIPO, SISO, PIPO, and PISO.
17. To Study digital logic families.

Note: At least ten experiments should be performed in semester

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SOFT SKILLS-II

Subject Code: **BHUM0-F92** **L T P C**
0 0 2 1

Course Objectives:
The course aims to address various challenges of communication as well as behavioural skills faced by individual at work place and organisations. Also, it aims to enhance the employability of the students.

Course Outcomes:
At the end of the course the student will be able to understand the importance of goal setting. They will also be able to handle stress in their lives and future in a better way.

UNIT-1

DEVELOPING POSITIVE ATTITUDE: Introduction. Formation of attitude. Attitude in workplace. Power of positive attitude. Examples of positive attitudes. Negative attitudes. Examples of negative attitude. overcoming negative attitude and its consequences.

IMPROVING PERCEPTION: Introduction. Understanding perception. perception and its application in organizations.

UNIT-2

CAREER PLANNING: Introduction. Tips for successful career planning. Goal setting- immediate, short term and long term. Strategies to achieve goals. Myths about choosing career.

UNIT-3

ART OF READING: Introduction. Benefits of reading. Tips for effective reading. the SQ3R technique. Different stages of reading. determining reading rate of students. Activities to increase the reading rate. Problems faced. Becoming an effective reader.

UNIT-4

STRESS MANAGEMENT: Introduction. meaning. positive and negative stress. Sources of stress. Case studies. signs of stress. Stress management tips. Teenage stress.

Recommended Books

1. K. Alex, S. Chand Publishers.
2. Rizvi, M. Ashraf, 'Effective Technical Communication', McGraw Hill.
3. Mohan Krishna & Meera Banerji, 'Developing Communication Skills', Macmillan.
4. Kamin, Maxine, 'Soft Skills Revolution: A Guide for Connecting with Compassion for Trainers, Teams & Leaders', Pfeiffer & Amp; Company, Washington, DC, **2013.**

SIGNALS & SYSTEMS

Subject Code: BEEE1-516 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

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Course Objectives:

1. To introduce the students about the theoretical concepts associated with processing continuous & discrete time signals & systems.
2. To be able to think critically & to apply problem solving & reasoning strategies to the analysis of various types of signals & systems.
3. To impart them knowledge of various types of noises.

Course Outcomes:

1. An ability to analyse various types of signals in communication system.
2. Developing skills to understand random signals.
3. To understand various types of noises.
4. 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 Systems', Oxford University Press.
2. Ravi Kumar, 'Signals and Systems', PHI Course.
3. Simon Haykin, 'Signals and Systems' Wiley.
4. D. Ganesh Rao and Satish Tunga, 'Signals and Systems', Pearson.

POWER ELECTRONICS AND UTILIZATION

Subject Code: BEEE1-517 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

Course Objectives:

1. To introduce the students to Power Electronics and thyristor family of devices.
2. To make them to understand their switching characteristics and turn-on and turn-off methods
3. To develop the understanding about operational concepts of various types of convertors
4. To make them aware about use of thyristors in diverse applications.

Course Outcomes:

1. Understand the Power Electronic devices and infer their usage as switches
2. Knowledge of various types of converters
3. Understand the use of converters in conversion and control of electrical power
4. Apply power electronics technology in efficient utilization of electrical power.

UNIT-I (11 Hrs.)

Thyristor Fundamentals: Construction of SCR, operating modes, Two Transistor Analogy, Static and Dynamic characteristics, Gate characteristics, Turn-on and Turn - off methods, Firing/Triggering circuits: R and RC type, UJT based triggering, Isolation of gate and base drive circuits using pulse transformer and optocouplers, Commutation circuits for thyristors.

Series and Parallel operation of SCRs: Need, string efficiency, Static and Dynamic equalizing circuits.

Ratings, di/dt and dv/dt rating, Snubber circuit and its design, Introduction to other members of Thyristor family such as SCR, DIAC, TRIAC, LASCR, GTO.

UNIT-II (11 Hrs.)

Phase Controlled (AC to DC) Converters: Principle of phase control, Single phase half wave circuit with different types of loads, Single phase and three phase full converter circuits with line commutation, Continuous and discontinuous load current, effect of Source impedance on single phase and three phase full converters, Single phase and three phase dual converters and their operation with circulating and non-circulating currents.

Chopper Circuits (DC to DC Converters): Types of chopper: step up, step down. Different classes of chopper circuits: Class A, B, C, D, E for R, R-L and RLE load. Voltage commutated Chopper.

UNIT-III (11 Hrs.)

Inverters (DC to AC Converters): 1-Ø voltage source bridge inverters and their steady state analysis, Fourier analysis of output voltage, Modified McMurray Half bridge inverter, 3-Ø bridge inverters with 180^o and 120^o modes, Voltage Control in single Phase Inverters: PWM techniques, Methods of Harmonic Reduction, Space Vector Modulation (SVM), Relationship between PWM and SVM, Introduction to Current Source Inverter and Series Inverter.

UNIT-IV (12 Hrs.)

(AC to AC Converters)

AC Voltage Controller: Types of single-phase voltage controllers, Single-phase voltage controller with R and RL type of loads.

Cycloconverters: Principles of operation, Single phase to single phase step up and step down Cyclo-converters. Three phase to single phase and three-phase to three-phase cyclo-converters, Output voltage equation for a cyclo-converter.

Utilization: Introduction to Speed control of AC and DC motor drives, Control of Electric heating, Welding, Illumination, Application in HVDC transmission, Reactive power control in power systems.

Recommended Books

1. P.S. Bimbhra, 'Power Electronics', Khanna Publishers, New Delhi, **2012.**
2. Muhammad H. Rashid, 'Power Electronics – Circuits, Devices and Applications', Prentice Hall of India Private Limited, **2006.**
3. M.D. Singh and K.B. Khan, 'Power Electronics', TMH, New Delhi, **2007.**
4. G.K. Dubey, S.R. Doradla, A. Joshi and R.N.K. Sinha, 'Thyristorised Power Controllers', New Age International (P) Limited, **2004.**

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MICROPROCESSOR AND INTERFACING

Subject Code: BEEE1-518 | **L T P C** **3 1 0 4** | **Duration: 45 Hrs.**

Course 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.

Course 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 (11 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 (12 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.
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.
4. B. Ram, 'Fundamentals of Microprocessor and Microcontrollers', Dhanpat Rai and Sons, New Delhi.

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MICROPROCESSOR LAB.

Subject Code: BEEE1-519 **L T P C**
0 0 2 1

Course 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

Course 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
11. microprocessors and 8255 PPI.

12. Write a program to control speed of DC motor using 8085/8086 microprocessors and
13. 8255 PPI.

Note: At least 08 experiments are required to be performed.

SOFT SKILLS-III

Subject Code: **BHUM0-F93** **L T P C**
0 0 2 1

Course Objectives:
The course aims to equip the students with effective writing skills in English. Also, to make the students understand their role as team players in organisations.

Course Outcomes:
At the completion of the course, the student will become well –versed with the behavioural skills. They will also understand the role of body language and non-verbal communication during the interview process.

UNIT-1

ART OF WRITING: Introduction, Importance of Writing Creative Writing, Writing tips, Drawback of written communication.

ART OF BUSINESS WRITING: Introduction, Business Writing, Business Letter, Format and Styles, Types of business letters, Art of writing correct and precise mails, Understand netiquette.

UNIT-2

BODY LANGUAGE: Introduction- Body Talk, Forms of body language, uses of body language, Body language in understanding Intra and Inter-Personal Relations, Types of body language, Gender differences, Gaining confidence with knowledge of Kinesics.

UNIT-3

TEAM BUILDING AND TEAM WORK: Introduction, Meaning, Characteristics of an effective team, Role of a Team Leader, Role of Team Members, inter group Collaboration-Advantages, Difficulties faced, Group Exercises-Team Tasks and Role-Play, Importance of Group Dynamics.

UNIT-4

TIME MANAGEMENT: Introduction, the 80-20 Rule, three secrets of Time Management, Time Management Matrix, Effective Scheduling, Time Wasters, Time Savers, Time Circle Planner, Difficulties in Time Management, Overcoming Procastination.

Recommended Books

1. K. Alex, S. Chand Publishers.
2. R.C. Sharma and Krishna Mohan, 'Business Correspondence and Report Writing', TMH, New Delhi, **2016.**
3. N. Krishnaswami and T. Sriraman, 'Creative English for Communication', Macmillan.
4. Penrose, John M., et al., 'Business Communication for Managers', Thomson South Western, New Delhi, **2007**.
5. Holtz, Shel, 'Corporate Conversations', PHI, New Delhi, **2007**.

SENSORS AND TRANSDUCERS

Subject Code: BEEE1-556 **L T P C** **Duration: 38 Hrs.**
3 0 0 3

Course Objectives:
1. Understanding the structural and functional principles of sensors and transducers used for

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various physical and nonelectric quantities and how to use them to measure these quantities.
2. Explain the principles of operation of the sensor parameters and generators
3. Interpretation of the measurement results by using transducers.
4. Development of measurement schemes for different non electrical quantities
5. Assimilating knowledge about the implementation of sensors and transducers into a control system structure.

Course Outcomes:
1. To explain the structure of the Transducers and sensors.
2. To design applications using the sensors and transducers.
3. To enhance knowledge on various types of thermoelectric effects and devices.
4. To study the effects of various sensors and their applications.

UNIT-I (9 Hrs.)

Introduction to Sensors and Transducers, Basic elements of instrumentation system, Static and Dynamic characteristics of transducers, selection criterion, Mechanical and Electromechanical sensors. Resistive (potentiometric) type: resolution, accuracy, sensitivity. Strain Gauges: theory, types, sensitivity, gauge factor, variation with temperature. Inductive sensors: common types- reluctance change type, mutual inductance change type, transformer action type, magnetostrictive type. LVDT: Construction, output-input relationship, I/O curve, Proximity and Range sensors.

UNIT-II (9 Hrs.)

Capacitive Sensors: Variable distance- parallel plate type, Variable area- parallel plate, serrated plate/teeth type and cylindrical type. Variable Dielectric Constant Type: calculation of sensitivities Stretched Diaphragm type: microphones, response characteristics. Piezoelectric Elements: piezoelectric effects, charge and voltage coefficients, crystal model, materials, natural and synthetic types – their comparison, force and stress sensing, ultrasonic sensors

UNIT-III (9 Hrs.)

Thermal sensors: Material expansion type: solid, liquid, gas and vapour Resistance change type: RTD, materials, construction, tip sensitive and stem sensitive type, Thermistor materials, shapes, ranges, accuracy specifications. Thermoemf sensors: types, thermoelectric powers, general consideration Junction semiconductor type IC and PTAT type Radiation sensors: types, characteristics and comparisons, Pyroelectric type.

UNIT-IV (11 Hrs.)

Magnetic sensors: Sensors based on Villari effect for assessment of force, torque, proximity; Wiedemann effect for yoke coil sensors, Thomson effect. Hall effect and Hall drive, performance characteristics Radiation sensors: LDR, photovoltaic cells, photodiodes, photo emissive cells- types, materials, construction, response Geiger counters, Scintillation detectors Introduction to Smart sensors, Humidity, pH, conductivity, Velocity, Acceleration: Electromagnetic velocity sensor; spring-mass-system, measurement of deflection principle of accelometers, sensitivity, Noise Flow: Pressure gradient technique; (orifice, venture, pitot,) rotameter thermal transport technique; electromagnetic sensor, laser Doppler anemometry; ultrasonic sensors.

Recommended Books

1. A.K. Sawhney, ‘Electrical and Electronics Measurements and Instrumentation’ Dhanpat Rai and Sons.
2. C.S. Rangan, G.R. Sarma, V.S.V. Mani, ‘Instrumentation Devices and Systems’, Tata McGraw Hill Publication.
3. B.C. Nakra, K.K. Chaudhary, ‘Instrumentation Measurement and Analysis’, McGraw Hill Publication Ltd.

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4. D. Patranabis, 'Sensors and Transducers', Prentice Hall India Course Private Limited.
5. E.A. Doebelin, 'Measurement Systems: Application and Design', McGraw Hill, New York.
6. H.K.P. Neubert, 'Instrument Transducers', Oxford University Press, London and Calcutta.

ELECTRICAL ENGINEERING MATERIALS

Subject Code: BEEE1-557 **L T P C** **Duration: 39 Hrs.**
3 0 0 3

Course Objectives
1. To provide knowledge about basics of electrical engineering materials.
2. Students will obtain skills of application of materials in daily life.

Course Outcomes
1. An ability to understand all types of magnetic and conducting materials.
2. To understand the various properties of electrical engineering materials.

UNIT-I (8 Hrs.)

Elementary Materials Science Concepts: Bonding and types of solids and its defects, resistivity, factors affecting resistivity, temperature dependence of resistivity, Skin Effect, Hall Effect.

UNIT-II (10 Hrs.)

Dielectric Properties of Insulators in Static and Alternating Field: Dielectric constant of gases, molecules and solids, internal field in solids and liquids, Properties of ferro-electric materials, polarization, types of polarizations, polarizability: atomic and molecular, frequency dependence of electronic and ionic polarizability, piezoelectricity and dielectric losses.

UNIT-III (10 Hrs.)

Magnetic Properties and Superconductivity: Magnetization of matter, magnetic material classification, ferromagnetic origin, Curie-Weiss law, soft and hard magnetic materials, Superconductivity and its origin, critical temperature, critical magnetic field, zero resistance and Meissner Effect, Type-I and Type-II superconductors, applications of superconductors.

UNIT-IV (9 Hrs.)

Conductivity of Metals: Drift velocity, relaxation time of electrons, collision time and mean free path, electron scattering and resistivity of metals.

Semiconductor Materials: Classification of semiconductors, semiconductor conductivity, temperature dependence, Carrier density and energy gap, fermi level, applications of semiconductors in electrical engineering.

Recommended Books
1. S.P. Seth, 'A Course in Electrical Engineering Materials', Dhanpat Rai and Sons, **2001.**
2. Electrical Engineering Materials, T.T.T.I., Madras, **1998.**
3. K.B. Raina and S.K. Bhattacharya, 'Electrical Engineering Materials, S.K. Kataria and Sons, **2004.**
4. P.K. Palanisamy, 'Material Science for Electrical Engineering, Scitech Pub. (India) Pvt. Ltd., Chennai, **2011.**

GENERATION & ECONOMICS OF ELECTRICAL POWER

Subject Code: BEEE1-558 **L T P C** **Duration: 39 Hrs.**
3 0 0 3

Course Objectives:
1. Define the performance characteristics and components of such power plants.
2. Estimate different efficiencies associated with such systems

3. Calculate present worth depreciation and cost of different types of power plants.
4. Estimate the cost of producing power per kW.

Course Outcomes:

1. Discuss the environmental impact of electric power production on air quality, climate change, water, and land
2. Discuss power generation from renewable/alternate fuels and heat sources: bio fuels, synthetic fuels, geothermal, ocean thermal, solar thermal power plants.
3. Discuss the principles and potential of direct-electric power conversion systems, such as fuel-cell and solar photovoltaic units.
4. Explain the major types of hydro-power and wind-power turbines and estimate power generation potential.

UNIT-I (8 Hrs.)

Introduction: Energy sources and their availability, Principle types of power plants, Their special features and applications, Present status and future trends.

UNIT-II (11 Hrs.)

a) Conventional Power Generation:
Hydro Electric Power Plants: Essentials, Classifications, Hydroelectric survey, Rainfall run off, Hydrograph, Flow duration curve, Mass curve, Storage capacity, Site selection, Plant layout, various components, Types of turbines, Governor and speed regulation, Pumped storage, Small scale hydroelectric plants (mini and micro),

b) Steam Power Plant: General developing trends, Essentials, Plant layout, Coal–its storage, Preparation, Handling, Feeding and burning, Ash handling, Dust collection, High pressure boilers and steam turbines, Their main components like super heaters, Economizers, Pre–heaters etc., Fuel efficiency/heat balance, Layout of Gas turbine power plant and comparison with steam power plants.

c) Nuclear Power Plant: Nuclear fuels, Nuclear energy, Main components of nuclear power plant, Nuclear reactors types and applications, Radiation shielding, Radioactive and waste disposal safety aspect.

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UNIT-III (10 Hrs.)

Non-Conventional Power Generation: Geothermal power plants, Electricity from biomass, direct energy conversion systems, Thermo-electric conversion system, Fuel cells, Magneto Hydro Dynamic system.

UNIT-IV (10 Hrs.)

Power Plant Economics: Cost of electrical energy, Selection of type of generation and generation equipment, Performance and operating characteristics of power plants, Economic scheduling principle, Load curves, Effect of load on power plant design, Methods to meet variable load, Load forecasting, Electric tariffs. Theory of peak load pricing, Theory and issues of real time pricing comparison of public supply and private generating units, Definition of Cogeneration and its scope, Cogeneration technologies, Sale of electricity and impact on cogeneration.

Recommended Books

1. S.C. Arora and S. Domkundawar, 'A Course in Power Plant Engineering', Dhanpat Rai.
2. M.V. Deshpandey, 'Power Plant Engineering', Tata McGraw Hill, **2004.**
3. B.R. Gupta, 'Generation of Electrical Energy', S. Chand.
4. M.V. Deshpandey, 'Electrical Power System Design', McGraw Hill, **2004.**
5. A.J Wood and B.F. Wollenberg, 'Power Generation and Control', John Wiley, **2004.**
6. S.N. Singh, 'Electric Power Generation: Transmission and Distribution', PHI Course.

MODERN OPTIMIZATION TECHNIQUES

Subject Code: BEEE1-559	L T P C 3 0 0 3	Duration: 38 Hrs.

Course Objectives:

The general objectives of the course are:

1. To introduce the fundamental concepts of Optimization Techniques
2. To make the learners aware of the importance of optimizations in real scenarios
3. To provide the concepts of various classical and modern methods of for constrained and unconstrained problems in both single and multivariable

Course Outcomes:

Upon completion of this course, the students would be able to:

1. Formulate optimization problems for determining optimum state of the system.
2. Understand and apply the concept of optimality criteria for various type of optimization problems
3. Solve various constrained and unconstrained problems in single variable as well as multivariable
4. Apply the methods of optimization in real life situation.

UNIT-I (10 Hrs.)

Introduction to Optimization: Classification of Optimization, Design vector and constraints, Constraint surface, Objective function, Classification of Optimization Problems, problem formulation.

Classical Optimization Techniques: Introduction to Classical Methods, Single variable optimization, Multi-variable: Direct substitution method, Lagrange's method of multipliers, Karush-Kuhn-Tucker Conditions Calculus method, Method of Multipliers.

UNIT-II (8 Hrs.)

Linear Programming: Introduction to linear programming formulation of different models, Geometry of linear programming, Graphical method, Linear programming (LP) in standard form, Solution of LP by simplex method, Exceptional cases in LP, Duality theory, Dual simplex method, Sensitivity analysis.

UNIT-III (10 Hrs.)

Single Variable Optimization: Problems Optimality Criterion, Bracketing Methods, Region Elimination Methods, Interval Halving Method, Fibonacci method, Golden section method. Gradient Based Methods: Newton-Raphson Method, Bisection Method, Secant Method, application to Root finding.

Multivariable Optimization: Algorithms Optimality Criteria, Unidirectional Search. Direct Search Methods: Hooke-Jeeves pattern search method, Random search methods, Grid search method, Powell's Conjugate Direction Method. Gradient Based Methods: Cauchy's Steepest Descent Method, Newton's method, Marquardt's Method.

UNIT-IV (10 Hrs.)

Transportation and Assignment Problem: Initial basic feasible solutions of balanced and unbalanced transportation/assignment problems, Optimal solutions.

Project Management: Construction of networks, Network computations, Floats (free floats and total floats), Critical path method (CPM), Crashing.

Recommended Books

1. S. Chandra, Jayadeva, Mehra, A., 'Numerical Optimization and Applications' Narosa Publishing House.
2. H.A. Taha, 'Operations Research-An Introduction', PHI.
3. S.S. Rao, 'Engineering Optimization', New Age International.
4. E.J. Haug and J.S. Arora, 'Applied Optimal Design', Wiley, New York.

5. Kalyanmoy Deb, 'Optimization for Engineering Design', Prentice Hall of India.

NON LINEAR & DIGITAL CONTROL SYSTEMS

Subject Code: BEEE1-621 | **L T P C 3 1 0 4** | **Duration: 45 Hrs.**

Course Objectives:

1. To explain the concepts of basic and modern control system for the real time analysis and design of control systems.
2. To explain the concepts of state variables analysis.
3. To study and analyse nonlinear systems.
4. To analyse the concept of stability for nonlinear systems and their categorization

Course Outcomes:

1. To understand various terms of basic and modern control system for the real time analysis and design of control systems.
2. To perform state variables analysis for any real time system.
3. Apply the concept of optimal control to any system.
4. Able to examine a system for its stability, controllability and observability.
5. Implement basic principles and techniques in designing linear control systems.

UNIT-I (11 Hrs.)

Sampled Data Systems: Sampling process, mathematical analysis of sampling process, application of Laplace transform, zero order, first order hold. Z- transform definition, evaluation of Z-transform, limitations of Z-transform, inverse Z-transform, Reconstruction of sampled signal, pulse transfer function, Stability analysis of sampled data control system.

UNIT-II (12 Hrs.)

State Variable Techniques: State space representation, Concept of state, transfer function decomposition, solution of state equations, transfer matrix, State variable formulation of discrete time systems, solution of discrete time state equations. Stability definition, Jury's test of stability, extension of Routh-Hurwitz criterion to discrete time systems, State variable representation of systems by various methods, solution of state variable model, Controllability and observability.

UNIT-III (11 Hrs.)

Phase Plane Analysis: Singular points, Method of isoclines, delta method, phase trajectory, phase portrait of second order nonlinear systems, limit cycle.

Lyapunov's Stability Method: Lyapunov's direct method, generation of Lyapunov's function by Krasovskii's and Variable Gradient methods.

UNIT-IV (11 Hrs.)

Describing Function Analysis: characteristics of nonlinear system and its properties, Definition, limitations, use of describing function for stability analysis, describing function of ideal relay, relay with hysteresis, dead zone, saturation, coulomb friction and backlash.

Recommended Books

1. Ogata K., 'Modern Control Engineering', Prentice Hall (India).
2. I.J. Nagrath and M. Gopal, 'Control System Engineering', New Age Publications.
3. M. Gopal, 'Digital Control and State Variable Methods', Tata McGraw Hill.
4. B.C. Kuo and Golnaraghi F, 'Automatic Control System', Wiley.
5. R.V. Dorf and R.H. Bishop, 'Modern Control Systems', Adison Wesle.
6. K.K. Aggarwal, 'Control Systems Analysis and Design', Khanna Publisher.
7. S. Hasan Saeed, 'Automatic Control Systems (With Matlab Programs)', S.K. Kataria & Sons.

POWER SYSTEM – II

Subject Code: BEEE1-622 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

Course Objectives:
1. To know about substation equipment and need for protection
2. To study and operation of circuit isolation devices
3. To understand the application operation of protective relays
4. To know about grounding practices and protection against over voltages

Course Outcomes:
1. Skill to understand basic need for protection schemes
2. Skill to understand functioning of isolators, fuses and circuit breakers
3. An ability to understand protection of feeders, transmission lines, Generators and Transformers.
4. Students will be able to understand protection against over voltages

UNIT- I (12 Hrs.)

Introduction: Principles and need for protective schemes, Types of Faults, Causes and Effects, Primary and Backup Protection, Basic Connection of Trip Circuit.

Sub-Station: Layout of Substation, Types, Main equipment in Substation, Busbar-arrangements.

UNIT- II (12 Hrs.)

Isolators and Fuses: Isolating switches functions, Types, Rating and operation. Fuse-types, Rating, Selection, theory and characteristics, applications.

Circuit Breakers: Need for Circuit Breakers, Arc phenomenon, Theory of Arc Interruption, Recovery Voltage and Restriking Voltage, Various Types of Circuit Breakers, Principles and Constructional Details of Air Blast, Minimum Oil, SF6, Vacuum Circuit Breakers etc.

UNIT- III (12 Hrs.)

Protective Relays: Introduction, classification, constructional features; and Characteristics of Electromagnetic, Induction, Thermal, Overcurrent relays, Directional relays, Distance relays, Differential, Translay Scheme, introduction to static and microprocessor-based relays.

Protection of Feeders: Time graded protection, Differential and Distance protection of feeders, choice between Impedance, Reactance and Mho relays, Elementary idea about carrier current protection of lines.

UNIT IV (12 Hrs.)

Protection of Generators and Transformers: Types of faults on alternator, Stator and rotor protection, Negative sequence protection, Loss of excitation and overload protection. Types of fault on transformers, percentage differential protection, Gas relays.

Protection against Over Voltages: Ground wires, Rod gap, Impulse gap, Valve type and Metal Oxide Arresters, Line Arrester/Surge Absorber. Ungrounded neutral system, Grounded neutral system and Selection of Neutral Grounding. Solid, resistance and reactance Earthing

Recommended Books

1. C.L Wadhwa, ‘Electrical Power System’, New Age International (P) Limited.
2. Sunil S. Rao, ‘Switchgear Protection and Power Systems’, Khanna Publishers.
3. S.L. Uppal, ‘Electrical Power’, Khanna Publishers.
4. Badri Ram, ‘Power System Protection and Switchgear’, Tata McGraw Hill.
5. N. Veerappan & S.R. Krishnamurthy, ‘Power System Switchgear & Protection’, S. Chand.
6. Ravinderpal Singh, ‘Switchgear & Power System Protection’, PHI.
7. Sunil S. Rao, ‘Switchgear Protection & Power System’, Khanna Publishers.

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POWER SYSTEM LAB.

Subject Code: BEEE1-623 **L T P C**
0 0 2 1

Course Objectives:

1. To provide practical knowledge about transmission systems.
2. To impart knowledge about performance of different types of Relays.
3. To develop understanding about operation of Circuit Breakers.
4. To provide knowledge about insulators, conductors and cables used in transmission and distribution.

Course Outcomes:

1. Skill to understand practical transmission system
2. Skill to understand performance and operation of different types of Relays and Circuit Breaker
3. Skill to understand about construction of insulators, conductors and cables used in power system

EXPERIMENTS

1. Visit Local substation and draw layout of local substation
2. To find the earth resistance using three spikes
3. To study the performance of medium transmission line as π model and compute its ABCD parameters.
4. To study the performance of medium transmission line as T model and compute its ABCD parameters.
5. Verification of Ferranti Effect of a Long transmission line
6. To study various types of Insulators used in transmission and distribution.
7. To study various types of conductors used in transmission and distribution
8. To study the different types of faults on transmission line demonstration panel/model.
9. To study the radial feeder performance when
   a) Fed at one end
   b) Fed at both ends
10. To study the performance of Distance Relay
11. To study the performance of Differential Relays
12. To study operation of Bucholz Relay
13. To study operation of IDMT relay
14. To study the operation of Vacuum Circuit Breaker
15. To study the operation of SF_6 Circuit Breaker

Note: At least ten experiments should be performed in a semester

POWER ELECTRONICS LAB.

Subject Code: BEEE1-624 **L T P C**
0 0 2 1

Course Objectives:

1. To develop the understanding of students about the behaviour of various type of
2. Thyristors by obtaining V-I characteristics.
3. To familiarize the performance of firing circuits and commutation circuits.
4. To check the output waveforms of converter circuits.
5. To introduce the students to some practical applications of Thyristors.

Course Outcomes:

1. Ability to simulate characteristics of SCR.

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2. Ability to understand speed control of induction motors using thyristor.

EXPERIMENTS

1. To obtain V-I characteristics of SCR and measure latching and holding currents.
2. To Draw V-I Characteristics of UJT.
3. To obtain the characteristics of TRIA
4. To obtain triggering wave forms of SCR for different types of firing circuits such as R, RC, UJT etc.
5. To obtain output voltage waveforms of single phase half wave controlled rectified for R-L load.
6. To obtain output voltage waveforms of single phase Full wave controlled rectified for R-L load.
7. To obtain output voltage waveforms of single phase ac voltage regulator with R-L load.
8. To study different types of chopper circuit and obtain output voltage waveforms.
9. To Study and obtain the output voltage waveform of single phase cycloconverter
10. Speed control of electric motor using thyristor.
11. To simulate single phase full wave ac voltage controller and draw load voltage and load current waveforms for inductive load.
12. To simulate single phase inverter using different modulation techniques and obtain load voltage and load current waveform for different types of loads.
13. Illumination control using SCR

SOFT SKILLS-IV

Subject Code: **BHUM0-F94** **L T P C**
0 0 2 1

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Course Objectives:
The course aims at the key areas like conversation skills, group skills and persuasion skills required during the interview process in an organisation.

Course Outcomes:
At the end of the course, the student will be able to:
1. Demonstrate soft skills required for business situations.
2. Analyze the value of soft skills for career enhancement.
3. Apply soft skills to workplace environment.
4. Confidently participate in GD and interview process.

UNIT-1

ART OF SPEAKING: Introduction. Communication process. Importance of communication, channels of communication. Formal and informal communication. Barriers to communication. Tips for effective communication. tips for conversation. Presentation skills. Effective multi-media presentation skills. Speeches and debates. Combating nervousness. Patterns and methods of presentation. Oral presentation, planning and preparation.

UNIT-2

GROUP DISCUSSION: Introduction. Importance of GD. Characters tested in a GD. Tips on GD. Essential elements of GD. Traits tested in a GD .GD etiquette. Initiating a GD. Non-verbal communication in GD. Movement and gestures to be avoided in a GD. Some topics for GD.

UNIT-3

PREPARING CV/RESUME: Introduction – meaning – difference among bio-data, CV and resume. CV writing tips. Do's and don'ts of resume preparation. Vocabulary for resume, common resume mistakes, cover letters, tips for writing cover letters.

UNIT-4

INTERVIEW SKILLS: Introduction. Types of interview. Types of question asked. Reasons for rejections. Post-interview etiquette. Telephonic interview. Dress code at interview. Mistakes during interview. Tips to crack on interview. Contextual questions in interview skills. Emotional crack an interview. Emotional intelligence and critical thinking during interview process.

Recommended Books

1. K. Alex, S. Chand Publishers.
2. Lucas, Stephen E., 'The Art of Public Speaking', 11th Edn., International Edn., McGraw Hill Book Co., **2014**.
3. Goleman, Daniel, 'Working with Emotional Intelligence', Banton Books, London, **1998**.
4. Thrope, Edgar and Showick Trope, 'Winning at Interviews', Pearson Education, **2004.**
5. Turk, Christopher, 'Effective Speaking', South Asia Division: Taylor & Francis, 1**985**.

FUZZY LOGIC SYSTEMS

Subject Code: BEEE1-660 **L T P C** **Duration: 38 Hrs.**
3 0 0 3

Course Objectives:
1. Provide an understanding of the basic mathematical elements of the theory of fuzzy sets
2. Provide an emphasis on the differences and similarities between fuzzy sets and classical sets theories.
3. Cover fuzzy logic inference with emphasis on their use in the design of intelligent or humanistic systems.
4. Provide a brief introduction to fuzzy arithmetic concepts.
5. Provide an insight into fuzzy inference applications in the area of control and robotics.

Course Outcomes:
1. To learn crips and fuzzy set theory and decide the difference between crips set and fuzzy set theory.
2. To make calculation on fuzzy set theory.
3. To recognize fuzzy logic membership function.
4. To make applications on Fuzzy logic membership function and fuzzy inference systems.

UNIT-I (9 Hrs.)

Theory of Fuzzy Sets and Fuzzy Relations: Fuzzy Reasoning-Fuzzy Rules-Fuzziness compared to randomness- Introduction - Classical sets and fuzzy sets-operations on both-properties of fuzzy sets-classical relations and fuzzy relations- cardinality of fuzzy Relations- Fuzzy Cartesian product and composition–fuzzy tolerance and equivalence relations- value assignments - cosine amplitude-max-min method.

UNIT-II (10 Hrs.)

Fuzzification and De-fuzzification: Formation of Fuzzy Rule Base-Membership functions - features –standard forms–fuzzification - membership value assignments - intuition – inference-rank ordering - angular fuzzy sets - inductive reasoning -fuzzy to crisp conversion – lambda/alpha cuts for fuzzy sets and fuzzy relations - defuzzification methods.

UNIT-III (10 Hrs.)

Fuzzy Logic: Classical logic and fuzzy logic –fuzzy rule based systems - approximate reasoning – canonical rule forms - decomposition of compound rules - likelihood and truth classification - aggregation of fuzzy rules – fuzzy inference systems- Mamdani and Takagi-Sugeno fuzzy models- fuzzy control Models-P-1-D like fuzzy control rules – implementation. Computer based Simulation-Language based programming in C/C++-Use of Simulation Tools.

UNIT-IV (9 Hrs.)

Fuzzy nonlinear simulation- fuzzy classification - clustering – fuzzy pattern recognition - fuzzy control systems- fuzzy optimization - case studies – Fuzzy Logic combined with Neural Networks and Genetic Algorithms-Soft Computing Techniques- Fuzzy measures (brief introduction only).

Recommended Books

1. Timothy J. Ross, 'Fuzzy Logic with Engineering Applications', McGraw Hill, **2007.**
2. Guanrong Chen & Trung Tat Pham, 'Introduction to Fuzzy Systems', Chapman & Hall CRC, **2006.**
3. D. Driankov, H. Hellendoorn, M. Reinfrank, 'An Introduction to Fuzzy Control', Narosa Publications.
4. Robert Babuska, 'Fuzzy Modeling for Control', International Series in Intelligent Technologies, Kluwer Academic Publications'.
5. Ronald R. Yager and Dimitar P. Filev, 'Essentials of Fuzzy Modelling & Control', John Wiley & Sons, Inc, **2002.**
6. B. Kosko, 'Fuzzy Engineering', Prentice Hall, **1997.**

VLSI DESIGN

Subject Code: BEEE1-661	**L T P C** **3 0 0 3**	**Duration: 38 Hrs.**

MRSPTU

Course 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.

Course 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 (10 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 (8 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 (10 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.
5. S.M. Kang, Y. Lebiebici, 'CMOS Digital Integrated Circuits Analysis & Design', TMH.

ENERGY AUDITING AND MANAGEMENT

Subject Code: BEEE1-662 **L T P C** **Duration: 39 Hrs.**
3 0 0 3

Course Objectives:

1. To understand and appreciate the energy crisis and environmental concerns associated with the energy management, and the importance of energy conservation.
2. To know the techniques of energy analysis and the associated energy efficient technologies for the routinely used thermal and electrical energy systems.
3. To understand the energy management systems and their essential elements.
4. To acquire the knowledge and the basic skills for energy monitoring, energy bench marking, energy action planning and energy auditing.

Course Outcomes:

1. Becoming aware of the energy crisis, and of environmental and sustainability concerns associated with the energy management.
2. Becoming aware of the Energy Conservation Act, 2001, and of the legal energy requirements applicable to the routinely used thermal and electrical energy systems Aware
3. Exposure to the most used energy planning and management softwares.
4. Able to carry out development, implementation and maintenance of ISO 50001 based Energy Management System.
5. Able to utilize the techniques and skills of Energy Management System Auditing.
6. Able to utilize the techniques and skills of energy analysis of organizations and development of energy baseline of organizations.

UNIT-I (10 Hrs.)

Energy Scenario: 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.

Energy Management and Audit: 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.

UNIT-II (8 Hrs.)

Material and Energy Balance: Facility as an energy system, Methods for preparing process flow, Material and energy balance diagrams.

Financial Management: Investment-need, Appraisal and criteria, Financial analysis techniques- Simple payback period, Return on investment, Net present value, Internal rate of return, Cash flows, Risk and sensitivity analysis, Financing options, Energy performance contracts and role of ESCOs.

UNIT-III (9 Hrs.)

Electrical System: Electricity tariff, Load management and maximum demand control, Power factor improvement, Distribution and transformer losses. Losses in induction motors, Motor efficiency, Factors affecting motor performance, Rewinding and motor replacement issues, energy efficient motors. Light source, Choice of lighting, Luminance requirements, and Energy conservation avenues.

UNIT-IV (12 Hrs.)

Compressed Air System: Types of air compressors, Compressor efficiency, Efficient compressor operation, Compressed air system components, Capacity assessment, Leakage test Factors affecting the performance and efficiency

HVAC and Refrigeration System**:** Vapor compression refrigeration cycle, Refrigerants, Coefficient of performance, Capacity, Factors affecting refrigeration and air conditioning system performance and savings opportunities, Vapor absorption refrigeration system: Working principle, Types and comparison with vapor compression system, Saving potential, Fans, Blowers and pumps- Types, Performance evaluation, Efficient system operation, Flow control strategies and energy conservation opportunities.

Recommended Books

1. Y.P. Abbi and S. Jain, 'Handbook on Energy Audit and Environment Management', Teri Bookstore, **2006.**
2. P. Diwan, 'Energy Conservation', Pentagon Press, **2008.**
3. Thumann and W.J. Younger, 'Handbook of Energy Audits', Fairmont Press, Georgia, USA.

MICROCONTROLLER AND EMBEDDED SYSTEMS

Subject Code: BEEE1-663 **L T P C** **Duration: 38 Hrs.**
3 0 0 3

Course Objectives:

The student should be made to:
1. Study the Architecture of 8051 microcontrollers.
2. Learn the design aspects of I/O and Memory Interfacing circuits.
3. Study about communication and bus interfacing.

Course Outcomes:

At the end of the course, the student should be able to:
1. Design and implement 8051 microcontroller based systems.
2. Serial communication of 8051.
3. Interfacing with 8051.

UNIT-I (10 Hrs.)

Introduction: 8051 microcontrollers, 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 (12 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 (11 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 (10 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. Joseph Yiu, 'The Definitive Guide to ARM Cortex-M3 processors' Newnes Publication.
3. Jonathan W. Valvano, 'Introduction to ARM Cortex-M Microcontrollers', Vol. 1.
4. Jonathan W. Valvano. 'Real-Time Interfacing to ARM Cortex-M Microcontrollers'.

DIGITAL SIGNAL PROCESSING

Subject Code: BEEE1-664	L T P C 3 0 0 3	Duration: 39 Hrs.

Course 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

Course 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 (9 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 (10 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.

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UNIT-III (8 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 (12 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', 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', PHI.
4. A. Widrow and S.D. Stearns, 'Adaptive Signal Processing', Prentice Hall.

REMOTE CONTROL AND TELEMETRY

Subject Code: BEEE1-665 **L T P C** **Duration: 39 Hrs.**
3 0 0 3

MRSPTU

Course Objectives:

1. To learn various types of telemetry required in instrumentation system
2. To study data acquisition
3. To understand the data analysis methods
4. To lean about the basics of Photo-grammetry

Course Outcomes:

After study of this subject students will have skill

1. About the setup of telemetry system
2. To analyse the data from remote location
3. To acquire the data in real time system
4. To design Photo-grammetry system

UNIT-I (10 Hrs.)

Introduction: classification of telemetry systems - voltage, current, position, frequency and time. Components of tele-metering and remote control systems, Quantization theory - sampling theorem, sample and hold, data conversion-coding.

Remote Sensing: Introduction of Remote Sensing, Electro Magnetic Spectrum -Effects of Atmosphere-Scattering –Absorption-Atmospheric Window-Energy interaction with surface features – Spectral reflectance of earth objects and land covers Resolution concepts –types – Satellites, orbits and missions.

UNIT-II (8 Hrs.)

Data Acquisition and Distribution System: Fundamentals of audio-telemetry system - R.F. links. Telemetry design system, Standard for telemetry e.g. JRIG, Microwave links, Pulse code modulation (PCM) techniques, Practical telemetry system - pipe line telemetry, power system telemetry, supervisory tele-control systems, Introduction to ISDN.

UNIT-III (10 Hrs.)

Data Analysis: Sources of Errors –scene, sensor and atmospheric causes -correction: geometric and Radiometric –visual and digital interpretation-elements of interpretation –interpretation keys -digital analysis and classification –image formation, visualization: Image enhancement, filters–Baye‟s theorem Image classification: unsupervised and supervised –thematic mapping -
accuracy assessment.

UNIT-IV (11 Hrs.

Photo-grammetry: Principles –aerial photo-aerial camera -Scale –overlaps –stereoscopy –concepts –viewing and measuring systems –image and object co-ordinates–transformation -floating mark –parallax equation –height information -Flight planning –computation for flight plan –photo control

Recommended Books

1. Robert A. Schowen Gerdt, 'Remote Sensing: Models and Methods for Image Processing', Academic Press, **2007.**
2. Gottfried Konecny, 'RS, Photogrammetry and Geographic Information Systems', CRC, **2009.**
3. M. Schwartz, 'Information Transmission - Modulation & Noise', McGraw Hill, **1970.**
4. D. Patranabis, 'Telemetry Principles', Tata McGraw Hill.
5. A.K. Sawhney, 'A course in Electrical and Electronic Measurements and Instrumentation' Dhanpat Rai, New Delhi.

NON CONVENTIONAL ENERGY RESOURCES

Subject Code : BEEE1-666 **L T P C** **3 0 0 3** **Duration: 38 Hrs.**

Course Objectives:

1. To understand conventional and nonconventional sources of energy.
2. To evaluate different sources of energy
3. To persuade community to use renewable energy sources

Course Outcomes:

1. Students would become aware about Non-Conventional Energy sources and Solar energy, different types of collectors, their uses, wind energy, tidal energy, geothermal energy, Thermo Nuclear Fusion, Cold Fusion.
2. Students will develop the use of wind energy and Biomass energy
3. Students would become aware about potential of energy present under earth surface and about energy of oceanic water tides.
4. Students would develop the understanding about Nuclear energy, Hydrogen energy etc.

UNIT-I (12 Hrs.)

Introduction: Energy sources and availability, new energy techniques, Renewable energy sources, Solar Energy; Solar constant, Radiation geometry, Solar energy collectors, Concentrated and flat plate, Energy balance and collector efficiency, Solar energy storage, Application to space heating, distillation, cooking and greenhouse effect,

UNIT-II (10 Hrs.)

Wind Energy: Basic principle, site selection, Aerodynamic analysis of blades,
Bio-energy; Biomass conversion technology, photosynthesis, Biogas plant, thermal gasification.

UNIT-III (8 Hrs.)

Geothermal Energy: Sources, hydrothermal sources, hot dry rock resources, geothermal fossil system, prime movers for geothermal energy

Energy from ocean; Ocean thermal electric conversion, energy from tides, small scale hydroelectric development.

UNIT-IV (8 Hrs.)

Hydrogen energy sources; Production, storage, utilization, magneto hydrodynamic power, thermo ionic generation, Nuclear fusion energy, Energy storage. Energy conservation.

Recommended Books

1. G.D. Rai, 'Non-Conventional Energy Sources', Khanna Publishers, Delhi.
2. S. Rao, B.B. Parulekar, 'Energy Technology: Non-Conventional Renewable and Conventional', Khanna Publishers, Delhi.
3. H.P. Garg & Jai Prakash, 'Solar Energy: Fundamentals and Applications', Tata McGraw Hill, N. Delhi.
4. Sutton, 'Direct Energy Conversion', McGraw Hill Inc., **1966.**
5. Duffie and Beckman, 'Solar Energy Thermal Processes', John Wiley, **1974**.
6. R.K. Rajput, 'Non-Conventional Energy Sources and Utilization (Energy Engineering)', S. Chand Publishers.

NEURAL NETWORKS

Subject Code : BEEE1-667	L T P C	Duration: 39 Hrs.
	3 0 0 3	

MRSPTU

Course Objectives:

1. Basic neuron models: McCulloch-Pitts model and the generalized one, distance or similarity based neuron model, radial basis function model, etc.
2. Basic neural network models: multilayer perceptron, distance or similarity based neural networks, associative memory and self-organizing feature map, radial basis function based multilayer perceptron, neural network decision trees, etc.
3. Basic Course algorithms: the delta Course rule, the back propagation algorithm, self-organization Course, the r4-rule, etc.
4. Applications: pattern recognition, function approximation, information visualization, etc.

Course Outcomes:

1. To learn basic neural network architecture
2. To learn basic Course algorithms
3. To understand data pre and post processing
4. To learn training, verification and validation of neural network models
5. To design Engineering applications that can learn using neural networks

UNIT-I (10 Hrs.)

Introduction to Neural Networks: Human brain and Biological Neuron, Artificial Neural Network, ANN Terminology, McCulloch- Pitts Neural Model, Activation functions, Topology, Feedforward Neural Networks, ANN Course: Supervised, Un-supervised, Competitive Course, Reinforcement Course, Knowledge representation.

UNIT-II (9 Hrs.)

Course Laws: Hebb's rule, Delta rule, Widrow & Hoff LMS Course rule, Correlation Course rule, Instar and Outstar Course rules, Back-propagation Neural Networks, K-means clustering algorithm, Kohenen's feature maps, Associative Memories

UNIT-III (8 Hrs.)

Radial Basis Neural Networks: Function Neural Networks, Basic Course laws in RBF Nets, Recurrent Networks, Recurrent Backpropagation, Counter-Propagation Networks, CMAC Networks, ART Networks.

UNIT-IV (12 Hrs.)

Associative-Memories: Paradigms of Associative Memory, Pattern Mathematics, Hebbian Course, General Concepts of Associative Memory, Bidirectional Associative Memory (BAM) Architecture, BAM Training Algorithms: Storage and Recall Algorithm, BAM Energy Function. Architecture of Hopfield Network: Discrete and Continuous versions, Storage and Recall Algorithm, Stability Analysis. Neural network applications: Process identification, control, fault diagnosis

Recommended Books

1. Laurene Fausett, 'Fundamentals of Neural Networks', Pearson Education, **2004.**
2. Simon Haykin, 'Neural Networks- A comprehensive foundation,'Pearson Education, **2003**.
3. S. Rajasekharan and G.A. Vijayalakshmi Pai, 'Neural Networks, Fuzzy logic, Genetic Algorithms: Synthesis and Applications', PHI Publication, **2004.**
4. Timothy J. Ross, 'Fuzzy Logic with Engineering Applications', Tata McGraw Hill Inc., **2000.**

COMPUTER APPLICATIONS IN POWER SYSTEM ANALYSIS

Subject Code: BEEE1-725 **L T P C** **Duration: 48 Hrs.**
3 1 0 4

MRSPTU

Course Objectives:

1. To study & understand the importance of per unit system, single line diagram and impedance diagrams of electric networks in power system analysis.
2. To understand how a fault can occur in the power system, what are the different types of faults in the system, what are the various methods to find out the fault.
3. To study how to control the Power system, how much power should be allowed in Transmission lines, so that system should not be out of synchronism.

Course Outcomes:

1. Students will be able to understand the importance of per unit system, single line diagram and impedance diagrams of electric networks in power system analysis.
2. Able to gain the information about various types of buses in the electric network and what type of data is required for power flow studies.
3. Students will be able to understand how a fault can occur in the power system, what are the different types of faults in the system, methods to find out the fault
4. Students will be able to understand that in real world, how to control the Power system, how much power should be allowed in Transmission lines, so that system should not be out of synchronism

UNIT-I (10 Hrs.)

Concept of Modeling: Steady State, Transient condition, system modelling of synchronous machine, load, transformer, transmission line., per unit system, one-line diagram, Impedance diagram

UNIT-II (15 Hrs.)

Power Flow Studies: Formation of network matrices, Singular and non-singular Transformation. Algorithms for formation of bus admittance and bus impedance matrices. Review of single phase load - Load flow studies using Y-bus, Iterative techniques for power flow–Gausses Seidel, Newton-Raphson, Fast decoupled method. Comparison of various iterative methods of load flow solution.

UNIT-III (13 Hrs.)

Network Fault: Z-bus formulation, Transients on Transmission line, symmetrical component transformation, Fault computation using Z-bus. Algorithm of Short-circuit studies. Symmetrical analysis of unsymmetrical faults using symmetrical components.

UNIT-IV (10 Hrs.)

System Stability: Steady state stability, Dynamics of synchronous machine, Power angle equations, Transient stability, Equal area criterion, factors effecting transient stability, Numerical solution of swing equation.

Recommended Books

1. J.J. Grainger and W.D. Stevenson, 'Power System Analysis', Tata McGraw Hill, New Delhi, **2003**.
2. I.J. Nagrath & D.P. Kothari, 'Modern Power System Analysis', Tata McGraw Hill Education, **2003.**
3. Glonn N. Stagg and Ahmed H. El-Abiad, 'Computer Methods in Power System Analysis', McGraw Hill, International, **1998**
4. J. Arrillaga, C.P. Arnold and B.J. Harker, 'Computer Modelling of Electrical Power Systems', John Willey & Sons, **1990**.
5. O.I. Elgerd, 'Electric Energy Systems Theory', Tata McGraw Hill.
6. Wolenburg, 'Power System Operation and Control', Wiley-Interscience, **2013**.

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COMMUNICATION SYSTEM

Subject Code: BEEE1-726 **L T P C** **3 1 0 4** **Duration: 48 Hrs.**

Course Objectives:

1. To study & understand the building blocks of Analog & Digital communication system.
2. To understand Inter-Symbol Interference causes and corrective measures.
3. To study the Analog & Digital transmission and detection techniques and Simulation of these techniques using MATLAB.

Course Outcomes:

1. An ability to understand analog communication system and modulation techniques
2. An ability to learn design of useful circuits required in analog communication system.
3. An ability to explore knowledge about various transmitter and receiver circuits used in communication.
4. An ability to provide students with tools for communication signal analysis

UNIT I (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, Concept of ISI, Pre-emphasis and De-emphasis.

UNIT-II (12 Hrs.)

AM Transmission/AM Reception: Introduction, Generation of Amplitude Modulation, Basic Principles of AM Generation; Square law Diode Modulation, Vander Bill 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.

UNIT-III (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.

UNIT-IV (12 Hrs.)

Digital communication: Diagram of Digital Communication System, Advantages of Digital communication system over Analog communication systems, Sampling theorem, Signal reconstruction in time domain, Line Coding & its properties, Concept of PCM system. Delta modulation, 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, Time division multiplexing

Recommended Books

1. George Kennedy, 'Electronic Communication System', 4th Edn., 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**.
5. Proakis, 'Communication Systems', 4th Edn., McGraw Hill, **2015**.
6. Taub and Schilling, 'Principles of Communication Systems', McGraw Hill, **2007**.
7. G. Kennedy, 'Electronic Communication System', PHI, **1999**.
8. Roddy and Coolen, 'Electronic Communications', PHI, **1995**.
9. Thiagrajan Vishwanathan, 'Communication Switching Systems and Networks', PHI Pub, **2015**.

COMPUTER APPLICATIONS IN POWER SYSTEM ANALYSIS LAB.

Subject Code: BEEE1-727 **L T P C**
0 0 2 1

Course Objectives:

1. To study & understand the formulation of Y-bus and Z-bus.
2. To understand load flow solution by various methods.
3. To study the Fault analysis and Transient stability.
4. To design a Simulink model for transient stability of single machine.

Course Outcomes:

1. An ability to understand the formulation of Y-bus and Z-bus.
2. An ability to learn load flow solution by various methods.
3. An ability to develop a Simulink model for transient stability of single machine.

EXPERIMENTS

Development of algorithms & flowcharts of the following using ETAP/MATLAB Software package:

1. Y-bus formulation using singular transformation.
2. Y-bus formulation using direct inspection technique.
3. Power flow solution using Gauss Seidal method.

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4. Power flow solution using Newton Raphson method.
5. Formation of Bus Impedance Matrix (Z-bus).
6. Short Circuit Fault analysis.
7. Transient stability studies.
8. To develop a Simulink model for transient stability of single machine connected to infinite bus bar

Recommended Books

1. Ashish Tewari, 'Modern Control Design with MATLAB and SIMULINK', John Wiley and Sons Ltd, **2002.**

COMMUNICATION SYSTEM LAB.

Subject Code: BEEE1-728 **L T P C**
0 0 2 1

Course Objectives:

1. 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.
2. To give students a working knowledge to perform pulse-modulation & demodulation.
3. The objective of the Communications Course is to familiarize students with the functions of modulators, limiters, mixers, and detectors in AM, FM, PM, ASK, FSK, PSK and PLL circuits

Course Outcomes:

1. An ability to perform transmission of signals from transmitter to receiver using various Analog & Digital modulation and demodulation techniques.
2. Ability to analyse TDM multiplexing system.
3. Different Observation on PCM Modulation & Demodulation Kit

EXPERIMENTS

1. Generation of DSB & DSB-SC AM signal using balanced modulator & determine modulation Index & detection of DSB using Diode detector.
2. Generation of SSB AM signal & detection of SSB signal using product detector.
3. To generate a FM Signal using Varactor & reactance modulation.
4. Detection of FM Signal using PLL & foster seelay & resonant detector.
5. To Study Super heterodyne AM receiver and measurement of receiver parameters viz. sensitivity, selectivity & fidelity.
6. To study the circuit of PWM & PPM modulator & Demodulator
7. Analysis of Time Division Multiplexing system.
8. Observation of pulse code modulation and demodulation.
9. To perform delta modulation and demodulation and observe effect of slope overload.
10. Analysis of pulse data coding techniques for various formats.
11. Data decoding techniques for various formats.
12. Observation of amplitude shift keying modulator and demodulator.
13. To observe and Analyse frequency shift keying modulator and demodulator.
14. To observe phase shift keying modulator and demodulator.

Note: Students are required to perform at least 8 experiments.

INDUSTRIAL AUTOMATION

Subject Code: BEEE1-768 **L T P C** **Duration: 38 Hrs.**
3 0 0 3

Course Objectives:

1. To introduce the concept of PLC, DCS and SCADA
2. To expose students to different types of transmitters, Final Control elements and actuators
3. To teach students about the role of Computers in Process Industries
4. To familiarize students on Programming of PLC with typical case studies
5. To teach about the various sub systems of DCS

Course Outcomes:

1. Gain knowledge on basics of Industrial Automation
2. Students will be able to Develop Ladder programmes for PLC
3. Will be able to recommend right choice of automation systems for a given application

Unit-I (8 Hrs.)

Introduction: Need for automation systems - Architecture of Industrial Automation system. Introduction to PLC, SCADA and DCS – Introduction to Industrial Data Networks, Introduction to satellite technology for power system measurement, commands & controls.

Unit-II (9 Hrs.)

Field Devices: Conventional / Smart Process Transmitters: - Temperature, Pressure, Flow, Level and pH Measurement - Final Control Elements: - Actuators: Pneumatic and electric actuators – Control Valves - Thyristor Power Controller. Introduction to DC and AC Servo Drives for motion control –Interfacing Field devices with I/O Sub Systems.

Unit-III (9 Hrs.)

Computer Aided Measurement and Control Systems: Role of computers in measurement and control - Elements of computer aided measurement and control: - Man-Machine interface, computer aided process control hardware and software –Industrial Internet of things (I^2oT) – Cyber Security for Industrial automation

Unit-IV (12 Hrs.)

Programmable Logic Controllers and Distributed Control System: Programmable Logic Controllers: - Hardware of PLC - PLC programming: -Ladder diagram with examples - PLC Communication and networking - Case studies: -Bottle filling application and Elevator control.

DCS: - LCU-Shared communication facility- Display Hierarchy- High Level and Low Level interfaces - Case studies: - DCS in cement plant and thermal power plant.

Recommended Books

1. S.K. Singh, 'Industrial Instrumentation', Tata McGraw Hill, 2nd Edn., Companies, **2003.**
2. C. D Johnson, 'Process Control Instrumentation Technology', Prentice Hall India, 8th Edn., **2006.**
3. E.A. Parr, Newnes, 'Industrial Control Handbook', 3rd Edn., New Delhi, **2000.**
4. Gary Dunning, Thomson Delmar, 'Programmable Logic Controller', Cengage Learning, 3rd Edn., **2005.**
5. M.P. Lucas, 'Distributed Control System', Van Nostrand Reinhold Company, New York, **1986**.

IMAGE PROCESSING

Subject Code: BEEE1-769 **L T P C** **Duration: 38 Hrs.**
3 0 0 3

Course Objectives:
1. Learn digital image fundamentals.
2. Be familiarizing with Morphological image processing.
3. To introduce Image Transforms & compression.
4. To show the computation and use of Image Processing Applications.

Course Outcomes: -
1. Discuss and analyse various digital image fundamentals
2. Apply image enhancement and restoration techniques.
3. To analyse model of image transformation and compression.
4. Extract and compare different image processing techniques

UNIT I (8 Hrs.)

Digital Image fundamentals: Steps in image processing, Human visual system, Sampling & quantization, Representing digital images, Spatial & gray-level resolution, Image file formats, Basic relationships between pixels, Distance Measures. Basic operations on images-image addition, subtraction, logical operations, scaling, translation, rotation. Image Histogram. Color fundamentals & models – RGB, HSI YIQ.

UNIT II (13 Hrs.)

Image Enhancement, Restoration and Compression: Spatial domain enhancement: Point Operations-Log transformation, Power-law transformation, Piecewise linear transformations, Histogram equalization. Filtering operations- Image smoothing, Image sharpening.
Frequency domain enhancement: 2D DFT, Smoothing and Sharpening in frequency domain. Homomorphic filtering.
Restoration: Noise models, Restoration using Inverse filtering and Wiener filtering
Image Compression: Types of redundancy, Fidelity criteria, Lossless compression – Run length coding, Huffman coding, Bit-plane coding, Arithmetic coding. Introduction to DCT, Wavelet transform. Lossy compression – DCT based compression, Wavelet based compression. Image and Video Compression Standards – JPEG, MPEG.

UNIT III (8 Hrs.)

Image Segmentation: Point Detections, Line detection, Edge Detection-First order derivative – Prewitt and Sobel. Second order derivative –LoG, DoG, Canny. Edge linking, Hough Transform, Thresholding – Global, Adaptive.Otsu's Method.Region Growing, Region Splitting and Merging.
Morphological Operations: Dilation, Erosion, Opening, Closing, Hit-or-Miss transform, Boundary Detection, Thinning, Thickening, Skeleton.

UNIT IV (9 Hrs.)

Image Processing Applications: Applications of transforms in fingerprinting, Medical applications such as tumor detection. Magnetic Resonance Imaging analysis using transforms, Morphological applications.

Recommended Books

1. Gonzalez and Woods, 'Digital Image Processing', 2nd Edn., PHI, **1986.**
2. Milan Sonka, 'Image Processing, Analysis & Machine Vision', Thomson Publication, **1996**.
3. W.K. Pratt, 'Digital Image Processing', John Wiley, **2001.**
4. A.K. Jain, 'Fundamentals of Digital Image Processing', PHI, **2010.**

HIGH VOLTAGE ENGINEERING

Subject Code: BEEE1-770 **L T P C** **Duration: 38 Hrs.**
3 0 0 3

Course Objectives:

1. Design a simple protection system for a section of a power system, such as a feeder, a transformer or a motor
2. Select appropriate hardware for certain applications in power system protection and high voltage engineering
3. Describe the principles of the generation and measurement of high voltage AC, DC and impulse voltages

Course Outcomes:

1. To make students aware about causes of High voltage
2. To develop the understanding about behaviour of solids, liquids and gases under the effect of high voltages
3. To introduce the students to generation & measurement of High voltages.

UNIT-I (9 Hrs.)

Over voltages in Electric power systems, causes of over voltages and its effect on power system – Lightning, switching surges and temporary over voltages-protection against over voltages.

UNIT-II (10 Hrs.)

Electrical Breakdown in Gases, Solids and Liquids, Gaseous breakdown in uniform and non-uniform fields–corona discharges –Vacuum breakdown -conduction and breakdown in pure and commercial liquids–breakdown mechanisms in solid and composite dielectrics. Partial discharge phenomenon and its detection.

UNIT-III (9 Hrs.)

Generation of High Voltages and High Currents, Generation of High DC, AC, impulse voltages and currents. Triggering and control of impulse generators.

UNIT-IV (10 Hrs.)

Measurement of High Voltages and High Currents, Measurement of High voltages and High currents – Digital techniques in high voltage measurement. High Voltage Testing & Insulation Coordination, High voltage testing of electrical power apparatus – power frequency, impulse voltage and DC testing–International and Indian standards.

Recommended Books

1. M.S. Naidu and V. Kamaraju, 'High Voltage Engineering', Tata McGraw Hill, 3rd Edn., **2004.**
2. E. Kuffeland, W.S. Zaengl, 'High Voltage Engineering Fundamentals', Pergamon Press, Oxford, London, **1986**.
3. C.L. Wadhwa, 'High Voltage Engineering', New Age International (P) Ltd, **1994.**

HVDC & EHVAC TRANSMISSION

Subject Code: BEEE1-771 **L T P C** **Duration: 38 Hrs.**
3 0 0 3

Course Objectives:

1. To study EHV AC and DC transmission system.
2. To learn the limitations and importance of EHV AC system.
3. To design different types of DC transmission systems, recent trends in HVDC transmission, design of AC filters, DC filters, surge arresters.

4. To study the effect of Corona, Radio and TV interference due to EHV AC and HVDC systems, methods to reduce noise, radio and TV interference.

Course Outcomes:

1. After the completion of course, students will be having skills to analyse the EHV AC and DC transmission system, their importance and limitation, recent trends in HVDC transmission,
2. Knowledge of Design different types of DC transmission systems, design of AC filters, DC filters, surge arresters.
3. Students will be able to understand the effect of Corona, Radio and TV interference due to EHV AC and HVDC systems, methods to reduce noise, radio and TV interference.

UNIT-I (8 Hrs.)

Overview: Comparison of EHV AC and DC transmission, description of DC transmission systems, modern trends in AC and DC transmission.

UNIT-II (9 Hrs.)

EHV AC Systems: Limitations of extra-long AC transmission, Voltage profile and voltage gradient of conductor, Electrostatic field of transmission line, travelling and standing waves, EHV cable transmission system.

Static VAR System: Reactive VAR requirements, Static VAR systems, SVC in power systems, design concepts and analysis for system dynamic performance, voltage support, damping and reactive support.

UNIT-III (10 Hrs.)

HVDC System: Configurations of DC transmission system, planning for High Voltage Direct Current (HVDC) transmission, Types of HVDC links, recent trends in HVDC transmission.

Converter and HVDC System Control: Introduction to Device; Thyrister valve, valve tests, Converter configurations and their characteristics, Pulse number, choice of converter configuration, simplified analysis of Graetz circuit, converter bridge characteristics, characteristics of a twelve-pulse converter, detailed analysis of converters with and without overlap.

UNIT-IV (11 Hrs.)

Corona and Interference: 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.

Harmonic Filters: Generation of harmonics, Smoothing reactor, design of AC filters, DC filters, protection against over-currents, over-voltages in a converter station, surge arresters.
Parallel operation of HVDC/AC systems, Multi terminal systems.

Recommended Books

1. E.W. Kimbark, ‘High Voltage Direct Current Transmission’, Wiley Interscience
2. V. Kamaraju and M.S. Naidu, ‘High Voltage Engineering’, Tata McGraw Hill Education
3. E. Kuffel and M. Abdullah, ‘High Voltage Engineering’, Pergamon Press
4. K.R. Padiyar, ‘HVDC Power Transmission Systems: Technology and System Interactions’, New Age International
5. Bagamudre, Rakesh Das, ‘Extra High Voltage A.C. Transmission Engineering’, New Age International Publishers.

PULSE WAVE SHAPING & SWITCHING

Subject Code: BEEE1-831 **L T P C** **Duration: 39 Hrs.**
3 1 0 4

Course Objectives:
1. To understand the concept of Passive linear and nonlinear wave shaping circuits & signals.
2. To study and analysis of various multivibrators
3. To learn the concept of switching using diode and transistor

Course Outcomes:
1. Design the circuits for generating desired wave shapes(non-sinusoidal) for different applications
2. Design RC circuits for triggering
3. Design the switching circuits
4. Design free running oscillators

UNIT- I (10 Hrs.)

Linear Wave Shaping: High Pass and Low Pass RC Circuits and their Response for Sinusoidal, Step Voltage, Pulse, Square Wave and Ramp Inputs. High Pass RC Circuit as a Differentiator. Low Pass RC Circuit as an Integrator. Passive attenuators and their Application, RL and RLC Circuits and their response for step input. Ringing circuit.

UNIT-II (10 Hrs.)

Non-Linear Wave Shaping: Diode clippers, Transistor Clippers. Clipping at two independent levels. Comparator – Applications of voltage Comparators – Diode Comparator. Clamping Operation. Clamping Circuits using Diode with Different Inputs. Clamping Circuit Theorem. Practical Clamping circuits. Effect of diode Characteristics on Clamping Voltage.

UNIT- III (11 Hrs.)

Monostable and Astable Multivibrators: Collector Coupled and Emitter Coupled Monostable multivibrators, Expression for Gate width, Astable Collector coupled and emitter coupled multivibrator, Complementary Transistor Astable multivibrator

Bistable Multivibrators: Fixed bias and self-bias bistable multivibrator, Speed-up Capacitors, unsymmetrical and symmetrical triggering, Application of Triggering, Bisatble multivibrator as T Flip-Flop, Schmitt trigger circuit, Calculation of Upper Tripping Point and Lower Tripping Point.

UNIT- IV (8 Hrs.)

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, Use of Schotkey diode for reducing storage time.

Recommended Books

1. Milliman and Taub, ‘Pulse and Digital Switching Circuits’, Tata McGraw Hill, **2011**.
2. MothikiS. Prakash Rao, ‘Pulse and Digital Circuits’, Tata McGraw Hill**, 2009.**
3. K. Rao, ‘Pulse & Digital Circuits’, Pearson Education**, 2010**.
4. Rao, ‘Switching Theory & Logic Design’, Pearson Education, **2006**.
5. Strauss, ‘Wave Generation and Shaping’, McGraw Hill**, 2013**.
6. Sanjeev Kumar, ‘Pulse and Switching Circuits’, Dhanpat Rai & Company, **2011.**
7. Anand Kumar, ‘Pulse & Digital Circuits’, PHI, **2005**.

SOFTWARE LAB.

Subject Code: BEEE1-832 **L T P C**
0 0 2 1

Course Objectives:

1. To introduce to BASIC built in functions of MATLAB and blocks of SIMULINK.
2. To learn to do various programming operations in MATLAB and develop simulink models in SIMULINK.
2. To learn to plot various types of graphs in MATLAB.

Course Outcomes:

1. Students will know about BASIC built in functions of MATLAB and blocks of SIMULINK.
2. They will learn to do various programming operations in MATLAB and develop simulink models in SIMULINK.
3. They will be able to draw 2-D and 3-D plots in MATLAB.

EXPERIMENTS

1. Introduction to Fundamentals of MATLAB Programming.
2. To perform Arithmetic and logic operations in MATLAB.
3. To perform branch and loop operations in MATLAB.
4. To use basic built-in function of Matrices in MATLAB.
5. To develop a user defined function file in MATLAB.
6. To plot 2-D & 3-D graphs in MATLAB, such as plots, subplots, logarithmic plots and multiple plots etc.
7. To plot 3-phase AC supply voltage in MATLAB.
8. To develop MATLAB program to calculate ABCD parameters of transmission line.
9. Introduction to commonly used blocks of SIMULINK.
10. To develop simulink model to show series resonance phenomenon and to plot voltage & current waveforms and frequency vs impedance graph.
11. To develop simulink model to show parallel resonance phenomenon and plot voltage & current waveforms and frequency vs admittance graph.
12. To develop a simulink model of symmetrical three phase power system supplying a three phase balanced load and to display the three phase voltage, current, active and reactive power.
13. To develop simulink model of three phase transformer and to display the primary and secondary voltages and currents.
14. To develop simulink model for speed control of dc motors.

Note: At least ten experiments should be performed in semester.

Recommended Books

1. Tyagi Agam Kumar, 'Matlab and Simulink for Engineers', Oxford Publishers, **2012**.
2. S. Swapna Kumar, S.V.B. Lenina, 'MATLAB Easy Way of Learning', PHI, **2016**.
3. Stephen J. Chapman, 'MATLAB Programming for Engineers', Cengage Learning, **2015**.

ELECTRICAL MACHINE DESIGN

Subject Code: BEEE1-872 **L T P C** **Duration: 39 Hrs.**
3 0 0 3

Course Objectives:

1. To study design of various electric machines, like transformer, three phase and single phase induction machines.

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2. To study different types of enclosures, heat dissipation, temperature rise, heating & cooling cycles, rating of machines, effect of size and ventilation of electrical machines.
3. To design core, coils, tank and Cooling tubes, magnetizing current, losses and efficiency, Temperature rise and regulations from design data, and Computerization of design procedures for transformers.
4. To study output equations, specific loadings, main dimensions, conductor size and turns, no. of slots, slot design, stator core, rotor design, performance calculations, Computerization of design procedures.

Course Outcomes:

1. After the completion of course, students will be having skills to design various electric machines, like transformer, induction machines,
2. Knowledge of Design core, coils, tank and Cooling tubes, Temperature rise and regulations from design data, and Computerization of design procedures for transformers.
3. Students will be able to understand the output equations, specific loadings, main dimensions, conductor size and turns, no. of slots, slot design, stator core, rotor design, performance calculations of induction machines.

UNIT I (8 Hrs.)

General: General features & limitations of electrical machine design, types of enclosures, heat dissipation, temperature rise, heating & cooling cycles, rating of machines, cooling media used & effect of size and ventilation.

UNIT II (9 Hrs.)

Transformers: Standard specifications, output equations, design of core, coil, tank and Cooling tubes, calculation of circuit parameters, magnetizing current, losses and efficiency, Temperature rise and regulations from design data, Computerization of design procedures.

UNIT III (12 Hrs.)

Three Phase Induction Motor: Standard specifications, output equations, specific loadings, main dimensions, conductor size and turns, no. of slots, slot design, stator core, rotor design, performance calculations, Computerization of design procedures.

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UNIT-IV (10 Hrs.)

Single Phase Induction Motor: output equations, specific loadings, main dimensions, design of main and auxiliary winding, capacitor design, equivalent circuit parameters, torque, efficiency, Computerization of design procedures.

Recommended Books

1. A.K. Sawhney, 'A Course in Electrical Machine Design', Dhanpat Rai & Sons.
2. R.K. Aggarwal, 'Principles of Electrical Machine Design', S.K. Kataria & Sons.

BIO-MEDICAL INSTRUMENTATION

Subject Code: BEEE1-873 **L T P C** **Duration: 38 Hrs.**
3 0 0 3

Course Objectives:

This course introduces general biological concepts

1. It helps students to understand importance of body subsystem, Transducers and Electrodes.
2. To understand application of engineering concepts in medical instrumentation.

Course Outcomes:

Upon successful completion of the course, students will be able to.

1. Use of Transducers and Electrodes for biomedical applications.
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 (8 Hrs.)

Human Body Subsystems: Brief description of neuronal, Muscular, Cardiovascular and respiratory systems; Their electrical, Mechanical and Chemical activities.

Transducers and Electrodes: Principles and classification of transducers for biomedical applications, Electrode theory, Different types of electrodes, Selection criteria for transducers and electrodes.

UNIT- II (10 Hrs.)

Cardiovascular System Measurements: Measurement of blood pressure, Blood flow, Cardiac output, Cardiac rate, Heart sounds; Electrocardiograph, Phonocardiograph, Plethysmograph, Echocardiograph.

Respiratory System Measurements: Measurement of gas volume, Flow rate, Carbon dioxide and oxygen concentration in exhaled air.

Instrumentation for Clinical Laboratory: Measurement of pH value of blood, ESR measurement, Polarographic measurements.

Measurement of Electrical Activity in Neuromuscular System and Brain: Neuron potential, Muscle potential, Electromyography, Brain potentials, Electroencephalograph.

UNIT-III (10 Hrs.)

Medical Imaging: Diagnostic X-rays, CAT, MRI, Thermography, Ultrasonography, Medical use of isotopes, Endoscopy.

Patient Care, Monitoring and Safety Measures: Elements of intensive care monitoring; Basic hospital systems and components; Physiological effect of electric currents, Shock hazards from electrical equipment, Safety measures; Standards, Codes and practices.

Computer Applications and Biotelemetry: Real time computer applications, Data acquisition and processing; Remote data recording and management.

UNIT-IV (10 Hrs.)

Prosthetics and Orthotics: Introduction to artificial kidney, Artificial heart, Heart lung machine, Limb prosthetics and Orthotics elements of audio and visual aids.

Assisting and Therapeutic Devices: Introduction to cardiac pacemakers, Defibrillators, Ventilators, Muscle stimulators, Diathermy.

Lasers: Application of lasers to biomedical sciences.

Recommended Books

1. J.J. Carr and J.M. Brown, 'Introduction to Biomedical Equipment Technology', 4th Edn., Prentice Hall, **2000.**
2. L. Cromwell, F.J. Weibell and E.A. Pfeiffer, 'Biomedical Instrumentation and Measurement', 2nd Edn., Dorling Kingsley, **2006**.

FLEXIBLE AC TRANSMISSION SYSTEMS

Subject Code: BEEE1-874	**L T P C**	**Duration: 38 Hrs.**
	3 0 0 3	

Course Objectives:

1. To review the power electronics fundamentals.
2. To review power transmission fundamentals and to introduce the FACTS concept.
3. To introduce to the need of shunt and series compensation and UPFC.

Course Outcomes:

1. Students will refresh the power converters' fundamentals.
2. They will learn about need and applications of FACTS controllers.
3. They would develop understanding about shunt and series compensation and UPFC.

UNIT-I (10 Hrs.)

Power Electronics Fundamentals: Basic function of power electronics, Power semiconductor device for high power converters, Static power convertor structures, AC controller based structure, DC link convertor topologies, Convertor output and harmonic control.

UNIT-II (9 Hrs.)

Power Transmission control: Fundamental of ac power transmission, Transmission problems and needs, the emergence of FACTS, FACTS control considerations, FACTS controllers.

UNIT-III (10 Hrs.)

Shunt and Series Compensation: Shunt SVC principles, Configuration and control, STATCOM, Configuration applications. Fundamental of series compensation using GCSC, TCSC and TSSC, Application of TCSC for different problems of power system, TCSC lay out, SSSC principle of operation.

UNIT-IV (9 Hrs.)

Unified Power Flow Controllers: Basic operating principles and characteristics, independent active and reactive power flow control, control of UPFC, installation, applications, UPFC model for power flow studies, comparison of UPFC with the controlled series compensators and phase shifters.

Recommended Books

1. A. Ghosh and G. Ledwich, 'Power Quality Enhancement Using Custom Power Devices', Kluwer Academic Publishers, **2005**.
2. N.G. Hingorani and L. Gyragyi, 'Understanding FACTS: Concepts and Technology of Flexible AC Transmission System', Standard Publishers and Distributors, **2005.**
3. Y.H. Sang and A.T. John, 'Flexible AC Transmission Systems', IEEE Press, **2006.**
4. R.M. Mathur and R.K. Verma, 'Thyristor Based FACTS Controllers for Electrical Transmission Systems', IEEE Press, **2002.**
5. T.J.E. Miller, 'Reactive Power Control in Electric Systems', John Wiley, **1982.**

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SUBSTATION EQUIPMENT & DESIGN

Subject Code: BEEE1-875 **L T P C** **Duration: 39 Hrs.**
3 0 0 3

Course Objectives:

1. To provide knowledge about substation, its layout and main equipment present in it.
2. To impart knowledge about power, current and potential transformer.
3. To understand the importance of reactive power management and the use of capacitor banks in reactive power management.
4. To introduce to elementary design considerations of substation equipment.

Course Outcomes:

1. Students will get familiar with main equipment used in substations and their design considerations.
2. They will be able to know the use of different types of transformers used in substations.
3. They will develop understanding about importance of reactive power and its management by use of capacitor banks.

UNIT-1 (8 Hrs.)

Substation: Introduction, classification and layout of substation, Single Bus bar, Mesh Substation, Factors affecting layout of substation, types of bus bars, Substation equipment specifications, testing of substation Equipment.

Power Transformer: Introduction and Working Principle of Power Transformer, Classification and their types, important characteristics of Transformer Oil.

UNIT-II (9 Hrs.)

Current Transformers (CT): Basic functions of Current Transformer, Rating and Performance of CTs, Burden, Theory and Operation of CT, Diagram of CT's Connection of Power Transformer and Selection of CT.

Potential Transformers (PT): Terminology, requirement of VA Burden, Testing and Commissioning of PTs, Capacitor Voltage Transformer.

Earthing: Introduction and purpose of Earthing, tolerable limits of body currents, soil resistivity, earth resistance and its measurement, tolerable and actual step and touch voltage, types of Earthing, Design of Earthing grid, impulse Behavior of Earthing system, grounded and ungrounded neutral system, Types, Methods and selection of grounding neutral.

UNIT-III (11 Hrs.)

Reactive Power Management: Introduction to Reactive Power & its Importance in Power System, Sources of Generation & Absorption of Reactive Power, Reactive Power Compensation & its Advantages, Various types of Reactive Power Compensation and its Calculation, Static Synchronous Compensator, Unified Power Flow Controller.

Capacitor Banks: - Need for Reactive Compensation, Power Factor Improvement and its Benefits, Purpose of Installation of Capacitor Bank, Protection of Capacitor Bank and Pre-Commissioning Checks and tests, Series and Shunt Compensators, Rating and operation of Shunt Capacitor banks.

UNIT-IV (11 Hrs.)

Station Battery and Charging Equipment: Introduction, Variable Load Battery and System Tester, Testing of Battery Charger and Battery, Types of Batteries, Basic Charging Methods.

Elementary Idea of Substation Equipment Design: Substation equipment ratings and its operation from design view point, selection of cables, Isolator Design, Overhead line terminations, bus bar size calculations and panel design, design of Surge Arrestor, selection of power transformer.

Computer Applications in Substation Engineering: Introduction, System Components, Communication Infrastructure and Methods, Trends in SCADA, Remote Terminal Unit, MODEM.

Recommended Books

1. R.S. Dahiya and Vinay Attri, 'Sub Station Engineering, Design, Concepts and Computer Application', S.K. Kataria & Sons Publishers, **2013.**
2. S. Rao, Electrical Substation Engineering and Practice, Khanna Publishers, **1992.**
3. P.S. Satnam and P.V. Gupta, 'Substation Design and Equipment', Dhanpat Rai Publications, **2013**.
4. McDonald John D., 'Electric Power Substations Engineering', 3rd Edn., CRC Press, **2012.**

LINEAR INTEGRATED CIRCUITS

Subject Code: BEEE1-876	**L T P C** **3 0 0 3**	**Duration: 39 Hrs.**

Course 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.

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5. To introduce the concepts of waveform generation and introduce some special function ICs.

Course Outcomes:

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. Analyse special function ICs.

Unit–I (9 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 (9 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.

Unit-III (11 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, 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.

Recommended Books

1. Ramakant A. Gayakward, 'Op–Amps & Linear Integrated Circuits', Pearson Education, **2015.**
2. William D. Stanley, 'Operational Amplifiers with Linear Integrated Circuits', Merrill Publishing Company, **1989.**
3. Millman & Grabal, 'Micro Electronics', Tata McGraw Hill, **2001.**

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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**	
BECE1-301	Object Oriented Programming	3	1	0	40	60	100	4
BECE1-302	Electronic Devices and Circuits - I	3	1	0	40	60	100	4
BECE1-303	Network Analysis and Synthesis	3	1	0	40	60	100	4
BECE1-304	Electronic Instrumentation	3	1	0	40	60	100	4
BECE1-305	Signals and Systems	3	1	0	40	40	100	1
BECE1-306	Electronic Devices and Circuits - I Lab.	0	0	2	60	40	100	1
BECE1-307	Object Oriented Programming Lab	0	0	2	60	40	100	4
BHUM0-F91	Soft Skills-I	0	0	2	60	40	100	1
BECE1-308	Training – I#	0	0	4	60	40	100	2
Total		**15**	**5**	**10**	**440**	**460**	**900**	**25**

After 2nd Sem, During Summer Vacation

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**	
BECE1-409	Electronic Devices and Circuits –II	3	1	0	40	60	100	4
BECE1-410	Analog Communication Systems	3	1	0	40	60	100	4
BECE1-411	Digital Electronics	3	1	0	40	60	100	4
BECE1-412	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	Neural Networks and Fuzzy Logic							
BECE1-457	Data Structures and Algorithms							
BECE1-458	RADAR and SONAR Engineering							
BECE1-459	Web Technologies							
BECE1-413	Electronic Devices and Circuits -II Lab.	0	0	2	60	40	100	1
BECE1-414	Analog Communication Systems Lab.	0	0	2	60	40	100	1
BECE1-415	Digital Electronics Lab.	0	0	2	60	40	100	1
BHUM0-F92	Soft Skills -II	0	0	2	60	40	100	1
Total		**15**	**4**	**8**	**440**	**460**	**900**	**23**

In House / Industrial Training of 6 Weeks during Summer vacations after 4th semester

Total Contact Hrs. = 30 **Total Marks = 1000** **Total Credits = 24**

Semester 5th		Contact Hours			Marks			Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
BECE1-516	Linear Integrated Circuits	3	1	0	40	60	100	4
BECE1-517	Microprocessor and Interfacing	3	1	0	40	60	100	4
BECE1-518	Digital Communication Systems	3	1	0	40	60	100	4
BECE1-519	Linear Integrated Circuits Lab.	0	0	2	60	40	100	1
BECE1-520	Microprocessor Lab.	0	0	2	60	40	100	1
BECE1-521	Digital Communication Systems Lab.	0	0	2	60	40	100	1
BECE1-522	Training –II#	0	0	4	60	40	100	2
BHUM0-F93	Soft 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**	**12**	**500**	**500**	**1000**	**24**

After 4th Sem, During Summer Vacation

Total Contact Hrs. = 24 **Total Marks = 800** **Total Credits = 21**

Semester 6th		Contact Hours			Marks			Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
BECE1-623	Microwave and Antenna Theory	3	1	0	40	60	100	4
BECE1-624	Microcontroller and Embedded System	3	1	0	40	60	100	4
BECE1-625	Linear Control System	3	1	0	40	60	100	4
BECE1-626	Microwave Engineering lab	0	0	2	60	40	100	1
BECE1-627	Microcontroller Lab.	0	0	2	60	40	100	1
BHUM0-F94	Soft Skills-IV	0	0	2	60	40	100	1
Departmental Elective-III (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**	**380**	**420**	**800**	**21**

In House / Industrial Training of 8 Weeks during summer vacations after 6th semester

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Total Contact Hrs. = 28 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	Minor Project	0	0	4	60	40	100	4
BECE1- 732	Training-III#	0	0	8	60	40	100	4
Departmental Elective-IV (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**	**14**	**340**	**360**	**700**	**23**

After 6th Sem, During Summer Vacation

Total Contact Hrs. = 21 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	12	60	40	100	6
Departmental Elective-V (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**	**14**	**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**

OBJECT ORIENTED PROGRAMMING

Subject Code: BECE1-301 **L T P C** **Duration: 48 Hrs.**
3 1 0 4

Course Objectives:
1. To provide knowledge regarding the Object oriented programming C++, data types and about classes.
2. To provide understanding of inheritance and memory management in C++.
3. To describe how to represent pointers, and understanding the concept of binding and polymorphism.
4. To make the students familiar with the File handling and generic functions.

Course Outcomes:
1. After undergoing the course students will be able to develop various programs and flow charts using C++.
2. Apply the concepts of data encapsulation, inheritance, and polymorphism to large-scale software.
3. Enable students to develop their skills in programming with C++.
4. Design and develop object-oriented computer programs.

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 constkeyword, 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, need for destructors.

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, object composition and delegation, order of execution of constructors and 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.

Files: File streams, hierarchy of file stream classes, reading/writing of files, error handling during file operations, accessing records, randomly, updating files.

Recommended Books:

1. I.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.
4. 'The Complete Reference to C++ Language', McGraw Hill-Osborne.
5. F.B. Lippman, 'C++ Primer', Addison Wesle.

ELECTRONIC DEVICES AND CIRCUITS - I

Subject Code: BECE1-302	L T P C 3 1 0 4	Duration: 48 Hrs.

Course Objectives:

This course is meant to provide fundamental knowledge to students for understanding of the various electronic devices, their circuits & behaviour under various conditions.

1. To aware the students about the various electronic devices and their circuits.
2. To impart knowledge of BJTs and FETs.
3. To provide the students detailed concepts of CMOS and MOSFET.
4. To analyze low and high frequency transistor models.

Course Outcomes:

After undergoing this course student will be able to:

1. Understand the concepts of junction diodes and their applications.
2. Analyze BJT characteristics and determine their behaviour under low and high frequencies.
3. Analyze various concepts of FETs and their characteristics.
4. Design low and high frequency models and observe and its various characteristics.

Unit-I (12 Hrs.)

Semiconductor Diodes: Semi-conductor materials and their characteristics, PN junction Diode - VI characteristics, Breakdown mechanism in diode, effect of temperature on diode 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 I_{CO}, 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', Pearson Education.
4. Sedra, Adel S. and Smith, C. Kenneth, 'Microelectronic Circuits', Oxford University Press, New York.
5. Streetman Ben J., Sanjay Banerjee, 'Solid State Electronic Devices', PHI.

NETWORK ANALYSIS AND SYNTHESIS

Subject Code: BECE1-303 **L T P C** **Duration: 48 Hrs.**

3 1 0 4

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Course Objectives:

1. To provide the knowledge to students about the various network theorems.
2. To make the students aware about the various transient responses for various signals.
3. To provide them basic concepts of different types of two port networks and their synthesis.
4. To impart knowledge about different passive filter design.

Course Outcomes:

1. An ability to design, analyze and synthesis of various networks and circuits.
2. Knowledge of mathematical forms such as Laplace transforms & designing of filters and circuits.
3. Synthesis of networks using fundamental concepts.
4. To understand, design and analysis of various passive filter design.

Unit-I (12 Hrs.)

Laws and Basic Theorems: Fundamental Laws and Concepts – Kirchoff'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: K-derived, m-derived, Low pass filter, High pass filter, Band pass filter, Band stop filter, their magnitude and phase response

Recommended Books:

1. Vanvalkenburg, 'Network Analysis', Prentice Hall of India Pvt. Ltd., New Delhi.
2. D. RoyChoudhary, 'Network and Systems', New Age International Publisher.
3. Franklin F. Kuo, 'Network Analysis and Synthesis', John Wiley.
4. Someshwar C. Gupta, 'Circuit Analysis - with Computer Applications to Problem Solving', Jon W. Bayless.

ELECTRONIC INSTRUMENTATION

Subject Code: BECE1-304	L T P C 3 1 0 4	Duration: 48 Hrs.

Course Objectives:

1. To provide knowledge about different types of measuring, waveform generation, and analysis of electronic instruments.
2. Exposure to various analog measuring instruments.
3. To provide detailed knowledge about different bridges.
4. To understand CRO and its operation.

Course Outcomes:

After undergoing this course student will be able to:

1. Analyze operation of different instruments and able to describe different terminology related to measurements.
2. Recognize and understand various analog measuring instruments.
3. Measure resistance using various methods.
4. Find various measurements using 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.

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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 & Publishers.
2. J.B. Gupta, 'A Course in Electrical and Electronics Measurement & Instrumentation', S.K. Kataria & Sons.
3. W.D. Cooper1, 'Electronic Instrumentation and Measurement Techniques', Prentice Hall.

SIGNAL AND SYSTEMS

Subject Code: BECE1-305	L T P C 3 1 0 4	Duration: 48 Hrs.

Course Objectives:

1. To introduce the students about the theoretical concepts associated with processing continuous & discrete time signals & systems.
2. To make the students aware about the signal transmission through linear networks
3. Tobe able to think critically & to apply problem solving & reasoning strategies to the analysis of various types of signals & systems.
4. To impart them knowledge of various types of noises.

Course Outcomes:

1. Ability to analyse various types of signals in communication system.
2. Developing skills to understand random signals.
3. To understand various types of noises.
4. 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.

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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 Systems', Oxford University Press.
2. Ravi Kumar, 'Signals and Systems', PHI Learning.
3. Simon Haykin, 'Signals and Systems', John Wiley.
4. George R. Cooper, 'Probabilistic Methods of Signals and System Analysis', Oxford University Press.

ELECTRONIC DEVICES AND CIRCUITS LAB. - I

Subject Code: BECE1-306 **L T P C** **Duration: 24 Hrs.**
0 0 2 1

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Course Objectives:

1. Able to understand and identification of various electronic components.
2. To understand and plot characteristics of various semiconductor devices.
3. To understand the applications of Transistors as amplifier in various configurations.

Course Outcomes:

1. An ability to understand all types of electronics devices and circuits
2. An ability to conduct experiments, as well as to analyze and interpret various data sheets.

EXPERIMENTS

1. To perform & analyze the use of Zener diode as voltage regulator.
2. To observe the characteristics and behavior of Half wave, full wave & Bridge rectifiers.
3. To plot the input and output characteristics of CE configuration.
4. To observe the characteristics of a Class- A amplifier.
5. To observe the characteristics of Class- B amplifier.
6. To observe the characteristics of Class- B push-pull amplifier.
7. To observe 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 Observe 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 perform an experiment to observe the working of BJT as an amplifier.

Note: At least 08 experiments are required to be performed.

OBJECT ORIENTED PROGRAMMING LAB.

Subject Code: BECE1-307 **L T P C** **Duration: 24 Hrs.**
0 0 2 1

Course Objectives:

1. To provide the basic knowledge about control statements, looping statements, various I/O statements and various data structures.
2. To describe how to create classes in C++ for understanding of basic OOPS features.
3. To discuss various concepts of data hiding, function overloading and operator overloading.

Course Outcomes:

1. Enable students to develop their skills in programming with C++.
2. To describe functions of creating constructors, destructor, inheritance, polymorphism and file handling programs
3. Formulate problems as steps so as to be solved systematically.
4. Integrate robustness, reusability, and portability into large-scale software development.

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 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.
16. [Inheritance] Write a program to demonstrate the multiple inheritances.
17. [Inheritance] Write a program to demonstrate the virtual derivation of a class.
18. [Polymorphism] Write a program to demonstrate the runtime polymorphism.
19. [Exception Handling] Write a program to demonstrate the exception handling.
20. [Templates and Generic Programming] Write a program to demonstrate the use of function template.

21. [Templates and Generic Programming] Write a program to demonstrate the use of class template
22. **[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,
23. **[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.

SOFT SKILLS-I

Subject Code: **BHUM0-F91** **L T P C**
0 0 2 1

Course Objectives

The course aims to cause a basic awareness about the significance of soft skills in professional and interpersonal communications and facilitate an all-round development of personality.

Course Outcomes

At the end of the course, the student will be able to develop his/her personal traits and expose their personality effectively.

UNIT-1

SOFT SKILLS- Introduction to Soft Skills, Aspects of Soft Skills, Identifying your Soft Skills, Negotiation skills, Importance of Soft Skills, Concept of effective communication.

SELF-DISCOVERY- Self-Assessment, Process, Identifying strengths and limitations, SWOT Analysis Grid.

UNIT-2

FORMING VALUES- Values and Attitudes, Importance of Values, Self-Discipline, Personal Values - Cultural Values-Social Values-some examples, Recognition of one's own limits and deficiencies.

UNIT-3

ART OF LISTENING- Proxemics, Haptics: The Language of Touch, Meta Communication, Listening Skills, Types of Listening, Listening tips.

UNIT-4

ETIQUETTE AND MANNERS- ETIQUETTE- Introduction, Modern Etiquette, Benefits of Etiquette, Taboo topics, Do's and Don'ts for Men and Women. MANNERS- Introduction, Importance of manners at various occasions, Professional manners, Mobile manners. CORPORATE GROOMING TIPS- Dressing for Office: Do's and Don'ts for Men and Women, Annoying Office Habits.

RECOMMENDED BOOKS

1. K. Alex, S. Chand Publishers.
2. Butterfield, Jeff, 'Soft Skills for Everyone', Cengage Learning, New Delhi, **2010**.
3. G.S. Chauhan and Sangeeta Sharma, 'Soft Skills', Wiley, New Delhi, **2016**.
4. Klaus, Peggy, Jane Rohman & Molly Hamaker, 'The Hard Truth About Soft Skills', Harper Collins E-books, London, **2007**.
5. S.J. Petes, Francis, 'Soft Skills and Professional Communication', Tata McGraw Hill Education, New Delhi, **2011**.

MRSPTU

ELECTRONIC DEVICES AND CIRCUITS - II

Subject Code: BECE1-409 **L T P C** **Duration: 48 Hrs.**
3 1 0 4

Course Objectives:

1. To aware the students about Basic Electronic Circuits.
2. To update the Knowledge about small signal & large signal amplifier.
3. To analyze various types of circuits to generate signals.
4. Selection and specification of electronic components for industrial applications.
5. To understand working of switching circuits.

Course 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 ability to understand various amplifiers including push pull and complementary symmetry.
3. Design different types of feedback amplifiers and oscillator circuits.
4. To understand and analyze 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. Analysis of R_i, R_o, A_i, A_v with and without feedback

Oscillators: Classification of Oscillators, frequency and frequency stability of oscillatory circuits, Hartley Oscillator, Colpitts Oscillators, Clapp Oscillator, Crystal Oscillator, Phase Shift Oscillator, Wein Bridge Oscillator.

Unit-IV (12 Hrs.)

A Stable Multivibrators: A stable Collector coupled and emitter coupled multivibrator, complementary Transistor A stable multivibrator.

Switching Characteristics of Devices: Diode and transistor as electronic switch.

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’, Pearson Education.

4. Sedra, S. Adel and Smith, C. Kenneth, 'Microelectronic Circuits', Oxford University Press, New York.
5. Streetman Ben J., Sanjay Banerjee, 'Solid State Electronic Devices', PHI.

ANALOG COMMUNICATION SYSTEMS

Subject Code: BECE1-410 | **L T P C 3 1 0 4** | **Duration: 48 Hrs.**

Course Objectives:
1. To understand various wave propagation concepts.
2. To provide the students about the concepts of analog modulation techniques
3. To provide the detailed knowledge about AM transmission and AM reception
4. To impart the knowledge about FM transmission and FM reception.

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 analyze the performance of AM/FM transmission and reception.

Unit-I (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, Concepts of VSB/ISB/SSB, Pre-emphasis and De-emphasis.

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.

Unit-II (12 Hrs.)

AM Transmission/AM Reception: Introduction, Generation of Amplitude Modulation, Basic Principles of AM Generation: Square law Diode 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-III (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 Seeley or Phase Discriminator, Indirect methods of FM Demodulation: FM Detector using PLL and Stereo FM Multiplex Reception.

Unit-IV (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.

Recommended Books:

1. George Kennedy, 'Electronic Communication System', McGraw Hill.
2. Gary M. Miller and Jeffery S. Beasley, 'Modern Electronic Communications', PHI.
3. Simon Haykin, 'Communication Systems', \Wiley.
4. Wayne Tomasi, 'Electronics Communication systems', Pearson Publishers.
5. Proakis, 'Communication Systems', McGraw Hill.

DIGITAL ELECTRONICS

Subject Code: BECE1- 411 **L T P C** **Duration: 48 Hrs.**

3 1 0 4

Course 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

Course Outcomes:

1. Students will simplify a digital design problem as part of the systematic approach to solve a problem.
2. To analyze and understand various sequential circuits & various Digital Logic families.
3. To design 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.

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-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.

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.

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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 Book:

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', Tata McGraw Hill.

ELECTROMAGNETIC FIELD THEORY

Subject Code: BECE1-412 **L T P C** **Duration: 48 Hrs.**
3 1 0 4

Course 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.

Course Outcomes:

1. Examine the phenomena of wave propagation in different media and its interfaces and in applications of microwave engineering.
2. An ability to understand the concepts of magnetic field and magnetic field intensity.
3. Analyze Maxwell's equation in different forms (differential and integral) and apply them to diverse engineering problems.
4. 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 law and its applications, Electric flux density, potential fields due to electric dipole, Laplace and Poison equations.

Magneto statics: Definition and explanation on Magnetic Field intensity due to a finite and infinite wire carrying current. Magnetic field intensity on rectangular loop carrying current, Amperes 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. N. Narayana Rao, ‘'Elements of Engineering Electromagnetics', Pearson Education.
4. R.F. Jordan, 'Electromagnetic Waves & Radio System', Prentice Hall India.
5. Bhag Singh Guru and Hüseyin R. Hiziroglu, 'Electromagnetic Field Theory Fundamentals, Cambridge University Press.

NEURAL NETWORKS AND FUZZY LOGIC

Subject Code: BECE1-456 **L T P C** **Duration: 48 Hrs.**
3 0 0 3

Course Objectives:

The students should be made to:

1. Learn the various soft computing frame works.
2. Be familiar with design of various neural networks.
3. Learn about the concepts of Fuzzification and De-Fuzzification.
4. Describe various optimization techniques.

Course Outcomes:

Students will be able to:

1. Apply various soft computing frame works.
2. Design of various neural networks.
3. Use fuzzy logic and Fuzzy rules.
4. Learn and understand various optimization techniques.

UNIT-I (12 Hrs.)

Neural Networks: History, Overview of Biological Neuro-System, Terminology of Artificial Neural Network, Comparison of BNN and ANN, Mathematical Models of Neuron, ANN Architecture, Topology, Fundamental Learning Laws, Learning Paradigms-Supervised, Unsupervised and reinforcement Learning.

UNIT-II (12Hrs)

Perceptron Architecture: Single layer perceptron, Perceptron Learning Rules, Multi-layer perceptron, Back Propagation Algorithm, Associative Memories, Hopfield Networks, Competitive Learning, Self-organizing Maps, ART Networks, Applications of Artificial Neural Networks.

UNIT-III (12 Hrs.)

Introduction to Fuzzy Logic, Classical and Fuzzy Sets: Overview of Classical Sets, Linguistic Variables, Membership Function, Fuzzification, De-Fuzzification to Crisp Sets, Operations on Fuzzy Sets: Compliment, Intersections, Unions, Combinations of Operations, Aggregation

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Operations, Fuzzy rule generation (IF-THEN), Applications of Fuzzy Logic.

UNIT-IV (12 Hrs.)

Neuro-Fuzzy System: Introduction and Architecture of Neuro-Fuzzy Networks.

Introduction to different Optimization Techniques: Genetic Algorithm, Particle Swarm Optimization, Biogeography Based Optimization, Bacterial Forging Optimization, Detailed study of Genetic Algorithm, GA in problem solving, Implementation of GA.

Recommended Books:

1. N. Yegnanarayana, 'Artificial Neural Network', PHI.
2. LaureneFausett, 'Fundamental of Neural Networks', Pearson.
3. Simon Haykin, 'Neural Networks', Pearson.
4. S. Rajasekaran and GA Vijayalakshmi, 'Neural Networks, Fuzzy Logic and Genetic Algorithms', PHI.
5. Timothy J. Ross, 'Fuzzy Logic with Engineering', John Wiley.
6. S.N. Sivanandam, 'Introduction to Fuzzy Logic using MATLAB', Springer.
7. Ahmad M. Ibrahim, 'Introduction to Applied Fuzzy Electronics', PHI.

DATA STRUCTURES AND ALGORITHMS

Subject Code: BECE1-457 | **L T P C 3 0 0 3** | **Duration: 48 Hrs.**

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Course Objectives:

1. To understand basic data structures and algorithms.
2. To use object oriented programming to implement data structures.
3. To introduce linear, non-linear data structures and their applications.
4. To understand the different methods of organizing large amount of data.

Course Outcomes:

Upon completion of the course, students will be able to:

1. Select basic data structures and algorithms for autonomous realization of simple programs or program parts.
2. Formulate new solutions for programming problems or improve existing code using learned algorithms and data structures.
3. Demonstrate advantages and disadvantages of specific algorithms and data structures.
4. To evaluate algorithms and data structures in terms of time and memory complexity of basic operations.

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 biconnected 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', Addison-Wesley.
4. Y. Langsam, M.J. Augenstein and A.M. Tenenbaum, 'Data Structures using C', Pearson Education.
5. Richard F. Gilberg, Behrouz A. Forouzan, 'Data Structures – A Pseudocode Approach with C', Thomson Brooks / COLE.

RADAR AND SONAR ENGINEERING

Subject Code: BECE1-458	**L T P C** **3 0 0 3**	**Duration: 48 Hrs.**

Course Objectives:

1. To understand theoretical principals underlying RADAR.
2. To understand the modern navigation system and general propagation phenomena.
3. Learn the fundamentals of physical acoustics and SONAR.

Course Outcomes:

1. Develop basic understanding of various types of RADARs and its applications.
2. Develop the ability to understand and design basic RADAR and SONAR systems.
3. Use of physical acoustics, electromagnetic, wireless communication and mathematics to understand fundamentals of RADAR and SONAR.

Unit-I (12 Hrs.)

Introduction to Radar: Radar Block Diagram & operation, Radar Frequencies, Radar development, Application of Radar.

Radar Equation: Simple form of Radar Equation, Prediction of Range performance, Minimum Detectable signal, Receiver noise, Signal to Noise ratio, Transmitter Power, Pulse repetition frequency &range ambiguities, System losses, Propagation effects.

Unit-II (12 Hrs.)

Continuous Wave (CW) &Frequency Modulated Radar: The Doppler effect, CW Radar, Frequency-modulated CW Radar, Multiple Frequency CW Radar.

MTI & Pulse Doppler RADAR: Introduction, Delay Line Cancellers, Multiple or staggered, Pulse repetition frequencies, Range-Gated Doppler Filters, Digital Signal Processing, Other

MTI delay line, Limitation of MTI performance, Noncoherent MTI, Pulse Doppler Radar, MTI from a moving platform.

Tracking RADAR: Tracking with Radar, Sequential Lobbing, Conical Scan, Monopulse Tracking Radar, Tracking in range.

Unit-III (12 Hrs.)

Types of SONAR Systems: active and passive, sonar equations, propagation characteristics of the medium, transmission loss and spreading effects, beam forming and steering, detection threshold, square law detector, cross-correlation detector.

Unit-IV (12 Hrs.)

Modern SONAR systems: signal and noise models, temporal sampling and quantization-spatial sampling and beam forming, band shifting, filtering and smoothing, decision processing, block diagram of active and passive sonars.

Correlation Receivers and Matched Filters: Advanced Sonar Signal Processing functions, adaptive beam forming, synthetic aperture arrays, automated decision-making.

Recommended Books:

1. Byron's Edde, 'Radar Principles technologies', Pearson.
2. Merrill I. Skolnik, 'Introduction to Radar Systems', Tata McGraw Hill.
3. K.K. Sharma, 'Fundamentals of Radar and Sonar Engineering', S.K. Kataria & Sons.

WEB TECHNOLOGIES

Subject Code: BECE1-459 **L T P C** **3 0 0 3** **Duration: 48 Hrs.**

Course Objectives:

1. To learn the concepts of www including browser and HTTP protocol.
2. List the various HTML tags and use them to develop the user friendly web pages.
3. To define the Cascading Style Sheets(CSS) with its types and use them to provide the styles to the web pages at various levels.
4. To use the JavaScript to develop the dynamic web pages.

Course Outcomes:

After completion of the course students will be able to:

1. Describe the concepts of WWW including browser and HTTP protocol.
2. Develop the modern web pages using the HTML and CSS features with different layouts as per need of applications.
3. Use server side scripting with PHP to generate the web pages dynamically using the database connectivity.
4. Develop the modern Web applications using the client and server side technologies and the web design fundamentals.

Unit-I (12 Hrs.)

Introduction: Concept of WWW, Internet and WWW, HTTP Protocol: Request and Response, Web browser and Web servers, Features of Web 2.0

Web Design: Concepts of effective web design, Web design issues including Browser, Bandwidth and Cache, display resolution, Look and Feel of the Website, Page Layout and linking, User centric design, Sitemap, Planning and publishing website, Designing effective navigation.

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Unit-II (12 Hrs.)

HTML: Basics of HTML, formatting and fonts, commenting code, color, hyperlink, lists, tables, images, forms, XHTML, Meta tags, Character entities, frames and frame sets, Browser architecture and Web site structure. Overview and features of HTML5

Unit-III (12 Hrs.)

Style Sheets: Need for CSS, introduction to CSS, basic syntax and structure, using CSS, background images, colors and properties, manipulating texts, using fonts, borders and boxes, margins, padding lists, positioning using CSS, CSS2, Overview and features of CSS3

Unit-IV(12Hrs.)

JavaScript: Client side scripting with JavaScript, variables, functions, conditions, loops and repetition, Pop up boxes, Advance JavaScript: Javascript and objects, JavaScript own objects, the DOM and web.

Recommended Books:

1. Ralph Moseley and M.T. Savaliya, 'Developing Web Applications', Wiley-India.
2. Joel Sklar, 'Web Design', Cengage Learning.
3. Harwani, 'Developing Web Applications in PHP and AJAX', McGraw Hill.
4. P.J. Deitel & H.M. Deitel, 'Internet and World Wide Web How to program', Pearson.

ELECTRONICS DEVICES AND CIRCUITS LAB - II

Subject Code: BECE1-413 **L T P C** **Duration: 24 Hrs.**
0 0 2 1

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Course Objectives:

1. To understand the characteristics of various semiconductor devices
2. To understand various sources of oscillations
3. Able to understand, identification and selection of various amplifiers.
4. To make the students aware about the various multivibrator circuits.

Course Outcomes:

1. An ability to understand different types of electronics devices and circuits
2. An ability to design and conduct experiments, as well as to analyse and interpret output.

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 observe the response of RC phase shift oscillator and determine frequency of oscillation.
5. To observe the response of Hartley oscillator and determine frequency of oscillation.
6. To observe the response of Colpitt’s oscillator and determine frequency of oscillation.
7. To observe 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 JFET as an amplifier.
10. To understand and plot working of Astable Multivibrator.
11. To understand and plot working of Monostable Multivibrator.

Note: At least 08 experiments are required to be performed.

ANALOG COMMUNICAION SYSTEM LAB

Subject Code: BECE1-414 **L T P C** **Duration: 24 Hrs.**
0 0 2 1

Course Objectives:

1. To familiarize with modulation & demodulation techniques and study their waveforms on oscilloscope.
2. To impart working knowledge of Voltage Controlled Oscillator.
3. To familiarize students with the functions of oscillators, filters, amplifiers, LC networks, modulators, limiters, mixers, and detectors in AM, FM, PM, SSB, and PLL circuits.

Course Outcomes:

1. An ability to perform transmission of signals from transmitter to receiver using various analog
   modulation and demodulation techniques.
2. Study of transmission and reception process.

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.

DIGITAL ELECTRONICS LAB

Subject Code: BECE1-415 **L T P C** **Duration: 24 Hrs.**
0 0 2 1

Course Objectives:

1. To give students a practical knowledge about all types of digital circuits.
2. To give students a working knowledge to connect digital circuits and verify their truth tables.
3. To give students a knowledge about integrated circuits of different combinational and sequential circuits.

Course Outcomes:

1. An ability to test and verify working and truth tables of combinational and sequential circuits.
2. Working knowledge of different converters.
3. To perform multiplexer and demultiplexer.

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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.

Note: At least ten experiments are required to be performed.

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SOFT SKILLS-II

Subject Code: **BHUM0-F92** **L T P C**
0 0 2 1

Course Objectives

The course aims to address various challenges of communication as well as behavioural skills faced by individual at work place and organisations. Also, it aims to enhance the employability of the students.

Course Outcomes

At the end of the course the student will be able to understand the importance of goal setting. They will also be able to handle stress in their lives and future in a better way.

UNIT-1

DEVELOPING POSITIVE ATTITUDE- Introduction. Formation of attitude. Attitude in workplace. Power of positive attitude. Examples of positive attitudes. Negative attitudes. Examples of negative attitude. overcoming negative attitude and its consequences.

IMPROVING PERCEPTION- Introduction. Understanding perception. perception and its application in organizations.

UNIT-2

CAREER PLANNING-Introduction. Tips for successful career planning. Goal setting- immediate, short term and long term. Strategies to achieve goals. Myths about choosing career.

UNIT-3

ART OF READING-Introduction. Benefits of reading. Tips for effective reading. the SQ3R technique. Different stages of reading. determining reading rate of students. Activities to increase the reading rate. Problems faced. Becoming an effective reader.

UNIT-4

STRESS MANAGEMENT - Introduction. meaning. positive and negative stress. Sources of stress. Case studies. signs of stress. Stress management tips. Teenage stress.

RECOMMENDED BOOKS

1. K. Alex, S. Chand Publishers.
2. Rizvi, M. Ashraf, 'Effective Technical Communication', McGraw Hill.
3. Mohan Krishna & Meera Banerji, 'Developing Communication Skills', Macmillan.
4. Kamin, Maxine, 'Soft Skills Revolution: A Guide for Connecting with Compassion for Trainers, Teams & Leaders', Pfeiffer & Amp; Company, Washington, DC, **2013.**

LINEAR INTEGRATED CIRCUITS

Subject Code: BECE1-516	**L T P C** **3 1 0 4**	**Duration: 48 Hrs.**

Course 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.

Course Outcomes:

Upon Completion of the course, 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. Analyse 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.

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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', Merrill Publishing Company.
3. Millman & Grabal, 'Micro Electronics', Tata McGraw Hill.

MRSPTU

MICROPROCESSOR AND INTERFACING

Subject Code: BECE1-517 **L T P C** **Duration: 48 Hrs.**
3 1 0 4

Course 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.

Course 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 (14 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 (14 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, Dhanpat Ra, 'Fundamentals of Microprocessor and Microcontrollers'.

DIGITAL COMMUNICATION SYSTEMS

Subject Code: BECE1-518 **L T P C** **Duration: 48 Hrs.**
3 1 0 4

Course Objectives:

1. To provide knowledge about basics of Communication system and various digital modulation and demodulation techniques.
2. To learn design of useful circuits required in communication system.
3. To provide knowledge about various transmitter and receiver circuits used in communication.
4. To provide students with tools for communication signal analysis.

Course Outcomes:

1. To understand the various blocks/stages in a digital communication system.
2. Analyze the performance of a baseband and pass band digital communication system.
3. Perform the time and frequency domain analysis of the signals in a digital communication system.
4. Analyze the performance of various multiplexing techniques.

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.

MRSPTU

Unit-II (12 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 (10 Hrs.)

Baseband Detection: rror 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 (16 Hrs.)

Band-pass Modulation and Demodulation: 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.

Multiplexing 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** **Duration: 21 Hrs.**
0 0 2 1

Course 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.

Course 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 pass 1st order butterworth active filters using Op Amp.
9. Design Phase shift oscillator using Op-Amp.
10. Design Wein Bridge oscillator using Op-Amp.
11. Application of Op Amp as Sawtooth wave generator.
12. Application of Op Amp as Zero Crossing detector and window detector.
13. Application of Op Amp as Schmitt Trigger.
14. Design a delay circuit using 555 timer.
15. Design of a function generator
16. Design of a Voltage Controlled Oscillator

Note: At least 12 experiments are required to be performed.

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MICROPROCESSOR LAB.

Subject Code: BECE1-520 | **L T P C 0 0 2 1** | **Duration: 21 Hrs.**

Course 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.

Course 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 LAB

Subject Code: BECE1-521	L T P C 0 0 2 1	Duration: 24 Hrs.

Course 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.

Course 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.

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.

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SOFT SKILLS-III

Subject Code: **BHUM0-F93** **L T P C**
0 0 2 1

Course Objectives
The course aims to equip the students with effective writing skills in English. Also, to make the students understand their role as team players in organisations.
Course Outcomes
At the completion of the course, the student will become well –versed with the behavioural skills. They will also understand the role of body language and non-verbal communication during the interview process.

UNIT-1

ART OF WRITING - Introduction, Importance of Writing Creative Writing, Writing tips, Drawback of written communication.
ART OF BUSINESS WRITING - Introduction, Business Writing, Business Letter, Format and Styles, Types of business letters, Art of writing correct and precise mails, Understand netiquette.

UNIT-2

BODY LANGUAGE - Introduction- Body Talk, Forms of body language, uses of body language, Body language in understanding Intra and Inter-Personal Relations, Types of body language, Gender differences, Gaining confidence with knowledge of Kinesics.

UNIT-3

TEAM BUILDING AND TEAM WORK - Introduction, Meaning, Characteristics of an effective team, Role of a Team Leader, Role of Team Members, inter group Collaboration-Advantages, Difficulties faced, Group Exercises-Team Tasks and Role-Play, Importance of Group Dynamics.

UNIT-4

TIME MANAGEMENT - Introduction, the 80-20 Rule, three secrets of Time Management, Time Management Matrix, Effective Scheduling, Time Wasters, Time Savers, Time Circle Planner, Difficulties in Time Management, Overcoming Procastination.

RECOMMENDED BOOKS

1. K. Alex, S. Chand Publishers.
2. R.C. Sharma and Krishna Mohan, 'Business Correspondence and Report Writing', TMH, New Delhi, **2016.**
3. N. Krishnaswami and T. Sriraman, 'Creative English for Communication', Macmillan.
4. Penrose, John M., et al., 'Business Communication for Managers', Thomson South Western, New Delhi, **2007**.
5. Holtz, Shel, 'Corporate Conversations', PHI, New Delhi, **2007**.

DATA COMMUNICATION NETWORKS

Subject Code: BECE1-560 **L T P C** **Duration: 48 Hrs.**
3 0 0 3

Course Objectives:
The students 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.

Course Outcomes:

At the end of the course, the students 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', PHI.
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', PHI.

HUMAN RESOURCE MANAGEMENT

Subject Code: BECE1-561	L T P C 3 0 0 3	Duration: 48 Hrs.

Course Objectives: Understand and apply the policies and practices of the primary areas of human resource management, including staffing, training, Integration, management and compensation**.**

Course Outcomes:
1. Apply effective written and oral communication skills to business situations.
2. Analyze the global business environment.
3. Analyze 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-I (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: 48 Hrs.**
3 0 0 3

Course Objectives:

1. To outline the formal procedures for the analysis and design of combinational circuits and sequential circuits.
2. To introduce the concept of memories and programmable logic devices.
3. To illustrate the concept of synchronous and asynchronous sequential circuits.

Course 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 (12 Hrs.)

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 (12 Hrs.)

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 (12 Hrs.)

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 (12 Hrs.)

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.

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BIOMEDICAL ELECTRONICS AND INSTRUMENTATION

Subject Code: BECE1-563 **L T P C** **Duration: 48 Hrs.**
3 0 0 3

Course 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.

Course 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 (10 Hrs.)

Biomedical Signals: Origins of Bioelectric Signals, Human body, Heart and Circulatory System, Electrodes, Transducers, ECG, EMG.

UNIT-II (14 Hrs.)

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 (12 Hrs.)

Imaging System: Working with X-Rays, CT scanner, NMR, NMR, Ultrasonic System, Ultrasonic System, Ultrasonic System.

UNIT-IV (12 Hrs.)

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 by', 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.

MICRO-ELECTRONICS

Subject Code: BECE1-564 **L T P C** **Duration: 48 Hrs.**
3 0 0 3

Course 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.

Course 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 (12 Hrs.)

Introduction: Advantages of IC's, General classification of IC's (Linear/Digital IC's, Monolithic/ Hybrid IC's), Basic IC fabrication steps.

UNIT-II (12 Hrs.)

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 (12 Hrs.)

Silicon Oxidation: Thermal oxidation process (Kinetics of growth, Thin oxide growth), Effect of impurities on the oxidation rate, Preoxidation Cleaning, Various oxidation techniques, Masking properties of SiO2.

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 (12 Hrs.)

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: 48 Hrs.**

Course 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.

Course 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 (14 Hrs.)

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 (14 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. M. Kulkarni, Umesh, 'Microwave Devices & Radar Engg.'.
3. A.K. Maini, 'Microwaves and Radar', Khanna Publishers.
4. Balanis A. Constantine, 'Antenna Theory, Analysis and Design', Wiley, New York.

MICROCONTROLLER AND EMBEDDED SYSTEM

Subject Code: BECE1-624	L T P C 3 1 0 4	Duration: 48 Hrs.

Course Objectives:

The students should be made to:

1. Study the Architecture of 8051 microcontrollers.
2. Learn the design aspects of I/O and Memory Interfacing circuits.
3. Study about communication and bus interfacing.

Course Outcomes:

At the end of the course, the students should be able to:

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1. Design and implement 8051 microcontroller based systems.
2. Serial communication 0f 8051.
3. Interfacing with 8051.

Unit-I (12 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 (12 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: 48 Hrs.

Course Objectives:

1. To introduce the elements of control system and their modeling using various Techniques.
2. To introduce methods for analyzing 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.

Course 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.

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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 (8 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 (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 (14 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.
5. Williams, Ivan J. Distefano, Joseph J. Stubberud, Allen R., 'Feedback and Control Systems', Schaum's Outlines.

MICROWAVE ENGINEERING LAB.

Subject Code: BECE1-626	**L T P C** **0 0 2 1**	**Duration: 24 Hrs.**

Course Objectives:

The student should be made to:

1. Know about the behavior of microwave components.
2. Practice microwave measurement procedures.

Course Outcomes:

At the end of the course, the student should be able to:

1. Test& analyze various microwave components.
2. Analyze 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 waves 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** | **Duration: 24 Hrs.**

Course 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.

Course 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.

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SOFT SKILLS-IV

Subject Code: **BHUM0-F94** **L T P C**
0 0 2 1

Course Objectives

The course aims at the key areas like conversation skills, group skills and persuasion skills required during the interview process in an organisation.

Course Outcomes

At the end of the course, the student will be able to:

1. Demonstrate soft skills required for business situations.
2. Analyze the value of soft skills for career enhancement.
3. Apply soft skills to workplace environment.
4. Confidently participate in GD and interview process.

UNIT-1

ART OF SPEAKING- Introduction. Communication process. Importance of communication, channels of communication. Formal and informal communication. Barriers to communication. Tips for effective communication. tips for conversation. Presentation skills. Effective multi-media presentation skills. Speeches and debates. Combating nervousness. Patterns and methods of presentation. Oral presentation, planning and preparation.

UNIT-2

GROUP DISCUSSION- Introduction. Importance of GD. Characters tested in a GD. Tips on GD. Essential elements of GD. Traits tested in a GD .GD etiquette. Initiating a GD. Non-verbal communication in GD. Movement and gestures to be avoided in a GD. Some topics for GD.

UNIT-3

PREPARING CV/RESUME-Introduction – meaning – difference among bio-data, CV and resume. CV writing tips. Do's and don'ts of resume preparation. Vocabulary for resume, common resume mistakes, cover letters, tips for writing cover letters.

UNIT-4

INTERVIEW SKILLS - Introduction. Types of interview. Types of question asked. Reasons for rejections. Post-interview etiquette. Telephonic interview. Dress code at interview. Mistakes during interview. Tips to crack on interview. Contextual questions in interview skills. Emotional crack an interview. Emotional intelligence and critical thinking during interview process.

RECOMMENDED BOOKS

1. K. Alex, S. Chand Publishers.
2. Lucas, Stephen E., 'The Art of Public Speaking', 11th Edn., International Edn., McGraw Hill Book Co., **2014**.
3. Goleman, Daniel, 'Working with Emotional Intelligence', Banton Books, London, **1998**.
4. Thrope, Edgar and Showick Trope, 'Winning at Interviews', Pearson Education, **2004.**
5. Turk, Christopher, 'Effective Speaking', South Asia Division: Taylor & Francis, 1**985**.

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NANO SCIENCE AND NANO TECHNOLOGY

Subject Code: BECE1-665 **L T P C** **Duration: 48 Hrs.**
3 0 0 3

Course 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

Course 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 (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.

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.
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.

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ADVANCED MICROPROCESSOR

Subject Code: BECE1-666 **L T P C** **Duration: 48 Hrs.**
3 0 0 3

Course 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.

Course 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 (12 Hrs.)

Microprocessor 8086: Block diagram, Architecture & Pin diagram of 8086, pipelining process, flag register. Register details of 8086, operation, different addressing modes.

Unit II (12 Hrs.)

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 (12 Hrs.)

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 (12 Hrs.)

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. Myke Predko, 'Programming and Customizing the ARM7 Microcontroller', McGraw Hill.
6. John Morton, 'The PIC Microcontroller: Your Personal Introductory Course', Newnes an Imprint of Butterworth-Heinemann Ltd.

IMAGE AND SPEECH PROCESSING

Subject Code: BECE1-667 **L T P C 3 0 0 3** **Duration: 48 Hrs.**

Course 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.

Course 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 (12 Hrs.)

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 (12 Hrs.)

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, Colour image processing.

Unit-III (12 Hrs.)

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 (12 Hrs.)

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 phasor mode, 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.

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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 3 0 0 3** **Duration: 48 Hrs.**

Course 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.

Course 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 (12 Hrs.)

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 (12 Hrs.)

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 (12 Hrs.)

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 (12 Hrs.)

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

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OPERATION RESEARCH

Subject Code: BECE1-669 | **L T P C 3 0 0 3** | **Duration: 48 Hrs.**

Course Objectives:

1. To Facilitate the knowledge about decision making systems.
2. To Enrich the idea of different models.

Course 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 (12 Hrs.)

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 (12 Hrs.)

Deterministic Model: Transportation model-balanced & unbalanced, north west rule, Vogel's Method, least cost or matrix minimal, stepping stone method, MODI methods, degeneracy, assignment, travelling 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 (12 Hrs.)

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 (12 Hrs.)

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. Vohra, 'Quantitative Techniques', TMH.
4. H.M. Wagher, 'Principles of operation Research (with Applications to Managerial Decisions), Prentice Hall of India.
5. Philips, Revindran, Solgeberg, 'Operation Research', Wiley ISE.

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WIRELESS COMMUNICATION SYSTEMS

Subject Code: BECE1-728 **L T P C** **Duration: 48 Hrs.**
3 1 0 4

Course 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 signaling schemes for fading channels.
4. Be familiar the various multipath mitigation techniques.
5. Understand the various multiple antenna systems.

Course Outcomes:
At the end of the course, the student should be able to:
1. Characterize wireless channels.
2. Design and implement various signaling schemes for fading channels.
3. Compare multipath mitigation techniques and analyze 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.

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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 (12 Hrs.)

Multiple Access Techniques f**or 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 (12 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', Pearson.

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: 48 Hrs.**
3 1 0 4

Course 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.

Course 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 (12 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 (12 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. B. 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	Duration: 24 Hrs.

Course 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.

Course 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.

EXERCISES

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.

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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: BECE1-730 **L T P C**
0 0 8 4

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: 48 Hrs.**
3 0 0 3

Course 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.

Course 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 (12 Hrs.)

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.

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Unit-II (12 Hrs.)

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 (12Hrs)

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 (12 Hrs.)

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. Huseyin Arslan, 'Cognitive Radio, Software Defined Radio and Adaptive Wireless Systems', Springer.
5. Linda Doyle, 'Essentials of Cognitive Radio', Cambridge University Press.

RELATIONAL DATABASE MANAGEMENT SYSTEMS

Subject Code: BECE1-771	L T P C 3 0 0 3	Duration: 48 Hrs.

Course 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.

Course 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 (12 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.

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 (12 Hrs.)

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 (12 Hrs.)

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 (12 Hrs.)

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.
5. Raghu Ramakrishnan, Johannes Gehrke, 'Database Management Systems', Tata McGraw Hill.
6. Abraham Silberschatz, S. Sudarshan, Henry F. Korth, 'Database System Concepts', Tata McGraw Hill.

COMPUTER ARCHITECTURE AND ORGANIZATION

Subject Code: BECE1-772 **L T P C** **Duration: 48 Hrs.**
3 0 0 3

Course 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.

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6. To expose the students with different ways of communicating with I/O devices and standard I/O interfaces.

Course Outcomes:

At the end of the course, 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-1 (12 Hrs.)

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 (12 Hrs.)

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 (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.

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 (12 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 [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, 'Computer Organization and Design', Morgan, Kauffmann, 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** **Duration: 48 Hrs.**
3 0 0 3

Course Objectives:
The students should be:
1. Learn the various soft computing frame works.
2. Be familiar with design of various neural networks.
3. Learn genetic programming.

Course 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 (12 Hrs.)

Neural Networks: Fundamentals of Neural Networks – History- Architectures- Learning methods- XOR Problem-Delta rule- Derivation-Back propagation- applications- parameters in BPN- Associative memory – Hetero associative- BAM- energy function- problems-applications of associative memories- ART1- ART2- applications of adaptive networks.

UNIT-II (12 Hrs.)

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 (12 Hrs.)

Genetic Algorithms: Fundamentals of GA – creation of offspring – encoding – fitness function reproduction – crossover- insertion& deletion- mutation- bitwise operators – applications.

UNIT-IV (12 Hrs.)

Programming Using Mat Lab: 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** **Duration: 48 Hrs.**
3 1 0 4

Course 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.

Course 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 (12 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 (12 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.
5. S.M. Kang, Y. Lebiebici, 'CMOS Digital Integrated Circuits Analysis & Design', TMH.

VLSI DESIGN LAB.

Subject Code: BECE1-834	**L T P C**	**Duration: 24 Hrs**
	0 0 2 1	

Course 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.

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Course 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 EXPERIMENTS

1. Design of all type of Flip-Flops using (if-then-else) Sequential Constructs
2. Design of 8-Bit Shift Register with shift Right, shift Left, Load and Synchronous reset.
3. Design of Synchronous 8-bit Johnson Counter.
4. Design of Synchronous 8-Bit universal shift register (parallel-in, parallel-out) with 3- state
5. output (IC 74299)
6. Design of 4 Bit Binary to BCD Converter using sequential statement.
7. Design counters (MOD 3, MOD 5, MOD 8, MOD 16)
8. Design a decimal up/down counter that counts up from 00 to 99 or down from 99 to 00.
9. Design 3-line to 8-line decoder with address latch

Note: At least 12 experiments are required to be performed.

MAJOR PROJECT

Subject Code: BECE1-874 **L T P C**

0 0 12 6

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.

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CELLULAR AND MOBILE COMMUNICATION

Subject Code: BECE1-874 **L T P C** **Duration: 48 Hrs.**
3 0 0 3

Course 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.

Course Outcomes:
Student shall be able to:
1. Understand the cellular systems
2. Analyse the concept of switching systems and base station subsystem.

Unit–I (12 Hrs.)

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 (12 Hrs.)

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, co–channel measurement design of antenna system, antenna parameter and their effects, diversity receiver in co–channel interference – different types.

Unit –III (12 Hrs.)

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 (12 Hrs.)

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. William, C.Y. Lee, 'Mobile Cellular Telecommunications', McGraw Hill.

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WIRELESS SENSORS NETWORKS

Subject Code: BECE1-875 **L T P C** **Duration: 48 Hrs.**
3 0 0 3

Course 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.

Course 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 (12 Hrs.)

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 (12 Hrs.)

Topology Control: Location driven, Geographic Adaptive Fidelity (GAF), Geographic Random Forwarding (GeRaF), GEAR, Connectivity driven, SPAN, ASCENT.

Unit-III (12 Hrs.)

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 (12 Hrs.)

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.
2. Feng Zhao & Leonidas J. Guibas, 'Wireless Sensor Networks- An Information Processing Approach'.
3. Waltenegus Dargie and Christian Poella Bauer, 'Fundamentals of Wireless Sensor Networks Theory and Practice', John Wiley and Sons.
4. Holger Karl and Andreas Willig, 'Protocols and Architectures for Wireless Sensor Networks', John Wiley and Sons.

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INFORMATION THEORY AND CODING

Subject Code: BECE1-876 **L T P C** **Duration: 48 Hrs.**
3 0 0 3

Course 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.

Course 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 convolution codes.

Unit-I (12 Hrs.)

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 (12 Hrs.)

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 (12 Hrs.)

Linear Block Codes: Introduction to Linear Block codes, Syndrome and Error detection, Minimum distance of block code, Hamming Code.

Cyclic Codes: Description of Cyclic codes, Generator and parity check matrices of cyclic codes, error detection decoding of cyclic codes.

UNIT-IV (12 Hrs.)

Convolution Codes: Encoding of convolution codes, structural properties of Convolution codes, Distance Properties of convolution codes.

Recommended Books:

1. Arijit Saha, 'Information Theory, Coding & Cryptography', Pearson Education.
2. Ranjan Bose, 'Information Theory, Coding and Cryptography', Tata McGraw 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: 48 Hrs.**
3 0 0 3

Course Objectives:

1. General understanding of structure of modern computers
2. Purpose, structure and functions of operating systems
3. 3.Illustration of key Operating system aspects by example

Course 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 (12 Hrs.)

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 (12 Hrs.)

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 (12 Hrs.)

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 (12 Hrs.)

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 3 0 0 3	Duration: 48 Hrs.

Course 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.

Course 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 (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 & ionosphere effects on link design, complete link design, interference effects on complete link design, earth station parameters.

Unit-II (14 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, 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 (10 Hrs.)

Laser & Satellite Communication: Link analysis, optical satellite link Transmitter & Receiver, Satellite, beam acquisition, tracking & pointing, cable channel frequency, head end equation, distribution of signal, n/w specifications and architecture, optical fiber CAT 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', John Wiley & Sons.
2. D.C. Aggarwal, 'Satellite Communication', Khanna Publishers.

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B. TECH. ELECTRONICS & TELECOMMUNICATION 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**	
BECE2-301	Object Oriented Programming	3	1	0	40	60	100	4
BECE2-302	Electronic Devices and Circuits - I	3	1	0	40	60	100	4
BECE2-303	Network Analysis and Synthesis	3	1	0	40	60	100	4
BECE2-304	Electronic Instrumentation	3	1	0	40	60	100	4
BECE2-305	Signals and Systems	3	1	0	40	40	100	1
BECE2-306	Electronic Devices and Circuits - I Lab.	0	0	2	60	40	100	1
BECE2-307	Object Oriented Programming Lab	0	0	2	60	40	100	4
BHUM0-F91	Soft Skills-I	0	0	2	60	40	100	1
BECE2-308	Training – I#	0	0	4	60	40	100	2
Total		**15**	**5**	**10**	**440**	**460**	**900**	**25**

After 2nd Sem, During Summer Vacation

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**	
BECE2-409	Electronic Devices and Circuits –II	3	1	0	40	60	100	4
BECE2-410	Analog Communication Systems	3	1	0	40	60	100	4
BECE2-411	Digital Electronics	3	1	0	40	60	100	4
BECE2-412	Electromagnetic Field Theory	3	1	0	40	60	100	4
Departmental Elective-I (Select any one)		3	0	0	40	60	100	3
BECE2-456	Neural Networks and Fuzzy Logic							
BECE2-457	Data Structures and Algorithms							
BECE2-458	RADAR and SONAR Engineering							
BECE2-459	Web Technologies							
BECE2-413	Electronic Devices and Circuits -II Lab.	0	0	2	60	40	100	1
BECE2-414	Analog Communication Systems Lab.	0	0	2	60	40	100	1
BECE2-415	Digital Electronics Lab.	0	0	2	60	40	100	1
BHUM0-F92	Soft Skills -II	0	0	2	60	40	100	1
Total		**15**	**4**	**8**	**440**	**460**	**900**	**23**

In House / Industrial Training of 6 Weeks during Summer vacations after 4th semester

Total Contact Hrs. = 30 **Total Marks = 1000** **Total Credits = 24**

Semester 5th		Contact Hours			Marks			Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
BECE2-516	Linear Integrated Circuits	3	1	0	40	60	100	4
BECE2-517	Microprocessor and Interfacing	3	1	0	40	60	100	4
BECE2-518	Digital Communication Systems	3	1	0	40	60	100	4
BECE2-519	Linear Integrated Circuits Lab.	0	0	2	60	40	100	1
BECE2-520	Microprocessor Lab.	0	0	2	60	40	100	1
BECE2-521	Digital Communication Systems Lab.	0	0	2	60	40	100	1
BECE2-522	Training –II#	0	0	4	60	40	100	2
BHUM0-F93	Soft Skills -III	0	0	2	60	40	100	1
Departmental Elective-II (Select any one)		3	0	0	40	60	100	3
BECE2-560	Data Communication Networks							
BECE2-561	Human Resource Management							
BECE2-562	Digital System Design							
BECE2-563	Biomedical Electronics and Instrumentation							
BECE2-564	Micro-electronics							
Open Elective – I		3	0	0	40	60	100	3
Total		**15**	**3**	**12**	**500**	**500**	**1000**	**24**

After 4th Sem, During Summer Vacation

Total Contact Hrs. = 24 **Total Marks = 800** **Total Credits = 21**

Semester 6th		Contact Hours			Marks			Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
BECE2-623	Microwave and Antenna Theory	3	1	0	40	60	100	4
BECE2-624	Microcontroller and Embedded System	3	1	0	40	60	100	4
BECE2-625	Linear Control System	3	1	0	40	60	100	4
BECE2-626	Microwave Engineering lab	0	0	2	60	40	100	1
BECE2-627	Microcontroller Lab.	0	0	2	60	40	100	1
BHUM0-F94	Soft Skills-IV	0	0	2	60	40	100	1
Departmental Elective-III (Select any one)		3	0	0	40	60	100	3
BECE2-665	Nano Science and Nano-Technology							
BECE2-666	Advanced Microprocessor							
BECE2-667	Image and Speech Processing							
BECE2-668	Optical Fibre Communication							
BECE2-669	Operation Research							
Open Elective – II		3	0	0	40	60	100	3
Total		**15**	**3**	**6**	**380**	**420**	**800**	**21**

In House / Industrial Training of 8 Weeks during summer vacations after 6th semester

Total Contact Hrs. = 28 Total Marks = 700 Total Credits = 23

Semester 7th		Contact Hours			Marks			Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
BECE2-728	Wireless Communication Systems	3	1	0	40	60	100	4
BECE2-729	Digital Signal Processing	3	1	0	40	60	100	4
BECE2-730	Digital Signal Processing Lab	0	0	2	60	40	100	1
BECE2-731	Minor Project	0	0	4	60	40	100	4
BECE2-732	Training-III#	0	0	8	60	40	100	4
Departmental Elective-IV (Select any one)		3	0	0	40	60	100	3
BECE2-770	Cognitive Radio							
BECE2-771	Relational Data Base Management System							
BECE2-772	Computer Architecture and Organization							
BECE2-773	Soft Computing							
Open Elective – III		3	0	0	40	60	100	3
Total		**12**	**2**	**14**	**340**	**360**	**700**	**23**

After 6th Sem, During Summer Vacation

Total Contact Hrs. = 21 Total Marks = 400 Total Credits = 14

Semester 8th		Contact Hours			Marks			Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
BECE2- 833	VLSI Design	3	1	0	40	60	100	4
BECE2- 834	VLSI Design Lab	0	0	2	60	40	100	1
BECE2- 835	Major Project	0	0	12	60	40	100	6
Departmental Elective-V (Select any one)		3	0	0	40	60	100	3
BECE2-874	Cellular and Mobile Communication							
BECE2-875	Wireless Sensor Networks							
BECE2-876	Information Theory and Coding							
BECE2-877	Operating Systems							
BECE2-878	Satellite Communication							
Total		**6**	**1**	**14**	**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**

OBJECT ORIENTED PROGRAMMING

Subject Code: BECE2-301 **L T P C** **Duration: 48 Hrs.**
3 1 0 4

Course Objectives:

1. To provide knowledge regarding the Object oriented programming C++, data types and about classes.
2. To provide understanding of inheritance and memory management in C++.
3. To describe how to represent pointers, and understanding the concept of binding and polymorphism.
4. To make the students familiar with the File handling and generic functions.

Course Outcomes:

1. After undergoing the course students will be able to develop various programs and flow charts using C++.
2. Apply the concepts of data encapsulation, inheritance, and polymorphism to large-scale software.
3. Enable students to develop their skills in programming with C++.
4. Design and develop object-oriented computer programs.

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 constkeyword, 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, need for destructors.

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, object composition and delegation, order of execution of constructors and destructors.

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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.

Files: File streams, hierarchy of file stream classes, reading/writing of files, error handling during file operations, accessing records, randomly, updating files.

Recommended Books:

1. I.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.
4. 'The Complete Reference to C++ Language', McGraw Hill-Osborne.
5. F.B. Lippman, 'C++ Primer', Addison Wesle.

ELECTRONIC DEVICES AND CIRCUITS - I

Subject Code: BECE2-302 | **L T P C** **3 1 0 4** | **Duration: 48 Hrs.**

Course Objectives:

This course is meant to provide fundamental knowledge to students for understanding of the various electronic devices, their circuits & behaviour under various conditions.

1. To aware the students about the various electronic devices and their circuits.
2. To impart knowledge of BJTs and FETs.
3. To provide the students detailed concepts of CMOS and MOSFET.
4. To analyze low and high frequency transistor models.

Course Outcomes:

After undergoing this course student will be able to:

1. Understand the concepts of junction diodes and their applications.
2. Analyze BJT characteristics and determine their behaviour under low and high frequencies.
3. Analyze various concepts of FETs and their characteristics.
4. Design low and high frequency models and observe and its various characteristics.

Unit-I (12 Hrs.)

Semiconductor Diodes: Semi-conductor materials and their characteristics, PN junction Diode - VI characteristics, Breakdown mechanism in diode, effect of temperature on diode 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 I_{co}, 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', Pearson Education.
4. Sedra, Adel S. and Smith, C. Kenneth, 'Microelectronic Circuits', Oxford University Press, New York.
5. Streetman Ben J., Sanjay Banerjee, 'Solid State Electronic Devices', PHI.

NETWORK ANALYSIS AND SYNTHESIS

Subject Code: BECE2-303 **L T P C** **Duration: 48 Hrs.**
3 1 0 4

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Course Objectives:

1. To provide the knowledge to students about the various network theorems.
2. To make the students aware about the various transient responses for various signals.
3. To provide them basic concepts of different types of two port networks and their synthesis.
4. To impart knowledge about different passive filter design.

Course Outcomes:

1. An ability to design, analyze and synthesis of various networks and circuits.
2. Knowledge of mathematical forms such as Laplace transforms & designing of filters and circuits.
3. Synthesis of networks using fundamental concepts.
4. To understand, design and analysis of various passive filter design.

Unit-I (12 Hrs.)

Laws and Basic Theorems: Fundamental Laws and Concepts – Kirchoff'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: K-derived, m-derived, Low pass filter, High pass filter, Band pass filter, Band stop filter, their magnitude and phase response

Recommended Books:

1. Vanvalkenburg, 'Network Analysis', Prentice Hall of India Pvt. Ltd., New Delhi.
2. D. RoyChoudhary, 'Network and Systems', New Age International Publisher.
3. Franklin F. Kuo, 'Network Analysis and Synthesis', John Wiley.
4. Someshwar C. Gupta, 'Circuit Analysis - with Computer Applications to Problem Solving', Jon W. Bayless.

ELECTRONIC INSTRUMENTATION

Subject Code: BECE2-304 **L T P C 3 1 0 4** **Duration: 48 Hrs.**

Course Objectives:

1. To provide knowledge about different types of measuring, waveform generation, and analysis of electronic instruments.
2. Exposure to various analog measuring instruments.
3. To provide detailed knowledge about different bridges.
4. To understand CRO and its operation.

Course Outcomes:

After undergoing this course student will be able to:

1. Analyze operation of different instruments and able to describe different terminology related to measurements.
2. Recognize and understand various analog measuring instruments.
3. Measure resistance using various methods.
4. Find various measurements using 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.

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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 & Publishers.
2. J.B. Gupta, 'A Course in Electrical and Electronics Measurement & Instrumentation', S.K. Kataria & Sons.
3. W.D. Cooper1, 'Electronic Instrumentation and Measurement Techniques', Prentice Hall.

SIGNAL AND SYSTEMS

Subject Code: BECE2-305	L T P C 3 1 0 4	Duration: 48 Hrs.

Course Objectives:

1. To introduce the students about the theoretical concepts associated with processing continuous & discrete time signals & systems.
2. To make the students aware about the signal transmission through linear networks
3. Tobe able to think critically & to apply problem solving & reasoning strategies to the analysis of various types of signals & systems.
4. To impart them knowledge of various types of noises.

Course Outcomes:

1. Ability to analyse various types of signals in communication system.
2. Developing skills to understand random signals.
3. To understand various types of noises.
4. 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.

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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 Systems', Oxford University Press.
2. Ravi Kumar, 'Signals and Systems', PHI Learning.
3. Simon Haykin, 'Signals and Systems', John Wiley.
4. George R. Cooper, 'Probabilistic Methods of Signals and System Analysis', Oxford University Press.

ELECTRONIC DEVICES AND CIRCUITS LAB. - I

Subject Code: BECE2-306 **L T P C** **Duration: 24 Hrs.**
0 0 2 1

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Course Objectives:

1. Able to understand and identification of various electronic components.
2. To understand and plot characteristics of various semiconductor devices.
3. To understand the applications of Transistors as amplifier in various configurations.

Course Outcomes:

1. An ability to understand all types of electronics devices and circuits
2. An ability to conduct experiments, as well as to analyze and interpret various data sheets.

EXPERIMENTS

1. To perform & analyze the use of Zener diode as voltage regulator.
2. To observe the characteristics and behavior of Half wave, full wave & Bridge rectifiers.
3. To plot the input and output characteristics of CE configuration.
4. To observe the characteristics of a Class- A amplifier.
5. To observe the characteristics of Class- B amplifier.
6. To observe the characteristics of Class- B push-pull amplifier.
7. To observe 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 Observe 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 perform an experiment to observe the working of BJT as an amplifier.

Note: At least 08 experiments are required to be performed.

OBJECT ORIENTED PROGRAMMING LAB.

Subject Code: BECE2-307 **L T P C** **Duration: 24 Hrs.**
0 0 2 1

Course Objectives:

1. To provide the basic knowledge about control statements, looping statements, various I/O statements and various data structures.
2. To describe how to create classes in C++ for understanding of basic OOPS features.
3. To discuss various concepts of data hiding, function overloading and operator overloading.

Course Outcomes:

1. Enable students to develop their skills in programming with C++.
2. To describe functions of creating constructors, destructor, inheritance, polymorphism and file handling programs
3. Formulate problems as steps so as to be solved systematically.
4. Integrate robustness, reusability, and portability into large-scale software development.

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 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.
16. [Inheritance] Write a program to demonstrate the multiple inheritances.
17. [Inheritance] Write a program to demonstrate the virtual derivation of a class.
18. [Polymorphism] Write a program to demonstrate the runtime polymorphism.
19. [Exception Handling] Write a program to demonstrate the exception handling.
20. [Templates and Generic Programming] Write a program to demonstrate the use of function template.

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21. [Templates and Generic Programming] Write a program to demonstrate the use of class template
22. **[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,
23. **[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.

SOFT SKILLS-I

Subject Code: **BHUM0-F91** **L T P C**
0 0 2 1

Course Objectives
The course aims to cause a basic awareness about the significance of soft skills in professional and interpersonal communications and facilitate an all-round development of personality.

Course Outcomes
At the end of the course, the student will be able to develop his/her personal traits and expose their personality effectively.

UNIT-1

SOFT SKILLS- Introduction to Soft Skills, Aspects of Soft Skills, Identifying your Soft Skills, Negotiation skills, Importance of Soft Skills, Concept of effective communication.

SELF-DISCOVERY- Self-Assessment, Process, Identifying strengths and limitations, SWOT Analysis Grid.

UNIT-2

FORMING VALUES- Values and Attitudes, Importance of Values, Self-Discipline, Personal Values - Cultural Values-Social Values-some examples, Recognition of one's own limits and deficiencies.

UNIT-3

ART OF LISTENING- Proxemics, Haptics: The Language of Touch, Meta Communication, Listening Skills, Types of Listening, Listening tips.

UNIT-4

ETIQUETTE AND MANNERS- ETIQUETTE- Introduction, Modern Etiquette, Benefits of Etiquette, Taboo topics, Do's and Don'ts for Men and Women. MANNERS- Introduction, Importance of manners at various occasions, Professional manners, Mobile manners. CORPORATE GROOMING TIPS- Dressing for Office: Do's and Don'ts for Men and Women, Annoying Office Habits.

RECOMMENDED BOOKS

1. K. Alex, S. Chand Publishers.
2. Butterfield, Jeff, 'Soft Skills for Everyone', Cengage Learning, New Delhi, **2010**.
3. G.S. Chauhan and Sangeeta Sharma, 'Soft Skills', Wiley, New Delhi, **2016**.
4. Klaus, Peggy, Jane Rohman & Molly Hamaker, 'The Hard Truth About Soft Skills', Harper Collins E-books, London, **2007**.
5. S.J. Petes, Francis, 'Soft Skills and Professional Communication', Tata McGraw Hill Education, New Delhi, **2011**.

ELECTRONIC DEVICES AND CIRCUITS - II

Subject Code: BECE2-409 **L T P C** **Duration: 48 Hrs.**
3 1 0 4

Course Objectives:

1. To aware the students about Basic Electronic Circuits.
2. To update the Knowledge about small signal & large signal amplifier.
3. To analyze various types of circuits to generate signals.
4. Selection and specification of electronic components for industrial applications.
5. To understand working of switching circuits.

Course 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 ability to understand various amplifiers including push pull and complementary symmetry.
3. Design different types of feedback amplifiers and oscillator circuits.
4. To understand and analyze 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. Analysis of R_i, R_o, A_i, A_v with and without feedback

Oscillators: Classification of Oscillators, frequency and frequency stability of oscillatory circuits, Hartley Oscillator, Colpitts Oscillators, Clapp Oscillator, Crystal Oscillator, Phase Shift Oscillator, Wein Bridge Oscillator.

Unit-IV (12 Hrs.)

A Stable Multivibrators: A stable Collector coupled and emitter coupled multivibrator, complementary Transistor A stable multivibrator.

Switching Characteristics of Devices: Diode and transistor as electronic switch.

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', Pearson Education.

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4. Sedra, S. Adel and Smith, C. Kenneth, 'Microelectronic Circuits', Oxford University Press, New York.
5. Streetman Ben J., Sanjay Banerjee, 'Solid State Electronic Devices', PHI.

ANALOG COMMUNICATION SYSTEMS

Subject Code: BECE2-410 **L T P C** **Duration: 48 Hrs.**
3 1 0 4

Course Objectives:
1. To understand various wave propagation concepts.
2. To provide the students about the concepts of analog modulation techniques
3. To provide the detailed knowledge about AM transmission and AM reception
4. To impart the knowledge about FM transmission and FM reception.

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 analyze the performance of AM/FM transmission and reception.

Unit-I (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, Concepts of VSB/ISB/SSB, Pre-emphasis and De-emphasis.

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.

Unit-II (12 Hrs.)

AM Transmission/AM Reception: Introduction, Generation of Amplitude Modulation, Basic Principles of AM Generation: Square law Diode 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-III (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 Seeley or Phase Discriminator, Indirect methods of FM Demodulation: FM Detector using PLL and Stereo FM Multiplex Reception.

Unit-IV (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

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through ionosphere, Critical frequency, Maximum usable frequency, Optimum working frequency, lowest usable high frequency, virtual height, Skip Distance, Effect of earth's magnetic field.

Recommended Books:

1. George Kennedy, 'Electronic Communication System', McGraw Hill.
2. Gary M. Miller and Jeffery S. Beasley, 'Modern Electronic Communications', PHI.
3. Simon Haykin, 'Communication Systems', \Wiley.
4. Wayne Tomasi, 'Electronics Communication systems', Pearson Publishers.
5. Proakis, 'Communication Systems', McGraw Hill.

DIGITAL ELECTRONICS

Subject Code: BECE2- 411	L T P C 3 1 0 4	Duration: 48 Hrs.

Course 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

Course Outcomes:

1. Students will simplify a digital design problem as part of the systematic approach to solve a problem.
2. To analyze and understand various sequential circuits & various Digital Logic families.
3. To design 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.

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-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.

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.

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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 Book:

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', Tata McGraw Hill.

ELECTROMAGNETIC FIELD THEORY

Subject Code: BECE2-412 **L T P C** **Duration: 48 Hrs.**
3 1 0 4

Course 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.

Course Outcomes:

1. Examine the phenomena of wave propagation in different media and its interfaces and in applications of microwave engineering.
2. An ability to understand the concepts of magnetic field and magnetic field intensity.
3. Analyze Maxwell's equation in different forms (differential and integral) and apply them to diverse engineering problems.
4. 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 law and its applications, Electric flux density, potential fields due to electric dipole, Laplace and Poison equations.

Magneto statics: Definition and explanation on Magnetic Field intensity due to a finite and infinite wire carrying current. Magnetic field intensity on rectangular loop carrying current, Amperes 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

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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. N. Narayana Rao, ‘'Elements of Engineering Electromagnetics', Pearson Education.
4. R.F. Jordan, 'Electromagnetic Waves & Radio System', Prentice Hall India.
5. Bhag Singh Guru and Hüseyin R. Hiziroglu, 'Electromagnetic Field Theory Fundamentals, Cambridge University Press.

NEURAL NETWORKS AND FUZZY LOGIC

Subject Code: BECE2-456 **L T P C** **Duration: 48 Hrs.**
3 0 0 3

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Course Objectives:

The students should be made to:

1. Learn the various soft computing frame works.
2. Be familiar with design of various neural networks.
3. Learn about the concepts of Fuzzification and De-Fuzzification.
4. Describe various optimization techniques.

Course Outcomes:

Students will be able to:

1. Apply various soft computing frame works.
2. Design of various neural networks.
3. Use fuzzy logic and Fuzzy rules.
4. Learn and understand various optimization techniques.

UNIT-I (12 Hrs.)

Neural Networks: History, Overview of Biological Neuro-System, Terminology of Artificial Neural Network, Comparison of BNN and ANN, Mathematical Models of Neuron, ANN Architecture, Topology, Fundamental Learning Laws, Learning Paradigms-Supervised, Unsupervised and reinforcement Learning.

UNIT-II (12Hrs)

Perceptron Architecture: Single layer perceptron, Perceptron Learning Rules, Multi-layer perceptron, Back Propagation Algorithm, Associative Memories, Hopfield Networks, Competitive Learning, Self-organizing Maps, ART Networks, Applications of Artificial Neural Networks.

UNIT-III (12 Hrs.)

Introduction to Fuzzy Logic, Classical and Fuzzy Sets: Overview of Classical Sets, Linguistic Variables, Membership Function, Fuzzification, De-Fuzzification to Crisp Sets, Operations on Fuzzy Sets: Compliment, Intersections, Unions, Combinations of Operations, Aggregation

Operations, Fuzzy rule generation (IF-THEN), Applications of Fuzzy Logic.

UNIT-IV (12 Hrs.)

Neuro-Fuzzy System: Introduction and Architecture of Neuro-Fuzzy Networks.

Introduction to different Optimization Techniques: Genetic Algorithm, Particle Swarm Optimization, Biogeography Based Optimization, Bacterial Forging Optimization, Detailed study of Genetic Algorithm, GA in problem solving, Implementation of GA.

Recommended Books:

1. N. Yegnanarayana, 'Artificial Neural Network', PHI.
2. LaureneFausett, 'Fundamental of Neural Networks', Pearson.
3. Simon Haykin, 'Neural Networks', Pearson.
4. S. Rajasekaran and GA Vijayalakshmi, 'Neural Networks, Fuzzy Logic and Genetic Algorithms', PHI.
5. Timothy J. Ross, 'Fuzzy Logic with Engineering', John Wiley.
6. S.N. Sivanandam, 'Introduction to Fuzzy Logic using MATLAB', Springer.
7. Ahmad M. Ibrahim, 'Introduction to Applied Fuzzy Electronics', PHI.

DATA STRUCTURES AND ALGORITHMS

Subject Code: BECE2-457	L T P C 3 0 0 3	Duration: 48 Hrs.

MRSPTU

Course Objectives:

1. To understand basic data structures and algorithms.
2. To use object oriented programming to implement data structures.
3. To introduce linear, non-linear data structures and their applications.
4. To understand the different methods of organizing large amount of data.

Course Outcomes:

Upon completion of the course, students will be able to:

1. Select basic data structures and algorithms for autonomous realization of simple programs or program parts.
2. Formulate new solutions for programming problems or improve existing code using learned algorithms and data structures.
3. Demonstrate advantages and disadvantages of specific algorithms and data structures.
4. To evaluate algorithms and data structures in terms of time and memory complexity of basic operations.

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 biconnected 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', Addison-Wesley.
4. Y. Langsam, M.J. Augenstein and A.M. Tenenbaum, 'Data Structures using C', Pearson Education.
5. Richard F. Gilberg, Behrouz A. Forouzan, 'Data Structures – A Pseudocode Approach with C', Thomson Brooks / COLE.

RADAR AND SONAR ENGINEERING

Subject Code: BECE2-458	L T P C 3 0 0 3	Duration: 48 Hrs.

MRSPTU

Course Objectives:

1. To understand theoretical principals underlying RADAR.
2. To understand the modern navigation system and general propagation phenomena.
3. Learn the fundamentals of physical acoustics and SONAR.

Course Outcomes:

1. Develop basic understanding of various types of RADARs and its applications.
2. Develop the ability to understand and design basic RADAR and SONAR systems.
3. Use of physical acoustics, electromagnetic, wireless communication and mathematics to understand fundamentals of RADAR and SONAR.

Unit-I (12 Hrs.)

Introduction to Radar: Radar Block Diagram & operation, Radar Frequencies, Radar development, Application of Radar.

Radar Equation: Simple form of Radar Equation, Prediction of Range performance, Minimum Detectable signal, Receiver noise, Signal to Noise ratio, Transmitter Power, Pulse repetition frequency &range ambiguities, System losses, Propagation effects.

Unit-II (12 Hrs.)

Continuous Wave (CW) &Frequency Modulated Radar: The Doppler effect, CW Radar, Frequency-modulated CW Radar, Multiple Frequency CW Radar.

MTI & Pulse Doppler RADAR: Introduction, Delay Line Cancellers, Multiple or staggered, Pulse repetition frequencies, Range-Gated Doppler Filters, Digital Signal Processing, Other

MTI delay line, Limitation of MTI performance, Noncoherent MTI, Pulse Doppler Radar, MTI from a moving platform.

Tracking RADAR: Tracking with Radar, Sequential Lobbing, Conical Scan, Monopulse Tracking Radar, Tracking in range.

Unit-III (12 Hrs.)

Types of SONAR Systems: active and passive, sonar equations, propagation characteristics of the medium, transmission loss and spreading effects, beam forming and steering, detection threshold, square law detector, cross-correlation detector.

Unit-IV (12 Hrs.)

Modern SONAR systems: signal and noise models, temporal sampling and quantization-spatial sampling and beam forming, band shifting, filtering and smoothing, decision processing, block diagram of active and passive sonars.

Correlation Receivers and Matched Filters: Advanced Sonar Signal Processing functions, adaptive beam forming, synthetic aperture arrays, automated decision-making.

Recommended Books:

1. Byron's Edde, 'Radar Principles technologies', Pearson.
2. Merrill I. Skolnik, 'Introduction to Radar Systems', Tata McGraw Hill.
3. K.K. Sharma, 'Fundamentals of Radar and Sonar Engineering', S.K. Kataria & Sons.

WEB TECHNOLOGIES

Subject Code: BECE2-459 | **L T P C 3 0 0 3** | **Duration: 48 Hrs.**

Course Objectives:

1. To learn the concepts of www including browser and HTTP protocol.
2. List the various HTML tags and use them to develop the user friendly web pages.
3. To define the Cascading Style Sheets(CSS) with its types and use them to provide the styles to the web pages at various levels.
4. To use the JavaScript to develop the dynamic web pages.

Course Outcomes:

After completion of the course students will be able to:

1. Describe the concepts of WWW including browser and HTTP protocol.
2. Develop the modern web pages using the HTML and CSS features with different layouts as per need of applications.
3. Use server side scripting with PHP to generate the web pages dynamically using the database connectivity.
4. Develop the modern Web applications using the client and server side technologies and the web design fundamentals.

Unit-I (12 Hrs.)

Introduction: Concept of WWW, Internet and WWW, HTTP Protocol: Request and Response, Web browser and Web servers, Features of Web 2.0

Web Design: Concepts of effective web design, Web design issues including Browser, Bandwidth and Cache, display resolution, Look and Feel of the Website, Page Layout and linking, User centric design, Sitemap, Planning and publishing website, Designing effective navigation

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Unit-II (12 Hrs.)

HTML: Basics of HTML, formatting and fonts, commenting code, color, hyperlink, lists, tables, images, forms, XHTML, Meta tags, Character entities, frames and frame sets, Browser architecture and Web site structure. Overview and features of HTML5

Unit-III (12 Hrs.)

Style Sheets: Need for CSS, introduction to CSS, basic syntax and structure, using CSS, background images, colors and properties, manipulating texts, using fonts, borders and boxes, margins, padding lists, positioning using CSS, CSS2, Overview and features of CSS3

Unit-IV(12Hrs.)

JavaScript: Client side scripting with JavaScript, variables, functions, conditions, loops and repetition, Pop up boxes, Advance JavaScript: Javascript and objects, JavaScript own objects, the DOM and web.

Recommended Books:

1. Ralph Moseley and M.T. Savaliya, 'Developing Web Applications', Wiley-India.
2. Joel Sklar, 'Web Design', Cengage Learning.
3. Harwani, 'Developing Web Applications in PHP and AJAX', McGraw Hill.
4. P.J. Deitel & H.M. Deitel, 'Internet and World Wide Web How to program', Pearson.

ELECTRONICS DEVICES AND CIRCUITS LAB - II

Subject Code: BECE2-413 **L T P C** **Duration: 24 Hrs.**
0 0 2 1

MRSPTU

Course Objectives:

1. To understand the characteristics of various semiconductor devices
2. To understand various sources of oscillations
3. Able to understand, identification and selection of various amplifiers.
4. To make the students aware about the various multivibrator circuits.

Course Outcomes:

1. An ability to understand different types of electronics devices and circuits
2. An ability to design and conduct experiments, as well as to analyse and interpret output.

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 observe the response of RC phase shift oscillator and determine frequency of oscillation.
5. To observe the response of Hartley oscillator and determine frequency of oscillation.
6. To observe the response of Colpitt's oscillator and determine frequency of oscillation.
7. To observe 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 JFET as an amplifier.
10. To understand and plot working of Astable Multivibrator.
11. To understand and plot working of Monostable Multivibrator.

Note: At least 08 experiments are required to be performed.

ANALOG COMMUNICAION SYSTEM LAB

Subject Code: BECE2-414 **L T P C** **Duration: 24 Hrs.**
0 0 2 1

Course Objectives:
1. To familiarize with modulation & demodulation techniques and study their waveforms on oscilloscope.
2. To impart working knowledge of Voltage Controlled Oscillator.
3. To familiarize students with the functions of oscillators, filters, amplifiers, LC networks, modulators, limiters, mixers, and detectors in AM, FM, PM, SSB, and PLL circuits.

Course Outcomes:
1. An ability to perform transmission of signals from transmitter to receiver using various analog
   modulation and demodulation techniques.
2. Study of transmission and reception process.

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.

DIGITAL ELECTRONICS LAB

Subject Code: BECE2-415 **L T P C** **Duration: 24 Hrs.**
0 0 2 1

Course Objectives:
1. To give students a practical knowledge about all types of digital circuits.
2. To give students a working knowledge to connect digital circuits and verify their truth tables.
3. To give students a knowledge about integrated circuits of different combinational and sequential circuits.

Course Outcomes:
1. An ability to test and verify working and truth tables of combinational and sequential circuits.
2. Working knowledge of different converters.
3. To perform multiplexer and demultiplexer.

MRSPTU

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.

Note: At least ten experiments are required to be performed.

MRSPTU

SOFT SKILLS-II

Subject Code: **BHUM0-F92** **L T P C**
0 0 2 1

Course Objectives

The course aims to address various challenges of communication as well as behavioural skills faced by individual at work place and organisations. Also, it aims to enhance the employability of the students.

Course Outcomes

At the end of the course the student will be able to understand the importance of goal setting. They will also be able to handle stress in their lives and future in a better way.

UNIT-1

DEVELOPING POSITIVE ATTITUDE- Introduction. Formation of attitude. Attitude in workplace. Power of positive attitude. Examples of positive attitudes. Negative attitudes. Examples of negative attitude. overcoming negative attitude and its consequences.

IMPROVING PERCEPTION- Introduction. Understanding perception. perception and its application in organizations.

UNIT-2

CAREER PLANNING-Introduction. Tips for successful career planning. Goal setting-immediate, short term and long term. Strategies to achieve goals. Myths about choosing career.

UNIT-3

ART OF READING-Introduction. Benefits of reading. Tips for effective reading. the SQ3R technique. Different stages of reading. determining reading rate of students. Activities to increase the reading rate. Problems faced. Becoming an effective reader.

UNIT-4

STRESS MANAGEMENT - Introduction. meaning. positive and negative stress. Sources of stress. Case studies. signs of stress. Stress management tips. Teenage stress.

RECOMMENDED BOOKS

1. K. Alex, S. Chand Publishers.
2. Rizvi, M. Ashraf, 'Effective Technical Communication', McGraw Hill.
3. Mohan Krishna & Meera Banerji, 'Developing Communication Skills', Macmillan.
4. Kamin, Maxine, 'Soft Skills Revolution: A Guide for Connecting with Compassion for Trainers, Teams & Leaders', Pfeiffer & Amp; Company, Washington, DC, **2013.**

LINEAR INTEGRATED CIRCUITS

Subject Code: BECE2-516	**L T P C** **3 1 0 4**	**Duration: 48 Hrs.**

Course 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.

Course Outcomes:

Upon Completion of the course, 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. Analyse 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.)

MRSPTU

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', Merrill Publishing Company.
3. Millman & Grabal, 'Micro Electronics', Tata McGraw Hill.

MRSPTU

MICROPROCESSOR AND INTERFACING

Subject Code: BECE2-517	**L T P C** **3 1 0 4**	**Duration: 48 Hrs.**

Course 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.

Course 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 (14 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 (14 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, Dhanpat Ra, 'Fundamentals of Microprocessor and Microcontrollers'.

MRSPTU

DIGITAL COMMUNICATION SYSTEMS

Subject Code: BECE2-518 **L T P C** **Duration: 48 Hrs.**
3 1 0 4

Course Objectives:

1. To provide knowledge about basics of Communication system and various digital modulation and demodulation techniques.
2. To learn design of useful circuits required in communication system.
3. To provide knowledge about various transmitter and receiver circuits used in communication.
4. To provide students with tools for communication signal analysis.

Course Outcomes:

1. To understand the various blocks/stages in a digital communication system.
2. Analyze the performance of a baseband and pass band digital communication system.
3. Perform the time and frequency domain analysis of the signals in a digital communication system.
4. Analyze the performance of various multiplexing techniques.

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 (12 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 (10 Hrs.)

Baseband Detection: rror 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 (16 Hrs.)

Band-pass Modulation and Demodulation: 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.

Multiplexing 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: BECE2-519 **L T P C** **Duration: 21 Hrs.**
0 0 2 1

Course 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.

Course 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 pass 1st order butterworth active filters using Op Amp.
9. Design Phase shift oscillator using Op-Amp.
10. Design Wein Bridge oscillator using Op-Amp.
11. Application of Op Amp as Sawtooth wave generator.
12. Application of Op Amp as Zero Crossing detector and window detector.
13. Application of Op Amp as Schmitt Trigger.
14. Design a delay circuit using 555 timer.
15. Design of a function generator
16. Design of a Voltage Controlled Oscillator

Note: At least 12 experiments are required to be performed.

MICROPROCESSOR LAB.

Subject Code: BECE2-520 **L T P C** **Duration: 21 Hrs.**
0 0 2 1

Course 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.

Course 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 LAB

Subject Code: BECE2-521 **L T P C** **Duration: 24 Hrs.**
0 0 2 1

Course 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.

Course 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.

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.

SOFT SKILLS-III

Subject Code: **BHUM0-F93** **L T P C**
0 0 2 1

Course Objectives
The course aims to equip the students with effective writing skills in English. Also, to make the students understand their role as team players in organisations.

Course Outcomes
At the completion of the course, the student will become well –versed with the behavioural skills. They will also understand the role of body language and non-verbal communication during the interview process.

UNIT-1

ART OF WRITING - Introduction, Importance of Writing Creative Writing, Writing tips, Drawback of written communication.

ART OF BUSINESS WRITING - Introduction, Business Writing, Business Letter, Format and Styles, Types of business letters, Art of writing correct and precise mails, Understand netiquette.

UNIT-2

BODY LANGUAGE - Introduction- Body Talk, Forms of body language, uses of body language, Body language in understanding Intra and Inter-Personal Relations, Types of body language, Gender differences, Gaining confidence with knowledge of Kinesics.

UNIT-3

TEAM BUILDING AND TEAM WORK - Introduction, Meaning, Characteristics of an effective team, Role of a Team Leader, Role of Team Members, inter group Collaboration-Advantages, Difficulties faced, Group Exercises-Team Tasks and Role-Play, Importance of Group Dynamics.

UNIT-4

TIME MANAGEMENT - Introduction, the 80-20 Rule, three secrets of Time Management, Time Management Matrix, Effective Scheduling, Time Wasters, Time Savers, Time Circle Planner, Difficulties in Time Management, Overcoming Procastination.

RECOMMENDED BOOKS

1. K. Alex, S. Chand Publishers.
2. R.C. Sharma and Krishna Mohan, 'Business Correspondence and Report Writing', TMH, New Delhi, **2016.**
3. N. Krishnaswami and T. Sriraman, 'Creative English for Communication', Macmillan.
4. Penrose, John M., et al., 'Business Communication for Managers', Thomson South Western, New Delhi, **2007**.
5. Holtz, Shel, 'Corporate Conversations', PHI, New Delhi, **2007**.

DATA COMMUNICATION NETWORKS

Subject Code: BECE2-560	**L T P C** **3 0 0 3**	**Duration: 48 Hrs.**

Course Objectives:
The students 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.

Course Outcomes:
At the end of the course, the students 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', PHI.
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', PHI.

HUMAN RESOURCE MANAGEMENT

Subject Code: BECE2-561 **L T P C** **Duration: 48 Hrs.**
3 0 0 3

Course Objectives: Understand and apply the policies and practices of the primary areas of human resource management, including staffing, training, Integration, management and compensation**.**

Course Outcomes:

1. Apply effective written and oral communication skills to business situations.
2. Analyze the global business environment.
3. Analyze the local business environment.
4. Use critical thinking skills in business situations.
5. Apply an ethical understanding and perspective to business situations.

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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-I (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: BECE2-562 **L T P C** **Duration: 48 Hrs.**
3 0 0 3

Course Objectives:
1. To outline the formal procedures for the analysis and design of combinational circuits and sequential circuits.
2. To introduce the concept of memories and programmable logic devices.
3. To illustrate the concept of synchronous and asynchronous sequential circuits.

Course 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 (12 Hrs.)

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 (12 Hrs.)

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 (12 Hrs.)

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 (12 Hrs.)

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: BECE2-563 **L T P C** **Duration: 48 Hrs.**
3 0 0 3

Course 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.

Course 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 (10 Hrs.)

Biomedical Signals: Origins of Bioelectric Signals, Human body, Heart and Circulatory System, Electrodes, Transducers, ECG, EMG.

UNIT-II (14 Hrs.)

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 (12 Hrs.)

Imaging System: Working with X-Rays, CT scanner, NMR, NMR, Ultrasonic System, Ultrasonic System, Ultrasonic System.

UNIT-IV (12 Hrs.)

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 by', 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.

MICRO-ELECTRONICS

Subject Code: BECE2-564 **L T P C** **Duration: 48 Hrs.**
3 0 0 3

Course 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.

Course 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 (12 Hrs.)

Introduction: Advantages of IC's, General classification of IC's (Linear/Digital IC's, Monolithic/ Hybrid IC's), Basic IC fabrication steps.

UNIT-II (12 Hrs.)

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 (12 Hrs.)

Silicon Oxidation: Thermal oxidation process (Kinetics of growth, Thin oxide growth), Effect of impurities on the oxidation rate, Preoxidation Cleaning, Various oxidation techniques, Masking properties of SiO2.

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 (12 Hrs.)

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: BECE2-623	L T P C 3 1 0 4	Duration: 48 Hrs.

Course 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.

Course 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 (14 Hrs.)

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 (14 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. M. Kulkarni, Umesh, 'Microwave Devices & Radar Engg.'.
3. A.K. Maini, 'Microwaves and Radar', Khanna Publishers.
4. Balanis A. Constantine, 'Antenna Theory, Analysis and Design', Wiley, New York.

MICROCONTROLLER AND EMBEDDED SYSTEM

Subject Code: BECE2-624 **L T P C** **Duration: 48 Hrs.**
3 1 0 4

Course Objectives:

The students should be made to:

1. Study the Architecture of 8051 microcontrollers.
2. Learn the design aspects of I/O and Memory Interfacing circuits.
3. Study about communication and bus interfacing.

Course Outcomes:

At the end of the course, the students should be able to:

1. Design and implement 8051 microcontroller based systems.
2. Serial communication 0f 8051.
3. Interfacing with 8051.

Unit-I (12 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 (12 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: BECE2-625	**L T P C** **3 1 0 4**	**Duration: 48 Hrs.**

Course Objectives:

1. To introduce the elements of control system and their modeling using various Techniques.
2. To introduce methods for analyzing 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.

Course 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.

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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 (8 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 modeling 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 (14 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.
5. Williams, Ivan J. Distefano, Joseph J. Stubberud, Allen R., 'Feedback and Control Systems', Schaum's Outlines.

MICROWAVE ENGINEERING LAB.

Subject Code: BECE2-626 **L T P C** **Duration: 24 Hrs.**
0 0 2 1

Course Objectives:

The student should be made to:

1. Know about the behavior of microwave components.
2. Practice microwave measurement procedures.

Course Outcomes:

At the end of the course, the student should be able to:

1. Test& analyze various microwave components.
2. Analyze 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 waves 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: BECE2-627	L T P C 0 0 2 1	Duration: 24 Hrs.

Course 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.

Course 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.

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SOFT SKILLS-IV

Subject Code: **BHUM0-F94** **L T P C**
0 0 2 1

Course Objectives

The course aims at the key areas like conversation skills, group skills and persuasion skills required during the interview process in an organisation.

Course Outcomes

At the end of the course, the student will be able to:

1. Demonstrate soft skills required for business situations.
2. Analyze the value of soft skills for career enhancement.
3. Apply soft skills to workplace environment.
4. Confidently participate in GD and interview process.

UNIT-1

ART OF SPEAKING- Introduction. Communication process. Importance of communication, channels of communication. Formal and informal communication. Barriers to communication. Tips for effective communication. tips for conversation. Presentation skills. Effective multi-media presentation skills. Speeches and debates. Combating nervousness. Patterns and methods of presentation. Oral presentation, planning and preparation.

UNIT-2

GROUP DISCUSSION- Introduction. Importance of GD. Characters tested in a GD. Tips on GD. Essential elements of GD. Traits tested in a GD .GD etiquette. Initiating a GD. Non-verbal communication in GD. Movement and gestures to be avoided in a GD. Some topics for GD.

UNIT-3

PREPARING CV/RESUME-Introduction – meaning – difference among bio-data, CV and resume. CV writing tips. Do's and don'ts of resume preparation. Vocabulary for resume, common resume mistakes, cover letters, tips for writing cover letters.

UNIT-4

INTERVIEW SKILLS - Introduction. Types of interview. Types of question asked. Reasons for rejections. Post-interview etiquette. Telephonic interview. Dress code at interview. Mistakes during interview. Tips to crack on interview. Contextual questions in interview skills. Emotional crack an interview. Emotional intelligence and critical thinking during interview process.

RECOMMENDED BOOKS

1. K. Alex, S. Chand Publishers.
2. Lucas, Stephen E., 'The Art of Public Speaking', 11th Edn., International Edn., McGraw Hill Book Co., **2014**.
3. Goleman, Daniel, 'Working with Emotional Intelligence', Banton Books, London, **1998**.
4. Thrope, Edgar and Showick Trope, 'Winning at Interviews', Pearson Education, **2004.**
5. Turk, Christopher, 'Effective Speaking', South Asia Division: Taylor & Francis, 1**985**.

NANO SCIENCE AND NANO TECHNOLOGY

Subject Code: BECE2-665 **L T P C** **Duration: 48 Hrs.**
3 0 0 3

Course 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

Course 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 (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.

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.
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.

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ADVANCED MICROPROCESSOR

Subject Code: BECE2-666 **L T P C** **Duration: 48 Hrs.**
3 0 0 3

Course 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.

Course 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 (12 Hrs.)

Microprocessor 8086: Block diagram, Architecture & Pin diagram of 8086, pipelining process, flag register. Register details of 8086, operation, different addressing modes.

Unit II (12 Hrs.)

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 (12 Hrs.)

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 (12 Hrs.)

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. Myke Predko, 'Programming and Customizing the ARM7 Microcontroller', McGraw Hill.
6. John Morton, 'The PIC Microcontroller: Your Personal Introductory Course', Newnes an Imprint of Butterworth-Heinemann Ltd.

IMAGE AND SPEECH PROCESSING

Subject Code: BECE2-667 **L T P C** **Duration: 48 Hrs.**
3 0 0 3

Course 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.

Course 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 (12 Hrs.)

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 (12 Hrs.)

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, Colour image processing.

Unit-III (12 Hrs.)

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 (12 Hrs.)

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 phasor mode, 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.

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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: BECE2-668 **L T P C** **Duration: 48 Hrs.**
3 0 0 3

Course 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.

Course 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 (12 Hrs.)

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 (12 Hrs.)

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 (12 Hrs.)

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 (12 Hrs.)

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.

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OPERATION RESEARCH

Subject Code: BECE2-669 **L T P C** **Duration: 48 Hrs.**
3 0 0 3

Course Objectives:

1. To Facilitate the knowledge about decision making systems.
2. To Enrich the idea of different models.

Course 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 (12 Hrs.)

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 (12 Hrs.)

Deterministic Model: Transportation model-balanced & unbalanced, north west rule, Vogel's Method, least cost or matrix minimal, stepping stone method, MODI methods, degeneracy, assignment, travelling 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 (12 Hrs.)

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 (12 Hrs.)

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. Vohra, 'Quantitative Techniques', TMH.
4. H.M. Wagher, 'Principles of operation Research (with Applications to Managerial Decisions), Prentice Hall of India.
5. Philips, Revindran, Solgeberg, 'Operation Research', Wiley ISE.

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WIRELESS COMMUNICATION SYSTEMS

Subject Code: BECE2-728 **L T P C** **Duration: 48 Hrs.**
3 1 0 4

Course 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 signaling schemes for fading channels.
4. Be familiar the various multipath mitigation techniques.
5. Understand the various multiple antenna systems.

Course Outcomes:
At the end of the course, the student should be able to:
1. Characterize wireless channels.
2. Design and implement various signaling schemes for fading channels.
3. Compare multipath mitigation techniques and analyze 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 (12 Hrs.)

Multiple Access Techniques f**or 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 (12 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', Pearson.

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2. W.C.Y. Lee, 'Mobile Cellular Telecommunication', McGraw Hill.
3. Jochen Schiller, 'Mobile Communications', Pearson.

DIGITAL SIGNAL PROCESSING

Subject Code: BECE2-729 **L T P C** **Duration: 48 Hrs.**
3 1 0 4

Course 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.

Course 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 (12 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 (12 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. B. Widrow and S.D. Stearns, 'Adaptive Signal Processing', Prentice Hall.

DIGITAL SIGNAL PROCESSING LAB

Subject Code: BECE2-730 **L T P C** **Duration: 24 Hrs.**
0 0 2 1

Course 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.

Course 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.

EXERCISES

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.

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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: BECE2-730 **L T P C**
0 0 8 4

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: BECE2-770 **L T P C** **Duration: 48 Hrs.**
3 0 0 3

Course 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.

Course 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 (12 Hrs.)

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.

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Unit-II (12 Hrs.)

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 (12Hrs)

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 (12 Hrs.)

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. Huseyin Arslan, 'Cognitive Radio, Software Defined Radio and Adaptive Wireless Systems', Springer.
5. Linda Doyle, 'Essentials of Cognitive Radio', Cambridge University Press.

RELATIONAL DATABASE MANAGEMENT SYSTEMS

Subject Code: BECE2-771	L T P C 3 0 0 3	Duration: 48 Hrs.

Course 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.

Course 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 (12 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.

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 (12 Hrs.)

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 (12 Hrs.)

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 (12 Hrs.)

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.
5. Raghu Ramakrishnan, Johannes Gehrke, 'Database Management Systems', Tata McGraw Hill.
6. Abraham Silberschatz, S. Sudarshan, Henry F. Korth, 'Database System Concepts', Tata McGraw Hill.

COMPUTER ARCHITECTURE AND ORGANIZATION

Subject Code: BECE2-772 **L T P C** **Duration: 48 Hrs.**
3 0 0 3

Course 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.

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6. To expose the students with different ways of communicating with I/O devices and standard I/O interfaces.

Course Outcomes:

At the end of the course, 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-1 (12 Hrs.)

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 (12 Hrs.)

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 (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.

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 (12 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 [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, 'Computer Organization and Design', Morgan, Kauffmann, Elsevier Publisher.
2. John P. Hayes, 'Computer Architecture and Organization', TMH.

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3. William Stallings, 'Operating Systems Internals and Design Principles', Prentice Hall Upper Saddle River, New Jersey.

SOFT COMPUTING

Subject Code: BECE2-773 **L T P C** **Duration: 48 Hrs.**
3 0 0 3

Course Objectives:
The students should be:
1. Learn the various soft computing frame works.
2. Be familiar with design of various neural networks.
3. Learn genetic programming.

Course 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 (12 Hrs.)

Neural Networks: Fundamentals of Neural Networks – History- Architectures- Learning methods- XOR Problem-Delta rule- Derivation-Back propagation- applications- parameters in BPN- Associative memory – Hetero associative- BAM- energy function- problems-applications of associative memories- ART1- ART2- applications of adaptive networks.

UNIT-II (12 Hrs.)

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 (12 Hrs.)

Genetic Algorithms: Fundamentals of GA – creation of offspring – encoding – fitness function reproduction – crossover- insertion& deletion- mutation- bitwise operators – applications.

UNIT-IV (12 Hrs.)

Programming Using Mat Lab: 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: BECE2-833 **L T P C** **Duration: 48 Hrs.**
3 1 0 4

Course 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.

Course 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 (12 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 (12 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.
5. S.M. Kang, Y. Lebiebici, 'CMOS Digital Integrated Circuits Analysis & Design', TMH.

VLSI DESIGN LAB.

Subject Code: BECE2-834	L T P C 0 0 2 1	Duration: 24 Hrs

Course 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.

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Course 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 EXPERIMENTS

1. Design of all type of Flip-Flops using (if-then-else) Sequential Constructs
2. Design of 8-Bit Shift Register with shift Right, shift Left, Load and Synchronous reset.
3. Design of Synchronous 8-bit Johnson Counter.
4. Design of Synchronous 8-Bit universal shift register (parallel-in, parallel-out) with 3- state
5. output (IC 74299)
6. Design of 4 Bit Binary to BCD Converter using sequential statement.
7. Design counters (MOD 3, MOD 5, MOD 8, MOD 16)
8. Design a decimal up/down counter that counts up from 00 to 99 or down from 99 to 00.
9. Design 3-line to 8-line decoder with address latch

Note: At least 12 experiments are required to be performed.

MAJOR PROJECT

Subject Code: BECE2-874 **L T P C**
0 0 12 6

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: BECE2-874 **L T P C** **Duration: 48 Hrs.**
3 0 0 3

Course 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.

Course Outcomes:

Student shall be able to:

1. Understand the cellular systems
2. Analyse the concept of switching systems and base station subsystem.

Unit–I (12 Hrs.)

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 (12 Hrs.)

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, co–channel measurement design of antenna system, antenna parameter and their effects, diversity receiver in co–channel interference – different types.

Unit –III (12 Hrs.)

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 (12 Hrs.)

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. William, C.Y. Lee, 'Mobile Cellular Telecommunications', McGraw Hill.

WIRELESS SENSORS NETWORKS

Subject Code: BECE2-875 **L T P C** **Duration: 48 Hrs.**
3 0 0 3

Course 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.

Course 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 (12 Hrs.)

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 (12 Hrs.)

Topology Control: Location driven, Geographic Adaptive Fidelity (GAF), Geographic Random Forwarding (GeRaF), GEAR, Connectivity driven, SPAN, ASCENT.

Unit-III (12 Hrs.)

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 (12 Hrs.)

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.
2. Feng Zhao & Leonidas J. Guibas, 'Wireless Sensor Networks- An Information Processing Approach'.
3. Waltenegus Dargie and Christian Poella Bauer, 'Fundamentals of Wireless Sensor Networks Theory and Practice', John Wiley and Sons.
4. Holger Karl and Andreas Willig, 'Protocols and Architectures for Wireless Sensor Networks', John Wiley and Sons.

INFORMATION THEORY AND CODING

Subject Code: BECE2-876 **L T P C** **Duration: 48 Hrs.**
3 0 0 3

Course 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.

Course 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 convolution codes.

Unit-I (12 Hrs.)

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 (12 Hrs.)

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 (12 Hrs.)

Linear Block Codes: Introduction to Linear Block codes, Syndrome and Error detection, Minimum distance of block code, Hamming Code.

Cyclic Codes: Description of Cyclic codes, Generator and parity check matrices of cyclic codes, error detection decoding of cyclic codes.

UNIT-IV (12 Hrs.)

Convolution Codes: Encoding of convolution codes, structural properties of Convolution codes, Distance Properties of convolution codes.

Recommended Books:

1. Arijit Saha, 'Information Theory, Coding & Cryptography', Pearson Education.
2. Ranjan Bose, 'Information Theory, Coding and Cryptography', Tata McGraw 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: BECE2-877 **L T P C** **Duration: 48 Hrs.**
3 0 0 3

Course Objectives:
1. General understanding of structure of modern computers
2. Purpose, structure and functions of operating systems
3. 3.Illustration of key Operating system aspects by example

Course 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 (12 Hrs.)

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 (12 Hrs.)

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 (12 Hrs.)

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 (12 Hrs.)

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: BECE2-878	L T P C	Duration: 48 Hrs.
	3 0 0 3	

Course 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.

Course 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 (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 & ionosphere effects on link design, complete link design, interference effects on complete link design, earth station parameters.

Unit-II (14 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, 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 (10 Hrs.)

Laser & Satellite Communication: Link analysis, optical satellite link Transmitter & Receiver, Satellite, beam acquisition, tracking & pointing, cable channel frequency, head end equation, distribution of signal, n/w specifications and architecture, optical fiber CAT 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', John Wiley & Sons.
2. D.C. Aggarwal, 'Satellite Communication', Khanna Publishers.

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B. TECH. ELECTRONICS & INSTRUMENTATION ENGINEERING

SEMESTER 3rd		Contact Hrs.			Marks			Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
BECE3-301	Electronic Devices and Circuits - I	3	1	0	40	60	100	4
BECE3-302	Digital Electronics	3	1	0	40	60	100	4
BECE3-303	Electrical Measurements & Instruments	3	1	0	40	60	100	4
BECE3-304	Network Analysis & Synthesis	3	1	0	40	60	100	4
BECE3-305	Electronic Devices and Circuits - I Lab.	0	0	2	60	40	100	1
BECE3-306	Digital Electronics Lab.	0	0	2	60	40	100	1
BECE3-307	Electromagnetic Field Theory	3	1	0	40	60	100	4
BHUM0-F91	Soft Skills-I	0	0	2	60	40	100	1
BECE3-308	Training -I	0	0	4	60	40	100	2
Total		**15**	**5**	**10**	**440**	**460**	**900**	**25**

SEMESTER 4th		Contact Hrs.			Marks			Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
BECE3-409	Linear Control System	3	1	0	40	60	100	4
BECE3-410	Transducers & Sensors	3	1	0	40	60	100	4
BECE3-411	Electrical and Electronics Instrumentation	3	1	0	40	60	100	4
BECE3-412	Microprocessors & Peripheral Devices	3	1	0	40	60	100	4
Departmental Elective-I (Select any one)		3	0	0	40	60	100	3
BECE3-456	Antenna &Wave Propagation							
BECE3-457	Data Structures and Algorithms							
BECE3-458	Electronic Instrumentation							
BECE3-459	Reliability Engineering							
BECE3-413	Linear Control System Lab.	0	0	2	60	40	100	1
BECE3-414	Instrumentation Lab.	0	0	2	60	40	100	1
BECE3-415	Microprocessor Lab	0	0	2	60	40	100	1
BHUM0-F92	Soft Skills-II	0	0	2	60	40	100	1
Total		**15**	**4**	**8**	**440**	**460**	**900**	**23**

In House / Industrial Training of 6 Weeks during Summer vacations

SEMESTER 5th		Contact Hrs.			Marks			Credits
Subject Code	Subject Name	L	T	P	Int.	Ext.	Total	
BECE3-516	Pneumatic and Hydraulic Instrumentation	3	1	0	40	60	100	4
BECE3-517	Linear Integrated circuits	3	1	0	40	60	100	4
BECE3-518	Microcontroller and Embedded System	3	1	0	40	60	100	4
Departmental Elective-II (Select any one)		3	0	0	40	60	100	3
BECE3-560	Advanced Microprocessor							
BECE3-561	Neural Networks and Fuzzy Logic							
BECE3-562	Digital Control System							
BECE3-563	Micro-Electronics							
Open Elective-I		3	0	0	40	60	100	3
BECE3-519	Instrumentation Lab. - II	0	0	2	60	40	100	1
BECE3-520	Microcontroller Lab.	0	0	2	60	40	100	1
BECE3-521	Linear Integrated circuits Lab.	0	0	2	60	40	100	1
BHUM0-F93	Soft Skills–III	0	0	2	60	40	100	1
BECE3-522	Training-II	0	0	0	60	40	100	2
Total		**15**	**3**	**8**	**500**	**500**	**1000**	**24**

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SEMESTER 6th		Contact Hrs.			Marks			Credits
Subject Code	Subject Name	L	T	P	Int.	Ext.	Total	
BECE3-623	Analytical Instrumentation	3	1	0	40	60	100	4
BECE3-624	Optoelectronics Instrumentation	3	1	0	40	60	100	4
BECE3-625	Signal and Systems	3	1	0	40	60	100	4
Departmental Elective-III (Select any one)		3	0	0	40	60	100	3
BECE3-664	Nano-Science and Nano-Technology							
BECE3-665	Internet of Things							
BECE3-666	Information Theory and Coding							
BECE3-667	Optical Fiber Communication							
Open Elective-II		3	0	0	40	60	100	3
BECE3-626	Analytical Instrumentation Lab.	0	0	2	60	40	100	1
BECE3-627	Industrial Lab.	0	0	2	60	40	100	1
BHUM0-F94	Soft Skills-IV	0	0	2	60	40	100	1
Total		**15**	**3**	**6**	**380**	**420**	**800**	**21**

SEMESTER 7th		Contact Hrs.			Marks			Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
BECE3-728	Biomedical Instrumentation	3	1	0	40	60	100	4
BECE3-729	Process Control	3	1	0	40	60	100	4
Departmental Elective-IV (Select any one)		3	0	0	40	60	100	3
BECE3-768	VLSI Design							
BECE3-769	Power Plant Instrumentation							
BECE3-770	Basics of Social Science, Economics and Industrial Management							
BECE3-771	Digital Systems Design							
Open Elective-III		3	0	0	40	60	100	3
BECE3-730	Process Control Lab.	0	0	2	60	40	100	1
BECE3-731	Training-III	0	0	0	60	40	100	4
BECE3-732	Minor Project	0	0	0	60	40	100	4
Total		**12**	**2**	**2**	**340**	**360**	**700**	**23**

SEMESTER 8th		Contact Hrs.			Marks			Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
BECE3-833	Virtual Instrumentation	3	1	0	40	60	100	4
Departmental Elective-V (Select any one)		3	0	0	40	60	100	3
BECE3-872	Programmable Logic Controller							
BECE3-873	Remote Sensing and Thermal Imaging							
BECE3-874	Advance Photonics							
BECE3-875	Data Acquisition and Processing							
BECE3-834	Virtual Instrumentation Lab.	0	0	2	60	40	100	1
BECE3-835	Major Project	0	0	0	60	40	100	6
Total	**Total 2 Theory & 2 Lab. Courses**	**6**	**1**	**2**	**200**	**200**	**400**	**14**

Total Credits: 25 + 25 + 25 + 23 + 24 + 21 + 23 + 14 = 180

ELECTRONIC DEVICES AND CIRCUITS - I

Subject Code: BECE3-301 **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.

Course 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 I_{co}, 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’, 6^{th} 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.

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DIGITAL ELECTRONICS

Subject Code: BECE3-302 **L T P C** **Duration: 48 Hrs.**
3 1 0 4

Course 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

Course 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.

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ELECTRICAL MEASUREMENTS & INSTRUMENTS

Subject Code: BECE3-303 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

Course 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.

Course 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

Course 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.

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3. To impart knowledge about different circuits, analyzing and synthesizing methods of circuits.

Course 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.

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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: BECE3-305 **L T P C**
0 0 2 1

Course 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.

Course 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. 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: BECE3-306 **L T P C**
0 0 2 1

Course 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

Course 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.

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.

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ELECTROMAGNETIC FIELD THEORY

Subject Code: ECE3-307 **L T P C** **Duration: 48 Hrs.**
3 1 0 4

Course 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.

Course 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 the concepts of magnetic field and magnetic field intensity.
3. An ability to understand Maxwell's equations in differential and integral forms.
4. 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 law and its applications, Electric flux density, potential fields due to electric dipole, Laplace and Poison 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, Amperes 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 –Smithchart.

Recommended Books

1. Matthew N.O. Sadiku, 'Elements of Engineering Electromagnetics', Oxford University Press.
2. William Hayt, 'Engineering Electromagnetics', Tata McGraw Hill.

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3. N. NarayanaRao, 'Elements of Engineering Electromagnetics', Pearson Education.
4. R.F. Jorden, 'Electromagnetic Waves & Radio System', Prentice Hall India.
5. J.D. Kraus, 'Electromagnetics', McGraw Hill.
6. Bhag Singh Guru and Hüseyin R. Hiziroglu, 'Electromagnetic Field Theory Fundamentals', Cambridge University Press.

SOFT SKILLS-I

Subject Code: **BHUM0-F91** **L T P C**
0 0 2 1

Course Objectives
The course aims to cause a basic awareness about the significance of soft skills in professional and interpersonal communications and facilitate an all-round development of personality.
Course Outcomes
At the end of the course, the student will be able to develop his/her personal traits and expose their personality effectively.

UNIT-1

SOFT SKILLS- Introduction to Soft Skills, Aspects of Soft Skills, Identifying your Soft Skills, Negotiation skills, Importance of Soft Skills, Concept of effective communication.
SELF-DISCOVERY- Self-Assessment, Process, Identifying strengths and limitations, SWOT Analysis Grid.

UNIT-2

FORMING VALUES- Values and Attitudes, Importance of Values, Self-Discipline, Personal Values - Cultural Values-Social Values-some examples, Recognition of one's own limits and deficiencies.

UNIT-3

ART OF LISTENING- Proxemics, Haptics: The Language of Touch, Meta Communication, Listening Skills, Types of Listening, Listening tips.

UNIT-4

ETIQUETTE AND MANNERS- ETIQUETTE- Introduction, Modern Etiquette, Benefits of Etiquette, Taboo topics, Do's and Don'ts for Men and Women. MANNERS- Introduction, Importance of manners at various occasions, Professional manners, Mobile manners. CORPORATE GROOMING TIPS- Dressing for Office: Do's and Don'ts for Men and Women, Annoying Office Habits.

RECOMMENDED BOOKS

1. K. Alex, S. Chand Publishers.
2. Butterfield, Jeff, 'Soft Skills for Everyone', Cengage Course, New Delhi, **2010**.
3. G.S. Chauhan and Sangeeta Sharma, 'Soft Skills', Wiley, New Delhi, **2016**.
4. Klaus, Peggy, Jane Rohman & Molly Hamaker, 'The Hard Truth About Soft Skills', Harper Collins E-books, London, **2007**.
5. S.J. Petes, Francis, 'Soft Skills and Professional Communication', Tata McGraw Hill Education, New Delhi, **2011**.

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LINEAR CONTROL SYSTEM

Subject Code: BECE3-409 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

Course 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.

Course 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.**

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TRANSDUCERS & SENSORS

Subject Code: BECE3-410 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

Course 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.

Course 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', 6^{th} 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: BECE3-411 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

Course 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.

Course 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**.

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MICROPROCESSORS & PERIPHERAL DEVICES

Subject Code: BECE3-412 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

Course 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.

Course 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.

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ANTENNA & WAVE PROPAGATION

Subject Code: BECE3-456 | **L T P C 3 0 0 3** | **Duration: 34 Hrs.**

Course 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

Course 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.

MRSPTU

DATA STRUCTURES AND ALGORITHMS

Subject Code: BECE3-457 **L T P C** **Duration: 34 Hrs.**
3 0 0 3

Course Objectives

1. To use object oriented programming to implement data structures.
2. To introduce linear, non-linear data structures and their applications.

Course 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.

MRSPTU

ELECTRONIC INSTRUMENTATION

Subject Code: BECE3-458 **L T P C** **Duration: 34 Hrs.**
3 0 0 3

Course 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. 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.

MRSPTU

RELIABILITY ENGINEERING

Subject Code: BECE3-459 **L T P C** **Duration: 34 Hrs.**
3 0 0 3

Course 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.**

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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: BECE3-413 **L T P C**
0 0 2 1

Course 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.

Course Outcomes:
1. To acquire skills to understand all types of control components
2. An ability to analyze the stability of control systems

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.

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INSTRUMENTATION LAB.

Subject Code: BECE3-414 **L T P C**
0 0 2 1

Course 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.

Course 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.

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.

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MICROPROCESSOR LAB.

Subject Code: BECE3-415 **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

SOFT SKILLS-II

Subject Code: **BHUM0-F92** **L T P C**
0 0 2 1

Course Objectives
The course aims to address various challenges of communication as well as behavioural skills faced by individual at work place and organisations. Also, it aims to enhance the employability of the students.

Course Outcomes
At the end of the course the student will be able to understand the importance of goal setting. They will also be able to handle stress in their lives and future in a better way.

UNIT-1

DEVELOPING POSITIVE ATTITUDE- Introduction. Formation of attitude. Attitude in workplace. Power of positive attitude. Examples of positive attitudes. Negative attitudes. Examples of negative attitude. overcoming negative attitude and its consequences.

IMPROVING PERCEPTION- Introduction. Understanding perception. perception and its application in organizations.

UNIT-2

CAREER PLANNING-Introduction. Tips for successful career planning. Goal setting-immediate, short term and long term. Strategies to achieve goals. Myths about choosing career.

UNIT-3

ART OF READING-Introduction. Benefits of reading. Tips for effective reading. the SQ3R technique. Different stages of reading. determining reading rate of students. Activities to increase the reading rate. Problems faced. Becoming an effective reader.

UNIT-4

STRESS MANAGEMENT - Introduction. meaning. positive and negative stress. Sources of stress. Case studies. signs of stress. Stress management tips. Teenage stress.

RECOMMENDED BOOKS

1. K. Alex, S. Chand Publishers.
2. Rizvi, M. Ashraf, 'Effective Technical Communication', McGraw Hill.
3. Mohan Krishna & Meera Banerji, 'Developing Communication Skills', Macmillan.
4. Kamin, Maxine, 'Soft Skills Revolution: A Guide for Connecting with Compassion for Trainers, Teams & Leaders', Pfeiffer & Amp; Company, Washington, DC, **2013.**

PNEUMATIC AND HYDRAULIC INSTRUMENTATION

Subject Code: BECE3-516 **L T P C** **Duration: 48 Hrs.**
3 1 0 4

Course Objectives: The student should be able to,
1. Understand the pneumatic and hydraulic systems.
2. Be familiar with the hydraulic actuators and control valves.
3. To get the knowledge about timing and sequence diagrams.
4. Learn about the hydraulic and pneumatic controllers.

Course Outcomes:
At the end of the course, the student should be able to:
1. Identify the components required to build different types of pneumatic and hydraulic systems

2. Understand the concept of various control valves and hydraulic actuators
3. Identify solution for Pneumatic temperature, pressure transmitters & PLC.
4. Learn the working principle of Pneumatic Sensors and controllers.

UNIT I (12 Hrs.)

Introduction: Basic requirement for Pneumatic System, Servicing compressed air: Air compressors, air treatment stages, pressure regulation. Introduction to hydraulic system, comparison of pneumatic and hydraulic system.

UNIT II (12 Hrs.)

Pneumatic & hydraulic Actuators, cylinders Spring, spring less, spring with positioner piston & motor actuators, electro pneumatic actuators, cylinder lubrication, cylinder with sensors, hydraulic actuators, control valves, types of control valves, basic pneumatic circuits.

UNIT III (12 Hrs.)

Timing & Sequence Diagram: Cylinder sequencing hydraulic & pneumatic Accessories pneumatic telemetry systems: Pneumatic temperature & pressure transmitters their working & applications, electrical control in pneumatic circuit. Introduction to PLC, architecture of PLC, Programming of PLC.

UNIT IV (12 Hrs.)

Pneumatic & Hydraulic Controllers (P, PI, PID), P & ID Diagrams, Converters: I/P, P/I, Pneumatic Relay, Pneumatic Sensors Flapper nozzle assembly. Maintenance and troubleshooting of pneumatic and hydraulic systems. Introduction to Mechatronics and its approach.

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.

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LINEAR INTEGRATED CIRCUITS

Subject Code: BECE3-517 **L T P C** **Duration: 48 Hrs.**
3 1 0 4

Course Objectives:
1. Students will be able to understand basic concepts of OP-AMPs characteristics and their specifications.
2. Op-AMP applications to signal conditioning for amplifiers, filters and oscillators.
3. Op-AMP applications for comparators and data conversions will be studied.

Course Outcomes:
1. Students will be able to learn about the operational amplifiers and its characteristics as well as various types of op-amps.
2. Students will acquire the ability to design and test practical circuits for amplifiers.
3. Students will be able to analyze the operation of active filters.

UNIT-I (12 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 (12 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 (12 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 (12 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.
4. 'Op Amps & Linear Integrated Circuits by Coughlin', Prentice Hall.

MICROCONTROLLER AND EMBEDDED SYSTEM

Course Code: BECE3-518	L T P C 3 1 0 4	Duration: 48 Hrs.

Course Objectives:

1. The student should be made to:
2. Study the Architecture of 8051 microcontroller.
3. Learn the design aspects of I/O and Memory Interfacing circuits.
4. Study about communication and bus interfacing.

Course Outcomes:

1. At the end of the course, the student should be able to:
2. Design and implement 8051 microcontroller based systems.
3. Serial communication 0f 8051.

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4. Interfacing with 8051

UNIT I (12 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 (12 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.

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ADVANCED MICROPROCESSOR

Course Code: BECE3-560 **L T P C** **Duration: 37 Hrs.**
3 0 0 3

Course Objectives

1. The purpose of this course is to 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 be able to learn and apply assembly language programming
4. Students will able to interface various circuits with advanced processors.

Course Outcomes

1. Students will have ability to deal with 16 bit microprocessors
2. They will be familiar with latest microprocessor and assembly language programming
3. Students will have skills to interface any peripheral devices with different microprocessors.
4. Students will have an introduction about more advanced processors like core to duo, I-5 & I-7.

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, I-5 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. Mc Kinlay 'The 8051 Micro Controllers & Embedded Systems', Pearson Education.
3. Kenneth J, Ayala, '8051 Microcontroller: Architecture, Programming and Application', Delmar Course.
4. Brey, 'Intel Micropocessors, The 8056/8055, 80186/80188, 8028, /80386, 80486, Pentium & PentiumPro, Pentium II, III, IV: Architecture, Programming and Interfacing', PHI.
5. Myke Predko, 'Programming and Customizing the ARM7 Microcontroller', McGraw-Hill.
6. John Morton, 'The PIC Microcontroller: Your Personal Introductory Course', Newnes (an imprint of Butterworth-Heinemann Ltd.).

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NEURAL NETWORKS AND FUZZY LOGIC

Subject Code: BECE3-561 **L T P C** **Duration: 38 Hrs.**
3 0 0 3

Course 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 about the concepts of Fuzzification and De-Fuzzification.
4. Describe various optimization techniques.

Course 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 and Fuzzy rules.
4. Learn and understand various optimization techniques.

UNIT I

Neural Networks: History, Overview of Biological Neuro-System, Terminology of Artificial Neural Network, Comparison of BNN and ANN, Mathematical Models of Neuron, ANN Architecture, Topology, Fundamental Course Laws, Course Paradigms-Supervised, Unsupervised and reinforcement Course.

UNIT II

Perceptron Architecture, Single layer perceptron, Perceptron Course Rules, Multi-layer perceptron, Back Propagation Algorithm, Associative Memories, Hopfield Networks, Competitive Course, Self-organizing Maps, ART Networks, Applications of Artificial Neural Networks.

UNIT III

Introduction to Fuzzy Logic, Classical and Fuzzy Sets: Overview of Classical Sets, Linguistic Variables, Membership Function, Fuzzification, De-Fuzzification to Crisp Sets, Operations on Fuzzy Sets: Compliment, Intersections, Unions, Combinations of Operations, Aggregation Operations, Fuzzy rule generation (IF-THEN), Applications of Fuzzy Logic.

UNIT IV

Neuro-Fuzzy System: Introduction and Architecture of Neuro-Fuzzy Networks.

Introduction to different Optimization Techniques: Genetic Algorithm, Particle Swarm Optimization, Biogeography Based Optimization, Bacterial Forging Optimization, Detailed study of Genetic Algorithm, GA in problem solving, Implementation of GA.

Recommended Books

1. N. Yegnanarayana, 'Artificial Neural Network', PHI.
2. Laurene Fausett, 'Fundamental of Neural Networks', Pearson.
3. Simon Haykin, 'Neural Networks', Pearson.
4. S. Rajasekaran and G.A. Vijayalakshmi, 'Neural Networks, Fuzzy Logic and Genetic Algorithms', PHI.
5. Timothy J. Ross, 'Fuzzy Logic with Engineering', John Wiley.
6. S.N. Sivanandam, 'Introduction to Fuzzy Logic using MATLAB', Springer.
7. Ahmad M. Ibrahim, 'Introduction to Applied Fuzzy Electronics', PHI.

MRSPTU

DIGITAL CONTROL SYSTEM

Course Code: BECE3-562 **L T P C** **Duration: 38 Hrs.**
3 0 0 3

Course Objectives:

1. To identify the different control system terminologies.
2. To describe the operation of digital control devices systems.
3. To study the different control systems using state variable methods.
4. To study stability analysis and analysis using state variable methods.

Course Outcomes:

At the end of the course the student shall be able to:

1. Understand concepts of stability, transfer function and terminologies of control systems.
2. Apply and analyze the principles of state feedback and state regulator.
3. Use various types of State Variable Methods for Digital Control Systems.

UNIT I

Introduction: Control system terminology, control theory history and trends, computer-based control. An overview of classical approach to analog controller design. Basic digital control scheme. Principles of signal conversion, Basic discrete time signals, Time domain models for discrete-time systems. Transfer function models, Stability on the Z-plane and jury stability criterion. Sampling as impulse modulation, Sampled spectra and aliasing. Filtering, choice of sampling rate, Principles of discretisation. Routh stability criterion on the r-plane.

UNIT II

Models of Digital Control Devices and Systems, Z-domain description of sampled continuous-time plants and systems with dead-time, Digital Controller design using direct synthesis procedures. Stability improvement by state feedback, Necessary and sufficient conditions for arbitrary pole-placement. State regulator design, Design of state observer. Compensator design by separation principle. Servo design. State feedback with integral control., Deadbeat control by state feedback and deadbeat observers.

UNIT III

Control System Analysis using State Variable Methods for Digital Control Systems: State variable representation, Conversion of state variable models to transfer function and of transfer function to canonical state variable models, Eigen values and Eigen vectors, Solution of state difference equations, controllability and Observability, Multi variable system.

UNIT IV

Lyapunov Stability Analysis: Basic concepts, Stability definitions and theorems, Lyapunov functions for linear and nonlinear systems, A model reference adaptive system. Parameter optimization and optimal control, Quadratic performance index, control configurations, State regulator design through the Lyapunov equation, Optimal state regulator through the Matrix Riccati-equation for digital control systems.

Recommended Books

1. B.C. Kuo,‘ Digital Control Systems’, Prentice Hall of India.
2. Sushil Das Gupta, ‘Automatic Control Systems’, Khanna Publishers.
3. M. Gopal, ‘Digital Control & State Variable Methods’, TMH.
4. M. Gopal, ‘Control System Principles & Design’, TMH.
5. K. Ogata, ‘Discrete-Time Control Systems’, Prentice Hall India.

MICROELECTRONICS

Course Code: BECE3-563 **L T P C** **Duration: 37 Hrs.**

3 0 0 3

Course Objectives:

The student should be made to:

1. Know the characteristic of Integrated Circuits
2. Learn the basics of diffusion and photolithography.
3. Understand the concepts behind etching and annealing techniques.
4. Be familiar the various types of IC packages and assembly techniques

Course Outcomes:

At the end of the course, the student should be able to:

1. Characterize Integrated Circuits
2. Understand and Implementation of oxidation, diffusion and photolithography
3. Describe photo resist, annealing and etching techniques in IC fabrication.
4. Compare several of IC packages and assembly techniques

UNIT I

Introduction to Integrated Circuits and advantages, classification of integration, size and complexity of IC’s, Crystal Growth of Silicon: Electronic-Grade Silicon, Czochralski Crystal growth, Liquid Encapsulated Czochralski growth, Zone-refining and float zone growth, Bridgman growth of GaAs. Wafer preparation, Slicing and polishing, Epitaxy, VPE, MBE, MOCVD.

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UNIT II

Oxidation, characterization of oxide films, diffusion, Diffusion, Fick's diffusion equation in one dimension, ion implantation, Rapid Thermal Annealing, Photolithography, E-beam lithography, optical lithography, and X-Ray lithography.

UNIT III

Photo resists: positive and negative photo resists, mask generation, wet and dry etching, Plasma and Rapid Thermal-Processing: Reactive Ion Etching technique, RTP for annealing, CVD and LPCVD techniques for deposition of poly silicon, silicon nitride and silicon dioxide, Metallization and patterning.

UNIT IV

VLSI process integration, process flows for CMOS and bipolar IC processes, Assembly techniques and Packaging of I.C's**,** packages Types, Packages using surface-mount-technology (SMT), Yield, reliability.

Recommended Books

1. S.M. Sze, 'VLSI Technology', Tata McGraw Hill.
2. Campbell, Stephen A., 'The Science and Engineering of Microelectronic Fabrication', Oxford Uni. Press.
3. S.K. Ghandhi, 'VLSI Fabrication Principles', John Wiley & Sons.

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INSTRUMENTATION LAB.-II

Subject Code: BECE3-519 **L T P C**
0 0 2 1

Course 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 study the characteristics of potentiometers, synchro set, dc and a.c. servo-systems.

Course Outcomes:

1. After the completion of the course, the students could have skills about the basic measurements of transducers, meters and servo systems.
2. An ability to use the techniques and skills to operate various meters, motors and transducers.

EXPERIMENTS

1. To determine output characteristic of a LVDT and determine its sensitivity.
2. Study characteristics of temperature transducer like Thermocouple, Thermistor and RTD with implementation of small project using signal conditioning circuit.
3. Study characteristics of Light transducer like Photovoltaic cell, Phototransistor and Pin Photodiode with implementation of small project using signal conditioning circuit.
4. To study input- output characteristics of a potentiometer and to use two potentiometers as an error detector.
5. To study transmitter- receiver characteristics of a synchro set to use the set as control component.
6. To study the operation of a d-c positional servo system and to investigate the effect of damping and supply voltage on its response.
7. To study the operation of an a.c. position servo-system and to obtain effects of supply voltage and system parameter on its transient response.

8. To study a stepper motor and control its direction speed and number of steps with the help of a microprocessor.
9. Design & Performance of Instrumentation amplifiers and Active filters.
10. To study the performance of Strain Gauge & pressure transducers.

Note: Perform any 08 experiments from the above list of experiments.

MICROCONTROLLER LAB.

Subject Code: BECE3-520 **L T P C**
0 0 2 1

Course Objectives:

The student should be made to:

1. Introduce microcontroller concepts and features.
2. Implement assembly language programming for various applications
3. Introduce the practical concepts to control speed of DC and stepper motor.

Course 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 8051/8031 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
12. LCD display.

Note: Perform any 08 experiments from the above list of experiments.

LINEAR INTEGRATED CIRCUITS LAB.

Subject Code: BECE3-521 **L T P C**
0 0 2 1

Course 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.

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Course 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 pass 1st order butterworth active filters using Op Amp.
9. Design Phase shift oscillator using Op-Amp.
10. Design Wein Bridge oscillator using Op-Amp.
11. Application of Op Amp as Sawtooth wave generator.
12. Application of Op Amp as Zero Crossing detector and window detector.
13. Application of Op Amp as Schmitt Trigger.
14. Design a delay circuit using 555 timer.
15. Design of a function generator
16. Design of a Voltage Controlled Oscillator

Note: At least 12 experiments are required to be performed.

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SOFT SKILLS-III

Subject Code: **BHUM0-F93** **L T P C**
0 0 2 1

Course Objectives

The course aims to equip the students with effective writing skills in English. Also, to make the students understand their role as team players in organisations.

Course Outcomes

At the completion of the course, the student will become well –versed with the behavioural skills. They will also understand the role of body language and non-verbal communication during the interview process.

UNIT-1

ART OF WRITING - Introduction, Importance of Writing Creative Writing, Writing tips, Drawback of written communication.

ART OF BUSINESS WRITING - Introduction, Business Writing, Business Letter, Format and Styles, Types of business letters, Art of writing correct and precise mails, Understand netiquette.

UNIT-2

BODY LANGUAGE - Introduction- Body Talk, Forms of body language, uses of body language, Body language in understanding Intra and Inter-Personal Relations, Types of body language, Gender differences, Gaining confidence with knowledge of Kinesics.

UNIT-3

TEAM BUILDING AND TEAM WORK - Introduction, Meaning, Characteristics of an effective team, Role of a Team Leader, Role of Team Members, inter group Collaboration- Advantages, Difficulties faced, Group Exercises-Team Tasks and Role-Play, Importance of Group Dynamics.

UNIT-4

TIME MANAGEMENT - Introduction, the 80-20 Rule, three secrets of Time Management, Time Management Matrix, Effective Scheduling, Time Wasters, Time Savers, Time Circle Planner, Difficulties in Time Management, Overcoming Procastination.

RECOMMENDED BOOKS

1. K. Alex, S. Chand Publishers.
2. R.C. Sharma and Krishna Mohan, 'Business Correspondence and Report Writing', TMH, New Delhi, **2016.**
3. N. Krishnaswami and T. Sriraman, 'Creative English for Communication', Macmillan.
4. Penrose, John M., et al., 'Business Communication for Managers', Thomson South Western, New Delhi, **2007**.
5. Holtz, Shel, 'Corporate Conversations', PHI, New Delhi, **2007**.

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ANALYTICAL INSTRUMENTATION

Subject Code: BECE3-623 **L T P C** **Duration: 48 Hrs..**
3 1 0 4

Course Objectives:

The student should be made to:

1. Understand the electromagnetic radiation and spectrum.
2. Be familiar with the components of spectrometry and photometry.
3. Be exposed to the Nuclear magnetic resonance spectrometry and mass spectrometry.
4. Learn the various characterization techniques.

Course Outcomes:

At the end of the course, the student should be able to:

1. Identify the components required to understand electromagnetic radiation and spectrum
2. Understand the theoretical concepts of flame photometry, emission spectrometry and atomic absorption spectrometer.
3. Describe the principle and basic components of NMR and mass spectrometry.
4. Learn the various characterization techniques like SEM, TEM etc.

UNIT I (12 Hrs.)

Introduction to electromagnetic Radiation & spectrum and interaction of radiation with matter. Laws relating to Absorption of Radiation; Beer Lamberts law, Ultraviolet (UV) and Visible absorption instruments components. UV and Visible instruments: spectro photo-meters: single and dual beam. Infra-Red (IR) spectrophotometers: basic components, types, Fourier transform techniques.

UNIT II (12 Hrs.)

Emission spectrometry: Theoretical concepts, instrumentation: source unit, electrodes. Direct reading multichannel spectrometers. Flame photometry: principle, constructional details, fuel gases, atomizer, burner, optical and recording systems. Atomic absorption spectrometers: theoretical concepts, instrumentation: hollow cathode lamps, burners and flames, plasma excitation sources, optical and electronic systems.

UNIT III (12 Hrs.)

Nuclear magnetic resonance (NMR) spectrometry: principle, nuclear spin, nuclear energy levels, resonance condition, NMR absorption spectra, chemical shift, constructional details, spin decoupler, Fourier transform NMR spectroscopy. Electron spin resonance (ESR) spectrometry: principle and constructional details. Basic principle of chromatography – Gas & Liquid column chromatograph.

Mass spectrometry: basic components, types (magnetic deflection type, time of flight, double focusing, quadrupole, gas chromatograph mass spectrometer (GCMS) system,

UNIT IV (12 Hrs.)

Characterization Techniques: Construction, principle and working of Scanning Electron Microscope (SEM), Scanning Tunneling Microscope (STM), Atomic Force Microscope (AFM), Transmission Electron Microscope (TEM) and X-Ray Diffractometer (XRD).

Recommended Books

1. R.S. Khandpur, 'Handbook of Analytical Instrumentation', Tata McGraw-Hill.
2. Willard, Merrit and Dean, 'Instrumental Methods of Analysis', CBC Publishers.
3. E.W. Ewing, 'Instrumental Methods of Chemical Analysis', McGraw Hill.
4. Bharat Bhushan, 'Handbook of Nanotechnology', Springer.
5. P.J. Goodhew and F.J. Humphreys, 'Electron Microscopy and Analysis', Taylor & Francis.
6. Mick Wilson, Kamali Kannangara, Geoff Smith, Michelle Simmons and Burkhard Raguse, 'Basic Science and Emerging Technologies', Overseas Press.

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OPTO ELECTRONICS INSTRUMENTATION

Subject Code: BECE3-624 **L T P C** **Duration: 48 Hrs.**
3 1 0 4

Course Objectives:
1. To inculcate understanding of the basics required for optical components.
2. To deal with the issues of the light transmission through a fiber.
3. To instill knowledge on optical fiber measurements.
4. To deal with fiber optic sensors and other fiber optical application

Course Outcomes:

Upon completion of the course, students will be able to:
1. Explain the nature of light, black body radiation and optical components.
2. Describe the modes of fibers and losses in optical fiber.
3. Analyze the various parameters required for the measurement of optical fiber.
4. Illustrate various fiber optic sensors.

UNIT I (12 Hrs.)

Nature of light, wave nature of light, light sources black body radiation, units of light. Optical components; Prisms, Filters, Monochromators, Diffraction Gratings, Holographic Gratings. Light Sources; Discharge lamps, Nernst lamp, Incandescence lamp, Globar, Led and Laser. Light Detectors: Photovoltaic, photo detector, photo diode array & APD.

UNIT II (12 Hrs.)

Principle of light transmission through a Fiber. Classification of optical fibers; Single Mode and Multi-Mode Fibres, Step Index and Graded Index Fibres. Losses in Optical Fibers; Absorption, Scattering and Dispersion. Optical Windows for Fiber Optic Transmission system.

UNIT III (12 Hrs.)

Optical Fiber Measurements: N.A. measurement, working of OTDR, microprocessor based OTDR, applications of OTDR, dispersion measurements, Bit Error Rate (BER) measurement, attenuation measurement using OTDR, cut off wavelength measurement, micro bending loss measurement. Splicing of fibers.

UNIT IV (12 Hrs.)

Fiber Optic Sensors, intensity modulated sensors, microben strain intensity modulated sensor, liquid level types hybrid sensor, internal effect intensity modulated sensor, phase sensor, diffraction grating sensors, sensors using single mode fiber, inter ferometric temperature sensor, distributed fiber optic sensors.

Optical Fiber Applications in the field of Communication, LAN and Medical diagnostic.

Recommended Books:

1. Optical Fibers & Fiber Optic Communication systems by Subir Kumar Sarkar, S. Chand & Co.
2. Opto electronics: Fiber Optics and Lasers by Morris Tischler, A Lab Text Manual, McGraw Hill.
3. Fiber Optics Handbook for Engineers & Scientist (Optical & Electro-optical Engineering Series), by Frederick C. Allard, McGraw Hill.
4. Optical Fiber Communications, Principles & Practice by John M. Senior, Prentice Hall of India.
5. Optical Fiber Communications by Gerd Keiser, McGraw-Hill International.
6. Optical Fiber Communications, Principles & Practice by John M. Senior, Pearson Publishers.

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SIGNAL AND SYSTEMS

Subject Code: BECE3-625 **L T P C** **Duration: 48 Hrs.**
3 1 0 4

Course Objectives:

1. To introduce the students about the theoretical concepts associated with processing continuous & discrete time signals & systems.
2. To be able to think critically & to apply problem solving & reasoning strategies to the analysis of various types of signals & systems.
3. To impart them knowledge of various types of noises.

Course Outcomes:

1. An ability to analyze various types of signals in communication system.
2. Developing skills to understand random signals.
3. To understand various types of noises.
4. 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 Systems', Oxford University Press.
2. Ravi Kumar, 'Signals and Systems', PHI Course.
3. Simon Haykin, 'Signals and Systems', Wiley.
4. D. Ganesh Rao and Satish Tunga, 'Signals and Systems', Pearson.

MRSPTU

NANO SCIENCE AND NANO-TECHNOLOGY

Subject Code: BECE3-664 **L T P C** **Duration: 37 Hrs.**
3 0 0 3

Course 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

Course 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 (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.

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.
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.

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INTERNET OF THINGS

Subject Code: BECE3-665 **L T P C** **Duration: 37 Hrs.**
3 0 0 3

Course Objectives

1. To aware the students about the internet and networking basis.
2. To provide the basic concepts of internet of things (IoT) platforms.
3. To impart knowledge about IoT architecture and application development.
4. To study case studies and advance IoT applications.

Course Outcomes:

At the end of the course the student shall be able to:

1. Understand concepts of OSI model, data transfer and network topologies.
2. Apply and analyze the principles wired and wireless networking equipment.
3. Use various types of IoT architectures and web of things
4. Understand the home and commercial applications of IoT.

UNIT-I (10 Hrs.)

Internet/Web and Networking Basics: OSI Model, Data transfer referred with OSI Model, IP Addressing, Point to Point Data transfer, Point to Multi Point Data transfer & Network Topologies, Sub-netting, Network Topologies referred with Web, Introduction to Web Servers, Introduction to Cloud Computing

UNIT-II (12 Hrs.)

IoT Platform overview: Overview of IoT supported Hardware platforms such as: Raspberry pi, ARM Cortex Processors, Arduino and Intel Galileo boards. Network Fundamentals: Overview and working principle of Wired Networking equipment's – Router, Switches, Overview and working principle of

Wireless Networking equipment's – Access Points, Hubs etc. Linux Network Configuration Concepts: Networking configurations in Linux Accessing Hardware & Device Files interactions.

UNIT-III (12 Hrs.)

IoT Architecture: History of IoT, M2M – Machine to Machine, Web of Things, IoT protocols
Applications: Remote Monitoring & Sensing, Remote Controlling, Performance Analysis the Architecture the Layering concepts, IoT Communication Pattern, IoT protocol Architecture, The 6LoWPAN, Security aspects in IoT

IoT Application Development: Application Protocols: MQTT, REST/HTTP, CoAP, MySQL 13 36 /85

UNIT-IV (14 Hrs.)

Back-end Application Designing: Apache for handling HTTP Requests, PHP & MySQL for data processing, MongoDB Object Type Database, HTML, CSS &jQuery for UI Designing, JSON lib for data processing, Security & Privacy during development, Application Development for mobile Platforms: Overview of Android / IOS App Development tools.

Case Study & Advanced IoT Applications: IoT applications in home, infrastructures, buildings, security, Industries, Home appliances, other IoT electronic equipment. Use of Big Data and Visualization in IoT, Industry 4.0 concepts. Sensors and sensor Node and interfacing using any Embedded target boards (Raspberry Pi / Intel Galileo/ARM Cortex/ Arduino)

Recommended Books

1. Zach Shelby, Carsten Bormann, 'The Wireless Embedded Internet', Wiley.
2. Ovidiu Vermesan, Peter Friess, 'Internet of Things: Converging Technologies for Smart Environments and Integrated Ecosystems', River Publishers.
3. Jean-Philippe Vasseur, Adam Dunkels, Morgan Kuffmann, 'Interconnecting Smart Objects with IP: The Next Internet'.
4. Lu Yan, Yan Zhang, Laurence T. Yang, HuanshengNing, 'The Internet of Things: From RFID to the Next-Generation Pervasive Networked'.
5. Vijay Madisetti, Arshdeep Bahga, 'Internet of Things (A Hands-On-Approach).

MRSPTU

INFORMATION THEORY AND CODING

Subject Code: BECE3-666 **L T P C** **Duration: 37 Hrs.**
3 0 0 3

Course 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.

Course 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 (12 Hrs.)

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 (12 Hrs.)

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 (12 Hrs.)

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 (12 Hrs.)

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 McGraw Hill.
3. Thomas M. Cover, Joy A. Thomas, 'Elements of Information Theory', Wiley India Pvt.
4. J. Mary Jones, 'Information and Coding Theory', Springer.

MRSPTU

OPTICAL FIBER COMMUNICATION

Subject Code: BECE3-667 **L T P C** **Duration: 37 Hrs.**
3 0 0 3

Course 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.

Course Outcomes:

1. Upon completion of the course, students will be able to:
2. Discuss the various optical fiber modes, configurations and various signal degradation factors associated with optical fiber.
3. Explain the various optical sources and optical detectors and their use in the optical communication system.
4. Analyze the digital transmission and its associated parameters on system performance

UNIT-I (12 Hrs.)

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 (12 Hrs.)

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 (12 Hrs.)

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 (12 Hrs.)

Avalanche and PIN Photo Detectors: 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. Tata McGraw Hill, Gerd Keiser, 'Optical Fiber Communications'.
3. John Gowar, 'Optical Communication Systems', PHI.
4. Selvarajan, Kar, Srinivas, 'Optical fiber Communication', Tata McGraw Hill.

ANALYTICAL INSTRUMENTATION LAB.

MRSPTU

Subject Code: BECE3-626 **L T P C**
0 0 2 1

Course objectives:

1. To introduce the students about the theoretical concepts associated with pH measurement.
2. To be able to think critically & to apply problem solving & reasoning strategies to the analysis of various gases.
3. To impart them knowledge of fluoride and moisture contents.

Course Outcomes:

1. Developing skills to measure pH using pH meter.
2. To understand viscosity and strength of solutions.
3. Understand the concept of fluoride and moisture contents

EXPERIMENTS

1. pH measurement of a given sample on microprocessor based pH meter.
2. To estimate the concentration of given sample in a given solution (PPM) on flame photometer.
3. To measure the viscosity of given solution.
4. To measure the strength of oxygen dissolved (PPM) in a given solution.
5. To analyse a given gas using gas analyser.
6. To determine fluoride content in a given sample using fluoride meter.
7. To determine moisture content in a given sample using Karl Fischer Titrator.

Note: At least 07 experiments are required to perform.

INDUSTRIAL LAB.

Subject Code: BECE3-627 **L T P C**
0 0 2 1

Course Objectives:

The student should be made to:

1. To introduce Programmable logic controllers concepts and features.
2. To introduce the practical concepts of Distributed control system and SCADA.
3. To introduce the functioning of relays and sensors

Course Outcomes:

At the end of the course, the student should be able to:

1. Write basic programs using ladder programming
2. Analyze the application of Distributed control systems.
3. Understand Functioning of different relays and sensors

EXPERIMENTS

1. To understand Programmable logic controllers
2. To implement basic programmes using Ladder programming
3. To implement basic logics using statement lists
4. To overview about SCADA.
5. To acquire knowledge about Distributed control system.
6. Temperature controller using Distributed control system.
7. Pneumatics controller using Distributed control system
8. Level control using Distributed control system.
9. Functioning of different relays and sensors
10. To understand different diagrams representation in Industry.

Note: At least 08 experiments are required to perform.

SOFT SKILLS-IV

Subject Code: **BHUM0-F94** **L T P C**
0 0 2 1

Course Objectives

The course aims at the key areas like conversation skills, group skills and persuasion skills required during the interview process in an organisation.

Course Outcomes

At the end of the course, the student will be able to:

1. Demonstrate soft skills required for business situations.
2. Analyze the value of soft skills for career enhancement.
3. Apply soft skills to workplace environment.
4. Confidently participate in GD and interview process.

UNIT-1

ART OF SPEAKING- Introduction. Communication process. Importance of communication, channels of communication. Formal and informal communication. Barriers to communication. Tips for effective communication. tips for conversation. Presentation skills. Effective multi-media presentation

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skills. Speeches and debates. Combating nervousness. Patterns and methods of presentation. Oral presentation, planning and preparation.

UNIT-2

GROUP DISCUSSION- Introduction. Importance of GD. Characters tested in a GD. Tips on GD. Essential elements of GD. Traits tested in a GD .GD etiquette. Initiating a GD. Non-verbal communication in GD. Movement and gestures to be avoided in a GD. Some topics for GD.

UNIT-3

PREPARING CV/RESUME-Introduction – meaning – difference among bio-data, CV and resume. CV writing tips. Do's and don'ts of resume preparation. Vocabulary for resume, common resume mistakes, cover letters, tips for writing cover letters.

UNIT-4

INTERVIEW SKILLS - Introduction. Types of interview. Types of question asked. Reasons for rejections. Post-interview etiquette. Telephonic interview. Dress code at interview. Mistakes during interview. Tips to crack on interview. Contextual questions in interview skills. Emotional crack an interview. Emotional intelligence and critical thinking during interview process.

RECOMMENDED BOOKS

1. K. Alex, S. Chand Publishers.
2. Lucas, Stephen E., 'The Art of Public Speaking', 11th Edn., International Edn., McGraw Hill Book Co., **2014**.
3. Goleman, Daniel, 'Working with Emotional Intelligence', Banton Books, London, **1998**.
4. Thrope, Edgar and Showick Trope, 'Winning at Interviews', Pearson Education, **2004.**
5. Turk, Christopher, 'Effective Speaking', South Asia Division: Taylor & Francis, 1**985**.

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BIOMEDICAL INSTRUMENTATION

Subject Code: BECE3-728 **L T P C** **Duration: 48 Hrs.**
3 1 0 4

Course Objectives:
1. To identify the various biomedical instruments and their characteristics.
2. To learn about the Therapeutic equipment and central nervous system.
3. To study the different ultrasound and medical imaging systems.
4. To study safety parameters of biomedical instruments.

Course Outcomes:
At the end of the course the student shall be able to:
1. Understand concepts of biomedical instruments and bioelectric signals.
2. Apply and analyze the principles of Therapeutic equipment and central nervous system.
3. Describe the various types of biomedical imaging systems.
4. Understand sources of noise and safety parameters of biomedical equipment.

UNIT I (12 Hrs.)

Introduction to Biomedical Instrumentation: Sources of bio medical potentials. Different bioelectric signals like ECG, EMG & EEG. Bio potential electrodes: basic electrode theory, nearest equation, electrical conductivity of electrode jellies & creams, skin contact impedance & its measurement. Electrodes for ECG, EEE & EMG. Cardiovascular system: physiology of heart & cardio vascular system, ECG lead configuration, ECG recorders, Vector cardiograph, Phonocardiograph, measurement of cardiac output, blood flow & blood pressure.

UNIT II (12 Hrs.)

Central Nervous System: Anatomy of nervous system, neuronal communication, neuronal receptors. The sematic nervous system & spinal reflexes. Neuronal firing measurements, EEG measurements, Recorder for EEG & EMG. Therapeutic equipment: cardiac pacemakers, cardiac de fibrillators, nerve & muscle stimulators, Diathermy: shortwave, UV & ultrasonic.

UNIT III (12 Hrs.)

Medical Imaging System: Instrumentation for Diagnostics-Ray: properties, X-ray units, X-ray machines & generation process, special imaging techniques for X-rays. Ultrasonic Imaging System: Physics of ultrasound, basic modes of transmission, ultrasonic display modes: A scan, B scan & M scan with applications. Biological effects of ultrasound.

UNIT IV (12 Hrs..)

Electrical Safety: General consideration for biomedical recorder amplifiers, sources of noise in zero level recording circuits, physiological effects of electrical currents, electric shock hazards, leakage currents, methods of accident prevention. Test instruments for checking safety parameters of biomedical equipment.

Recommended Books

1. R.S. Khandpur, 'Handbook of Biomedical Instrumentation', Tata McGraw Hill.
2. L. Cromwell, F. Weibell, E.A. Pfciffer, 'Biomedical Instrumentation & Measurements', PHI.
3. Carr & Brown, 'Introduction to Biomedical Equipment', McGraw Hill.
4. J.G. Webster, 'Medical Instrumentation', 3rd Edn., John Wiley.

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PROCESS CONTROL

Course Code: BECE3-729 **L T P C 3 1 0 4** **Duration: 48 Hrs.**

Course Objectives:
1. To identify the various process variables and mathematical modeling.
2. To learn about the controlling modes of process control.
3. To study the different types of actuators.
4. To study various advanced control schemes.

Course Outcomes:
At the end of the course the student shall be able to:
1. Understand need and application of mathematical modeling.
2. Realize and analyze the control modes.
3. Describe the various types of actuators used in process control.
4. Understand the different advanced control schemes.

UNIT I (12 Hrs.)

Introduction: Incentives of process control, Synthesis of control system. Classification and definition of process variables.

Mathematical Modelling: Need and application of mathematical modelling, Lumped and distributed parameters, Analogies, Thermal, Electrical and chemical systems, Modelling of CSTR, modelling of heat exchanger, Interacting and non-interacting type of systems, Dead time elements, Developing continuous time and discrete time models from process data.

UNIT II (12 Hrs.)

Control Modes: Definition, Characteristics and comparison of on-off, Proportional (P), Integral (I), Differential (D), PI, PD, PID, Dynamic behavior of feedback controlled processes for different control modes, Control system quality, IAE, ISE, IATE criterion, tuning of controllers Ziegler-Nichols, Cohen-Coon methods, Controller troubleshooting.

Realization of Control Modes: Realization of different control modes like P, I, D, In Electric, Pneumatic, Hydraulic controllers.

UNIT III (12 Hrs.)

Actuators: Hydraulic, Pneumatic actuators, Solenoid, E-P converters, Control valves, Types, Functions, Quick opening, Linear and equal percentage valve, Ball valves, Butterfly valves, Globe valves, Pinch valves, Valve application and selection, Cavitation and flashing, Dampers and variable speed Drives.

UNIT IV (12 Hrs.)

Advanced Controls: Introduction to advanced control schemes like Cascade, Feed forward, Ratio, Selective, Override, Split range and Auctioneering control, Plant wide control.

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.

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VLSI DESIGN

Subject Code: BECE3-768 | **L T P C** **3 0 0 3** | **Duration: 37 Hrs.**

Course 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 tradeoffs involved in designing and realizing the circuits in CMOS technology are discussed.

Course 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 behavioral, 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 (12 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 (12 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', Tata McGraw Hill.
5. S.M. Kang, Y. Lebiebici, 'CMOS Digital Integrated Circuits Analysis & Design', Tata McGraw Hill.

MRSPTU

POWER PLANT INSTRUMENTATION

Subject Code: BECE3-769 **L T P C** **Duration: 37 Hrs.**
3 0 0 3

Course Objectives:

1. To identify the various process of thermal power plant.
2. To learn about the boiler and turbine instrumentation.
3. To study the automation strategy of thermal power plant.
4. To study hydroelectric power generation and regulation.

Course Outcomes:

At the end of the course the student shall be able to:

1. Understand comparison between thermal, hydro, nuclear power plant.
2. Analyze the different parameters of boiler and turbines.
3. Describe the PLC, DCS, SCADA strategies of industrial automation.
4. Understand the different hydraulic and nuclear power generators.

UNIT I (12 Hrs.)

Thermal Power Plant: Unit overview, types of boilers, turbine generators, condensers, variable speed pumps and fans, material handling system. Comparison of thermal, hydro, nuclear power plant, boiler safety standards, boiler inspection procedures.

UNIT II (12 Hrs.)

Boiler & Turbine instrumentation: Control and optimization, combustion control, air to fuel ratio control, 3-element drum level control, steam temperature and pressure control, Oxygen/CO/CO2 furnace draft, electrical megawatt controls, boiler interlocks, sequence event recorder, supervisory control, data acquisition systems, burner management systems and controllers.

Turbine Instrumentation: Speed calculation, valve actuation, auto-start-up, thermal stress control, condition monitoring and power distribution instrumentation.

UNIT III (12 Hrs.)

Automation strategy of thermal power plant (PLC, DCS, SCADA) and open system application, block schematic, control equipment, boiler automation, diagnostic functions and protection, digital electro hydraulic governor, man-machine interface, software system, graphic display of automated power plant application functions, variable pressure control.

UNIT IV (12 Hrs.)

Hydroelectric power generation, regulation and monitoring of voltage and frequency, pollution and effluent monitoring and control. Nuclear power generation and control station.

Recommended Books

1. Payne and Thompson, 'Efficient Boiler Operation Source Book', The Fairmont Press.
2. Popovic & Bhatkar, 'Distributed Computer Control for Industrial Automation', Marcel Dekker.
3. Dickinson and Cheremisinoff, 'Solar Energy Technology', Vol. I, II, Marcel Dekker, CRC Press.
4. Krishna Kant, 'Computer Based Industrial Control', PHI.
5. Energy Management Handbook by W.C.Turner, John willey & Sons .
6. Energy Technology Handbook by D.M.Considine, Tata McGraw Hill.
7. B.G. Liptak, 'Process Control', CRC Press.

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BASICS OF SOCIAL SCIENCE, ECONOMICS AND INDUSTRIAL MANAGEMENT

Subject Code: BECE3-770 **L T P C** **Duration: 37 Hrs.**
3 0 0 3

Course Objectives:
1. To study the several aspects of social change
2. To learn about nature and scope of economics.
3. To study about the difference of management and administration.
4. To study marketing management and total quality management.

Course Outcomes:

At the end of the course the student shall be able to:
1. Understand the processes of social change.
2. Analyze the different parameters of industrial economics.
3. Describe the entrepreneurial qualities, skills, role of government, financing agencies
4. Understand the marketing management and total quality management

Unit I (12 Hrs.)

Meaning of social change, nature of social change, theories of social change. The direction of social change, the causes of social change, the process of social change. Factors of social change - the technological factors, the cultural factors, the effect of technology on major social institutions, social need of status system, social relations in industry.

Unit II (12 Hrs.)

Nature and Scope of Economics: Special significance of economics to engineers. Meaning of Industrial Economic, production function and its type; least cost combination, law of variable proportion, law of return increasing, constant and diminishing. Fixed and variable costs in short run and long run, opportunity costs, relation between AC and MC, U shaped short run AC curve. Price and output determination under monopoly in short run and long run. Price discrimination, price determination under discriminating monopoly. Comparison between monopoly and perfect competition.

Unit III (12 Hrs.)

Meaning of Management: Characteristics of management, management versus administration, management-art, science and profession, Fayol's principles of management. Personal management - meaning and functions, manpower – process of manpower planning, recruitment and selection – selection procedure. Training – Objectives and types of training, various methods of training. Labour legislation in India – main provisions of industrial dispute & act 1947. Industrial ownership: types, single partnership, JSC, cooperative, public sector, private sector, merits & demerits. Entrepreneurial qualities, skills, role of government, financing agencies.

Unit IV (12 Hrs.)

Marketing Management: Definition and meaning, scope of marketing management, marketing research meaning, objectives. Purchasing management – meaning and objectives, purchase procedure, inventory control techniques. Financial management- Introduction, objectives of financial decision, source of finance. Quality management: Concepts and applications of Kaizen, quality circle, ISO 9000series, just-in-time, quality planning and total quality management, elements of TQM, quality circles.

Recommended Books

1. K.P. Sundharam and E.N. Sundharam, 'Economic Analysis', Sultan Chand & Sons.
2. M.L. Jhingam, 'Micro Economic Theory', Konark Publishers Pvt. Ltd.
3. M.L. Seth, Lakshami Narain Aggarwal, 'Principles of Economics', Educ. Pub. Agra.
4. D.R. Sachdeva and Vidya Bhusan, 'An Introduction to Sociology', Kitab Mahal Pub.
5. R.D. Aggarwal, 'Organization and Management', Tata McGraw Hill.
6. N.C. Shukla, 'Business Organization and Management', Sultan Chand & Sons.

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DIGITAL SYSTEM DESIGN

Subject Code: BECE3-771 **L T P C** **Duration: 37 Hrs.**
3 0 0 3

Course Objectives:
1. To outline the formal procedures for the analysis and design of combinational circuits and sequential circuits
2. To introduce the concept of memories and programmable logic devices.
3. To illustrate the concept of synchronous and asynchronous sequential circuits

Course Outcomes:
Students will be able to:
1. Design and implement Combinational circuits.
2. Design and implement synchronous and asynchronous sequential circuits.
3. Write simple HDL codes for the circuits.

UNIT-I (12 Hrs.)

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 (12 Hrs.)

Multi-input System Controllers Design: System controller, controller design principles, timing and frequency considerations, DFD development, controller architecture design, asynchronous input handling.

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 (12 Hrs.)

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 (12 Hrs.)

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.

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PROCESS CONTROL LAB.

Subject code: BECE3-730 **L T P C**
0 0 2 1

Course Objectives:
To get practical knowledge of process control based systems, programmable logic controller, Fuzzy Controller, and software based PLC operation.

Course Outcomes:
1. To familiarize with PID control & its tuning procedures.
2. To experiment various functions of a Fuzzy Controller.
3. To practice various process control based pressure and level control system.

EXPERIMENTS

1. To study the control valve, shuttle valve and logic valve on pneumatic trainer.
2. To study PID control & its tuning procedures on a furnace.
3. To study the functioning of a Fuzzy Controller.
4. To study the operation of programmable logic controller.
5. To study the effect of cascade control in temp and flow system.
6. To study the effect of forward control in temp and flow system.
7. To study the process control based pressure control system.

8. To study the process control operation in level control.
9. To study distribution process control in temp process and level system.
10. To study the supervisory control in process control.
11. To study of a Software-based PLC operation.

Note: At least 10 experiments are required to be performed.

MINOR PROJECT

Subject code: BECE3-732 **L T P C**
0 0 4 4

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.

VIRTUAL INSTRUMENTATION

Subject Code: BECE3-833 **L T P C** **Duration: 48 Hrs.**
3 1 0 4

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Course Objectives:
1. To study the basic concept of virtual instrumentation.
2. To learn various programing methods of virtual instrumentation.
3. To know the characteristics of data acquisition system.
4. To understand various application of virtual instrumentation.

Course Outcomes:
Upon completion of the course, students will be able to
1. Explore historical perspective and architecture of virtual instrumentation
2. Understand programing methods and analysis tools of virtual instrumentation.
3. Analyze the field of data acquisition system.
4. Learn about various applications of virtual instrumentation.

UNIT I (12 Hrs.)

Introduction to Virtual Instrumentation: Definition of virtual instrumentation, need & advantage of virtual instrumentation, historical perspective of virtual instrumentation. Block diagram & architecture of V.I., data flow techniques, graphical programming in data flow & comparison of conventional programming.

UNIT II (12 Hrs.)

Programming Methods: VIS & sub VIS, loops& charts, arrays, cluster, graphs, sequence & structure, formula modes, local and global variables, string& file inputs. Analysis tools: Fourier transforms, power spectrum, correlation methods, windowing &filtering.

UNIT III (12 Hrs.)

Data Acquisition Systems: ADC, DAO, DIO, ccounters & timers, PC hardware structures, timing, interrupts, DMA, software& hardware installations. Current loops, RS 232/RS 485, GPIB,system basics, interface basics, USB, PCMIA,VXI,SCXI,PXI etc., networking basics for office & industrial application VISA & VI , image acquisition & processing , motion control.

UNIT IV (12 Hrs.)

Application of Virtual Instrumentation: Application in process control, Laboratory equipments: Oscilloscope, digital multi meter, Pentium computer, lab view software. Study of data acquisition & control using lab view. Virtual instrumentation for an innovative thermal conductivity apparatus to measure the thermal conductivity.

Recommended Books

1. Gary Johnson, 'Labview Graphical Programming', 2^{nd} Edn., McGraw Hill, New York.
2. Lisa K. Wells & Jeffrey Travis, 'Labview for Everyone', Prentice Hall, New Jersey.

PROGRAMMABLE LOGIC CONTROLLER

Subject Code: BECE3-872 **L T P C** **Duration: 37 Hrs.**
3 0 0 3

Course Objectives:

1. To outline the formal procedures for the analysis of PLC
2. To introduce the commands and functions of PLC
3. To illustrate the concept of advance functions.

Course Outcomes:

Students will be able to:

1. Understand the need for automation in process industries
2. Learn about the various technologies used in process automation.
3. Learn programming of PLC.

UNIT I (10 Hrs.)

Introduction to PLC: Evolution Advantages/Disadvantages: system description, internal operation of CPU and I/C modules, installation &testing.

Programs & Software: General programming procedures, registers and Addresses, Relation of Digital Gate Logic to contact logic.

UNIT II (14 Hrs.)

Basic PC Functions: Programming, On-Off inputs to produce on – off outputs: Timers, Counters: Auxiliary Commands &functions.

UNIT III (12 Hrs.)

Intermediate Functions: Arithmetic functions, Number Comparison functions, The skip & master control relay functions.

Functions involving individual register bits: Utilizing digital bits, the sequences functions, Matrix functions.

UNIT IV (12 Hrs.)

Advanced Functions: Controlling a robot with a PC; Analog PC operator, Immediate update, select continuously, ascending sort, transmit print, FIFO, LIFO & Loop Control.

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.

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5. B.G. Liptak, 'Instrument Engineers Handbook', CRC Press.

REMOTE SENSING AND THERMAL IMAGING

Subject Code: BECE3-873 **L T P C** **Duration: 37 Hrs.**
3 0 0 3

Course Objectives:
1. To outline the formal procedures for the basics and history of remote sensing
2. To introduce the concept of Microwave Remote Sensing.
3. To illustrate the concept of Thermal Imaging system.
4. To study Meteorological satellite characteristics and their orbits

Course Outcomes:
Students will be able to:
1. Describe the principles and history of remote sensing.
2. Illustrate platforms and remote sensing sensors.
3. Learn electromagnetic spectrum, and atmospheric transmission for thermal imaging system.
4. Understand applications, future trends and research in remote sensing.

UNIT I (12 Hrs.)

Basics of Remote Sensing: Principles of Remote sensing, History of Remote sensing, Remote sensing in India, Electromagnetic Radiation and Electromagnetic Spectrum, EMR quantities: Nomenclature and Units Thermal Emission of Radiation, Radiation Principles (Plank's Law, Stephen Boltzmann law), Interaction of EMR with the Earth Surface (Wien's displacement law, Kirchhoff's Law) Spectral signature, Reflectance characteristics of Earths cover types, Remote sensing systems.

UNIT II (12 Hrs.)

Platforms and sensors: Platforms, Remote sensing sensors, resolutions Across track and along the track scanning, Optical sensors, Thermal scanners Microwave sensing radar satellite missions. Land sat series, SPOT series, IRS satellite series, IKNOS.

Microwave Remote Sensing: Airborne and Space borne radar systems basic instrumentation. System parameters: Wave length, Polarization, Resolutions, Radar geometry. Target parameters - Back scattering, Point target, Volume scattering, Penetration, Reflection, Bragg resonance, Cross swath variation. Speckie radiometric calibration, Radar Grametry, Introduction, Mosaicing Stereoscope.

UNIT III (12 Hrs.)

Thermal Imaging system: Thermal Imaging System: Introduction - IR region of the Electromagnetic spectrum, Atmospheric transmission, Kinetic and radiant temperature, Thermal properties of materials, Emissivity, Radiant temperature. Thermal conductivity. Thermal capacity, thermal inertia, Apparent thermal inertia, Thermal diffusivity. IR - radiometers, Airborne and Satellite TTR scanner system Characteristics of IR images: Scanner distortion, image irregularities, Film density and recorded & Temperature ranges. Effects of weather on images; Clouds, Surface winds and Penetration of smoke plumes. Interpretation of thermal imagery.

UNIT IV (12 Hrs.)

Meteorological Satellites: Meteorological satellite characteristics and their orbits, TIROS, NIMBUS, NOAA, TIROS, SEASAT, GOES, METEOSAT, INSAT**.** Measurement of Earth and Atmospheric energy and Radiation budget parameters from satellites. Applications of remote sensing: Geology, Forestry, Land use, Soils etc. Future trends and Research.

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Recommended Books

1. W. Travelt , 'Imaging Radar for Resource Survey: Remote Sensing Applications', Chapman & Hall.
2. P.H. Swain and S.M. Davis, 'Remote Sensing: The Quantitative Approach', McGraw Hill.
3. Floyd, F. Sabins, 'Remote Sensing Principles and Interpretation', Jr. Freeman and Co. San Franscisco.
4. 'Applied Remote Sensing C.P.L.O.', Longman Scientific and Technical Publishers.
5. E.C. Barrett & L.F Curtis, 'Introduction to Environmental Remote Sensing', Chapman and Hall, London.
6. George Joseph, 'Fundamentals of Remote Sensing', Universities Press.

ADVANCE PHOTONICS

Subject Code: BECE3-874	**L T P C** **3 0 0 3**	**Duration: 37 Hrs.**

Course Objectives:
1. To understand the various photonics concepts.
2. To introduce the concept of wave optics.
3. To illustrate the concept how propagation of light in confined geometries is done.

Course Outcomes:
Students will be able to:
1. Understand various photonics concepts.
2. Understanding of wave optics.
3. Propagation of light through various geometries.

UNIT I (12 Hrs.)

Introduction to Photonics – Nature of Light – Wave and light terminology, Maxwell equation, light spectra and sources, absorption and emission, black body radiation. Geometric Optics – Light as a ray, law of reflection including plane mirrors, law of refraction including optical fiber applications, prisms and thin lenses including Lens maker's equation, Lens problems and optical instruments using the thin lens equation.

UNIT II (12 Hrs.)

Wave Optics – wave descriptive terminology, wave superposition (interference) including double – slit interference, diffraction and diffraction gratings, interference applications, e.g. Michelson, Mach Zender and Fabry Perot interferometers, Thin film interference and Fiber Bragg Gratings. Diffraction Effects including: airy disk, near far field effects. Polarization principles including scattering, reflection and birefringence.

UNIT III (12 Hrs.)

Propagation of light in confined geometries, planar waveguides, Optical fibers and their design, Linear and Nonlinear wave propagation in Fibers, Optical Solitons, Directional couplers, Fiber Bragg gratings, Fiber-optic communication systems. Generation of light in semiconductors, Electroluniscence, p-n junction and hetrostructure LEDs, their properties and modulation, Semi-conductor lasers (p-n junction diode, MQW and DFB lasers) and their modulation, Semiconductor Amplifiers.

UNIT IV (12 Hrs.)

Photo-chemical effects, CDROMS, Magneto Optic memories, Persistent spectral hole burning and data storage. Photo detectors – thermal and quantum devices, Noise in light detectors. Coherent and squeezed

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states of light, Quantum no demolition measurement, correlated photons, Entanglement and applications to quantum information processing, Coherent control of physical processes.

Recommended Books

1. T.P. Pearsall, 'Photonics Essentials: An Introduction with Experiments', McGraw Hill.
2. F.G. Smit and T.A. King, 'Optics and Photonics: An introduction', John Wiley & Sons.
3. B. Balkrishna Laud, 'Lasers and Non-Linear Optics', Halsted Press.
4. F.A. Jenkins and H.E. White, 'Fundamentals of Optics', McGraw Hill.
5. R.S. Quimby, 'Photonics and Lasers-An Introduction', Wiley-Interscience.
6. E.A. Baha, Saleh and M.C. Teich, 'Fundamental of Photonics', John Wiley and Sons.

DATA ACQUISITION AND PROCESSING

Subject Code: BECE3-875	L T P C 3 0 0 3	Duration: 37 Hrs.

Course Objectives

1. To impart knowledge about the measuring instruments and the methods of measurement
2. To understand different ADCs and DACs.
3. To study and practice calibration and testing of different instrumentation systems.

Course Outcomes

At the end of the course the student shall be able to:

1. Do error budget analysis associated with DACS and ADCS.
2. Analyse and use the functions of various instrumentation systems.

UNIT-I (12 Hrs.)

Introduction: Objective of a DAS, single channel DAS, Multi-channel DAS, Components used in DAS– Converter Characteristics-Resolution-Non-linearity, settling time, Monotonicity.

Digital to analog converters (DACS): Principles and design of – Parallel R– 2R, weighted resistor, inverted ladder, D/A decoding – Codes other than ordinary binary.

UNIT-II (12 Hrs.)

Analog to Digital Converters (ADCS): Classification of A/D converters. Parallel feedback – Successive approximation – Ramp comparison – Dual slope integration – Voltage to frequency – Voltage to Time – Logarithmic types of ADCS.

non-linear data converters (NDC): Basic NDC configurations – Some common NDACS and NADCS – Programmable non-linear ADCS – NADC using optimal sized ROM – High speed hybrid NADC – PLS based NADC – Switched capacitor NDCS.

UNIT-III (12 Hrs.)

Data Converter Applications: DAC applications – Digitally programmable V/I source – Arbitrary waveform generators – Digitally programmable gain amplifiers – Analog multipliers/ dividers – Analog delay lines.

ADC APPLICATIONS: Data Acquisition systems – Digital signal processing systems – PCM voice communication systems – Test and measurement instruments – Electronic weighing machines.

UNIT-IV (12 Hrs.)

Monolithic Data Converters: Typical study of monolithic DACS and ADCS. Interfacing of DACS and ADCS to a microprocessor.

Error budget of DACS and ADCS: Error sources, error reduction and noise reduction techniques in DAS. Error budget analysis of DAS, case study of a DAC and an ADC.

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Recommended Books

1. Dinesh K. Anvekar, B.S. Sonde, 'Electronic Data Converters Fundamentals and Applications', Tata McGraw Hill.
2. H.S. Kalsi, 'Electronic Instrumentation', Tata McGraw Hill.
3. Hermann Schmid, 'Electronic Analog/ Digital Conversions', Tata McGraw Hill.
4. E.R. Hanateck, 'User's Handbook of D/A and A'.

VIRTUAL INSTRUMENTATION LAB.

Subject Code: BECE3-834 **L T P C**
0 0 2 1

Course Objectives:
To get practical knowledge in programming techniques, data acquisition and interfacing techniques of virtual instrumentation and to use VI for different applications.

Course Outcomes:
1. To familiarize with the VI software and learn programming in VI.
2. To experiment various functions available in LabVIEW.
3. To practice various Instrument Interfacing and data acquisition methods.
4. To check various analysis tools and develop programs for Process control applications.

EXPERIMENTS

1. Verification of Arithmetic Operations.
2. Verification of Half Adder and Full adder.
3. Program to find Addition of First n natural numbers using for and while loop.
4. Implementation of Array functions.
5. Program for implementing seven segment displays.
6. Program to perform Traffic light control.
7. Calculation of BMI using cluster.
8. Program to control Temperature by using RTD and DAQ.
9. Program to control Temperature by using Thermocouple and DAQ
10. Program to control Temperature by using Thermistor and DAQ
11. Program for controlling the Flow of water using DAQ.
12. Program for controlling the Level of water using DAQ.
13. Program for Pressure control using DAQ.
14. Program for controlling the speed of a DC motor using PID tool box.

Note: At least 10 experiments are required to be performed.

MAJOR PROJECT

Subject Code: BECE3-835 **L T P C**
0 0 12 6

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,

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report writing. Students can use different hardware and software in order to analyse and verify the results.

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3rd Semester		Contact Hrs.			Marks			Credits
Code	**Course**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
BITE2-302	Data Structures	3	1	0	40	60	100	4
BITE2-303	Object Oriented Programming Using C++	3	0	0	40	60	100	3
BITE2-304	Digital Circuits & Logical Design	3	0	0	40	60	100	3
BITE2-305	Computer Architecture & Organization	3	0	0	40	60	100	3
BITE2-306	Discrete Structures	3	1	0	40	60	100	4
BITE2-307	Data Structures Lab.	0	0	2	60	40	100	1
BITE2-308	Object Oriented Programming Using C++ Lab.	0	0	2	60	40	100	1
BITE2-309	Digital Circuit & Logical Design Lab.	0	0	2	60	40	100	1
BHUM0-F91	Soft Skills-I	0	0	2	60	40	100	1
BITE2-310	Training-I#	0	0	4	60	40	100	2
Total		**15**	**2**	**12**	**500**	**500**	**1000**	**23**

 # 4-Week Training during summer vacations after 2nd semester

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4th Semester		Contact Hrs.			Marks			Credits
Code	**Course**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
BITE2-411	Operating System	3	0	0	40	60	100	3
BITE2-412	Database Management Systems-I	3	0	0	40	60	100	3
BITE2-413	Computer Networks-I	3	0	0	40	60	100	3
BITE2-414	Design & Analysis Of Algorithms	3	1	0	40	60	100	4
BITE2-415	Microprocessors & Assembly Languages	3	0	0	40	60	100	3
BITE2-416	Database Management Systems-I Lab.	0	0	4	60	40	100	2
BITE2-417	Computer Networks-I Lab.	0	0	2	60	40	100	1
BITE2-418	Design & Analysis of Algorithms Lab.	0	0	2	60	40	100	1
BITE2-419	Microprocessors & Assembly Languages Lab.	0	0	2	60	40	100	1
BHUM0-F92	Soft Skills-II	0	0	2	60	40	100	1
Total		**15**	**1**	**12**	**500**	**500**	**1000**	**22**

5th Semester		Contact Hrs.			Marks			Credits
Code	**Course**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
BITE2-520	System Analysis and Design	3	1	0	40	60	100	4
BITE2-521	Programming in Java	3	1	0	40	60	100	4
BITE2-522	Computer Networks-II	3	1	0	40	60	100	4
Departmental Electives-I (Choose any one)		3	1	0	40	60	100	4
BITE2-556	Cyber Laws & IPR							
BITE2-557	Compute4r Graphics							
BITE2-558	Linus & Shell Programming							
BITE2-523	Programming in Java Lab.	0	0	2	60	40	100	1
BITE2-524	Computer Networks-II Lab.	0	0	2	60	40	100	1
BHUM0-F93	Soft Skills-III	0	0	2	60	40	100	1
Open Elective-I (Choose any one)		3	0	0	40	60	100	3
BITE2-525	Training-II#	0	0	4	60	40	100	2
Total		**15**	**4**	**10**	**440**	**460**	**900**	**24**

 # 6-Week Training during summer vacations after 4th semester

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6th Semester		Contact Hrs.			Marks			Credits
Code	**Course**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
BITE2-626	Network Programming	3	1	0	40	60	100	4
BITE2-627	Software Engineering	3	1	0	40	60	100	4
Departmental Electives-II (Choose any one)		3	1	0	40	60	100	4
BITE2-659	Mobile App Development							
BITE2-660	Cryptography & Network Security							
BITE2-661	Web Technologies							
Departmental Electives-III (Choose any one)		3	1	0	40	60	100	4
BITE2-662	Cloud Computing							
BITE2-663	Enterprise Resource Planning							
BITE2-664	Parallel & Distributed							
BITE2-628	Network Programming Lab.	0	0	2	60	40	100	1
BITE2-629	Software Engineering Lab.	0	0	2	60	40	100	1
Open Elective-II (Choose any one)		3	0	0	40	60	100	3
BHUM0-F94	Soft Skills-IV	0	0	2	60	40	100	1
Total		**15**	**4**	**6**	**380**	**420**	**800**	**22**

7th Semester		Contact Hrs.			Marks			Credits
Code	**Course**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
BITE2-730	Building Enterprise Applications	3	1	0	40	60	100	4
BITE2-731	Simulation and Modeling	3	1	0	40	60	100	4
BITE2-732	Building Enterprise Applications Lab.	0	0	4	60	40	100	2
BITE2-733	Simulation and Modeling Lab.	0	0	4	60	40	100	2
BITE2-734	Training-III#	0	0	0	60	40	100	4
BITE2-735	Project-I	0	0	8	60	40	100	4
Departmental Electives-IV (Choose any one)		3	1	0	40	60	100	4
BITE2-765	Information Security and Risk Management							
BITE2-766	Digital Image Processing							
BITE2-767	Software Project Management							
Total		**9**	**3**	**16**	**360**	**340**	**700**	**24**

 # 8-Week Training during summer vacations after 6th semester

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8th Semester		Contact Hrs.			Marks			Credits
Code	**Course**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
BITE2-836	Artificial Intelligence and Expert Systems	3	1	0	40	60	100	4
BITE2-837	Artificial Intelligence and Expert Systems Lab.	0	0	4	60	40	100	2
BITE2-838	Project-II	0	0	12	60	40	100	6
Departmental Electives-V (Choose any one)		3	0	0	40	60	100	3
BITE2-668	Mobile App Development							
BITE2-669	Cryptography & Network Security							
BITE2-670	Web Technologies							
Total		**6**	**1**	**16**	**200**	**200**	**400**	**15**

Total Credits = 25 + 25 + 23 + 22 + 24 + 22 + 24 + 15 = 180

DATA STRUCTURES

Subject Code: BITE2-302 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

COURSE 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.

COURSE 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

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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 COURSE 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 COURSE, **2012**.

OBJECT ORIENTED PROGRAMMING USING C++

Subject Code: BITE2-303 **L T P C** **Duration: 36 Hrs.**
3 0 0 3

Course Objectives:
To introduce the principles and paradigms of Object Oriented Programming Language for design and implement the Object Oriented System

Course 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- BITE2-304	**L T P C** **3 0 0 3**	**Duration: 36 Hrs.**

Course Objectives:

To learn the basic methods for the design of digital circuits and provide the fundamental concepts used in the design of digital systems.

Course 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.

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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-McCluskey method - 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 COURSE, **2012**.

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COMPUTER ARCHITECTURE & ORGANISATION

Subject Code- BITE2-305 **L T P C** **Duration: 36 Hrs.**
3 0 0 3

Course 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.

Course 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.

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- BITE2-306	L T P C 3 1 0 4	Duration: 45 Hrs.

Course 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.

Course Outcomes:

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

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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)

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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 COURSE.
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: BITE2-307 **L T P C**
0 0 2 1

COURSE 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

OBJECT ORIENTED PROGRAMMING USING C++ LAB.

Subject Code- BITE2-308 **L T P C**
0 0 2 1

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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- BITE2-309 **L T P C**
0 0 2 1

Course 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.

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.

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SOFT SKILLS-I

Subject Code: **BHUM0-F91** **L T P C**
0 0 2 1

Course Objectives:
The course aims to cause a basic awareness about the significance of soft skills in professional and interpersonal communications and facilitate an all-round development of personality.

Course Outcomes:
At the end of the course, the student will be able to develop his/her personal traits and expose their personality effectively.

UNIT-1

SOFT SKILLS: Introduction to Soft Skills, Aspects of Soft Skills, Identifying your Soft Skills, Negotiation skills, Importance of Soft Skills, Concept of effective communication.
SELF-DISCOVERY: Self-Assessment, Process, Identifying strengths and limitations, SWOT Analysis Grid.

UNIT-2

FORMING VALUES: Values and Attitudes, Importance of Values, Self-Discipline, Personal Values - Cultural Values-Social Values-some examples, Recognition of one's own limits and deficiencies.

UNIT-3

ART OF LISTENING: Proxemics, Haptics: The Language of Touch, Meta Communication, Listening Skills, Types of Listening, Listening tips.

UNIT-4

ETIQUETTE AND MANNERS: ETIQUETTE- Introduction, Modern Etiquette, Benefits of Etiquette, Taboo topics, Do's and Don'ts for Men and Women. MANNERS- Introduction, Importance of manners at various occasions, Professional manners, Mobile manners. CORPORATE GROOMING TIPS- Dressing for Office: Do's and Don'ts for Men and Women, Annoying Office Habits.

Recommended Books

1. K. Alex, S. Chand Publishers.
2. Butterfield, Jeff, 'Soft Skills for Everyone', Cengage Learning, New Delhi, **2010**.
3. G.S. Chauhan and Sangeeta Sharma, 'Soft Skills', Wiley, New Delhi, **2016**.
4. Klaus, Peggy, Jane Rohman & Molly Hamaker, 'The Hard Truth About Soft Skills', Harper Collins E-books, London, **2007**.
5. S.J. Petes, Francis, 'Soft Skills and Professional Communication', Tata McGraw Hill Education, New Delhi, **2011**.

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OPERATING SYSTEMS

Subject Code: BITE2-411 | **L T P C** **3 0 0 3** | **Duration: 38 Hrs.**

Course Objectives:

To understand the services and design of Operating Systems. To understand the organization of file systems and process scheduling and memory management

Course 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.

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**.

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DATABASE MANAGEMENT SYSTEMS-I

Subject Code- BITE2-412	L T P C 3 0 0 3	Duration: 45 Hrs.

Course Objectives:

To familiarize the students with Data Base Management system

Course 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.**

COMPUTER NETWORKS-I

Subject Code- BITE2-413	L T P C 3 0 0 3	Duration: 38 Hrs.

Course 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

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(Physical, Data Link, Network and Transport) layers of the model. They are also introduced to the areas of Network Security and Mobile Communications.

Course 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

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**.

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5. Douglas E. Comer, 'Internetworking with TCP/IP', Volume-I, 2nd Edn., Prentice Hall, India, **1996**.
6. Greg Tomsho, 'Guide to Networking Essentials', 6th Edn.., Cengage COURSE, **2011**.
7. Michael W. Graves, 'Handbook of Networking', Cengage COURSE.

DESIGN & ANALYSIS OF ALGORITHMS

Subject Code- BITE2-414 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

Course 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.

Course 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.

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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.

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- BITE2-415 **L T P C** **Duration: 37 Hrs.**
3 0 0 3

Course Objectives:
The course is intended to give students good understanding of internal architectural details and functioning of microprocessors.
Course 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**.

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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 COURSE, **2007.**

DATABASE MANAGEMENT SYSTEMS-I LAB.

Subject Code- BITE2-416 **L T P C**
0 0 4 2

Course 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- BITE2-417 **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- BITE2-417 **L T P C**
0 0 2 1

Course 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 analyse to compute the greatest common divisor (GCD) of two numbers.
2. Code and analyse to find the median element in an array of integers.
3. Code and analyse to find the majority element in an array of integers.
4. Code and analyse to sort an array of integers using Heap sort.
5. Code and analyse to sort an array of integers using Merge sort.
6. Code and analyse to sort an array of integers using Quick sort.
7. Code and analyse Knapsack problem using dynamic programming
8. Code and analyse to find the shortest path for single source shortest path using dynamic programming.
9. Code and analyse to find the shortest path for All pair shortest path using dynamic programming.
10. Code and analyse 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 analyse 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 analyse to find the minimum spanning tree in a weighted, undirected graph.
13. Code and analyse to find all occurrences of a pattern P in a given string S using KMP Method
14. Code and analyse to compute the convex hull of a set of points in the plane.

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MICROPROCESSORS AND ASSEMBLY LANGUAGES LAB.

Subject Code-BITE2-419 **L T P C**
0 0 2 1

Course 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.

SOFT SKILLS-II

Subject Code: **BHUM0-F92** **L T P C**
0 0 2 1

Course Objectives:
The course aims to address various challenges of communication as well as behavioural skills faced by individual at work place and organizations. Also, it aims to enhance the employability of the students.

Course Outcomes:
At the end of the course the student will be able to understand the importance of goal setting. They will also be able to handle stress in their lives and future in a better way.

UNIT-1

DEVELOPING POSITIVE ATTITUDE: Introduction. Formation of attitude. Attitude in workplace. Power of positive attitude. Examples of positive attitudes. Negative attitudes. Examples of negative attitude. overcoming negative attitude and its consequences.
IMPROVING PERCEPTION: Introduction. Understanding perception. perception and its application in organizations.

UNIT-2

CAREER PLANNING: Introduction. Tips for successful career planning. Goal setting-immediate, short term and long term. Strategies to achieve goals. Myths about choosing career.

UNIT-3

ART OF READING: Introduction. Benefits of reading. Tips for effective reading. the SQ3R technique. Different stages of reading. determining reading rate of students. Activities to increase the reading rate. Problems faced. Becoming an effective reader.

UNIT-4

STRESS MANAGEMENT: Introduction. meaning. positive and negative stress. Sources of stress. Case studies. signs of stress. Stress management tips. Teenage stress.

Recommended Books

1. K. Alex, S. Chand Publishers.
2. Rizvi, M. Ashraf, 'Effective Technical Communication', McGraw Hill.
3. Mohan Krishna & Meera Banerji, 'Developing Communication Skills', Macmillan.
4. Kamin, Maxine, 'Soft Skills Revolution: A Guide for Connecting with Compassion for Trainers, Teams & Leaders', Pfeiffer & Amp; Company, Washington, DC, **2013.**

SYSTEM ANALYSIS AND DESIGN

Subject Code: **BITE2-520** **L T P C** **Duration: 45 Hrs.**
3 1 0 4

Course Objectives:
The course has been designed to provide a solid foundation of systems principles and an understanding of how business function, while heightening students to the issues analysts face daily.

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UNIT-I

1. Introduction: System definition and concepts: Characteristics and types of automated systems, Manual and Real-life Business sub-systems: Production, Marketing, Personal, Material, Finance Systems models types of models: Systems environment and boundaries, Real- time and distributed systems, Basic principles of successful systems

2. Systems Analyst: Role and need of systems analyst, Qualifications and responsibilities, Systems Analyst as an agent of change.

3. System Development Cycle: Introduction to systems development life cycle (SDLC): Various phases of development: Analysis, Design, Development, Implementation, Maintenance Systems documentation considerations: Principles of systems documentation, Types of documentation and their importance, Enforcing documentation discipline in an organization.

UNIT-II

4. System Planning: Data and fact gathering techniques: Interviews, Group communication, Presentations, Site visits. Feasibility study and its importance Types of feasibility reports, System Selection plan and proposal Prototyping Cost-Benefit and analysis: Tools and techniques

5. Systems Design and Modeling:

Process modeling, Logical and physical design, Design representation, Systems flowcharts and structured charts, Data flow diagrams, Common diagramming conventions and guidelines using DFD and ERD diagrams. Data Modeling and systems analysis, Designing the internals: Program and Process design, Designing Distributed Systems.

UNIT-III

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6. Input and Output: Classification of forms: Input/output forms design, User-interface design, Graphical interfaces.

7. Modular and Structured Design: Module specifications, Module coupling and cohesion, Top-down and bottom-up design.

8. System Implementation and Maintenance: Planning considerations, Conversion methods, producers and controls, System acceptance Criteria, System evaluation and performance, Testing and validation, Systems qualify Control and assurance, Maintenance activities and issues.

UNIT-IV

9. System Audit and Security: Computer system as an expensive resource: Data and Strong Media Procedures and norms for utilization of computer equipment, Audit of computer system usage, Audit trails, Types of threats to computer system and control measures: Threat to computer system and control measures, Disaster recovery and contingency planning.

10. Object Oriented Analysis and Design: Introduction to Object Oriented Analysis and design life cycle, object modeling: Class Diagrams, Dynamic diagramming modeling: state diagram, Dynamic modeling: sequence. Case study of the following systems

(I) Inventory Control, (II) Railway Reservation System, (III) University Management System, (IV) Hospital management System.

Recommended Books

1. Elias M. Awad, 'System Analysis and Design'.
2. Perry Edwards, 'System Analysis and Design'.
3. Ames A. Senn, 'Analysis and Design of Information Systems'.

Course Outcomes

Upon successful completion of this course, the student will be able to:

1. Define and describe the five phases of the system development life cycle.
2. State at least five expected benefits from systems projects.
3. Explain at least three ways in which information systems support business requirements.

4. Describe how systems analysts interact with users, management, and other information systems professionals.
5. Develop data flow diagrams and decision tables.
6. Perform a feasibility study.
7. Evaluate systems development alternatives.
8. Solve realistic systems analysis problems.
9. Determine methods for evaluating the effectiveness and efficiency of a system.
10. Work as an effective team member on assigned projects.

PROGRAMMING IN JAVA

Subject Code: **BITE2-521** **L T P C** **3 1 0 4** **Duration: 45 Hrs.**

Course Objectives:
This course will provide the knowledge of Java and prepare students to be in a position to write object oriented programs in Java.

UNIT-I

1. Overview of Java: Object oriented programming, two paradigms, abstraction, the three OOP principles, Java class libraries.

2. Date Types, Variables and Arrays:
Integers, floating-point types, characters, Boolean, Iterates, Variable, Data types and casting, automatic type promotion in expressions, arrays.

3. Operators and Control Statements:
Arithmetic operators, bit wise operators, relational operators, Boolean logical operators, the ? Operators, operator precedence, Java's selection statements, iteration statements, jump statements.

UNIT-II

4. Introduction to Classes:
Class fundamentals, declaring object reference variable, Introducing methods, method. Constructors, this keyword, garbage collection, the finalize.

5. Methods and Classes:
Overloading methods, using objects as parameters, recursion.

6. Inheritance:
Inheritance basics, using super, method overriding, dynamic method dispatch, using abstract Classes, using final with inheritance, Package and Interfaces, Package access protection, importing packages.

UNIT-III

7. Exception Handling: Exception handling fundamentals, Exception types, Uncaught Exceptions Using try and catch, multiple catch clauses, nested try statements, throw, finally Java's built-in exceptions. Exceptions, creating your own exception sub classes, using

8. Multithreaded Programming:
The Java thread model, the main thread, creating thread, creating multiple threads, using is alive and join, Thread priorities, synchronization, inter thread communications, suspending resuming and stopping threads.

9. String Handling:
The string constructors, string length, special string operations, character extraction, string comparison, searching string, modifying string, data conversion, changing the case of characters, string buffer.

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UNIT-IV

10. I/O and Applets:
I/O Basics, Reading Console Input, Writing Console Output, Reading and Writing Files, Applet Fundamentals, Applet Architecture, The HTML Applet tag, Passing parameters to Applets.

11. Networking:
Networking basics, Java and the Net, TCP/IP Client Sockets URL, URL Connection, TCP/IP Server Sockets, Database connectivity.

Recommended Books

1. Herbert Schildt, 'The Complete Reference Java2', McGraw Hill.
2. Joyce Farrell, 'Java for Beginners', Cengage Learning.
3. Deitel and Deitel, 'Java: How to Program', 6th Edn., Pearson Education.
4. James Edward Keogh, Jim Keogh, 'J2EE: The Complete Reference', McGraw Hill.
5. Khalid A. Mughal, Torill Hamre, Rolf W. Rasmussen, 'Java Actually', Cengage Learning.
6. Shirish Chavan, 'Java for Beginners', 2nd Edn., Shroff Publishers.

Course Outcomes

Upon successful completion of this course, the student will be able to:
1. Knowledge of the structure and model of the Java programming language, (knowledge)
2. Use the Java programming language for various programming technologies (understanding)
3. Develop software in the Java programming language, (application)
4. Evaluate user requirements for software functionality required to decide whether the Java programming language can meet user requirements (analysis)
5. Propose the use of certain technologies by implementing them in the Java programming language to solve the given problem (synthesis)
6. Choose an engineering approach to solving problems, starting from the acquired knowledge of programming and knowledge of operating systems. (Evaluation)

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COMPUTER NETWORKS–II

Subject Code: **BITE2-522** | **L T P C** **3 1 0 4** | **Duration: 45 Hrs.**

Course Objectives:
The objective of the course is to offer good understanding of the concepts of network security, wireless, Adhoc and various emerging network technologies. Course Contents:

UNIT-I

1. Network Security: Fundamentals of network security, Basics of IPv6, IPsec: overview of IPsec, IP and IPv6, Authentication header (AH), Encapsulating Security Payload (ESP).

2. Internet Key Exchange (IKE): History, Photuris, Simple Key-management for Internet protocols (SKIP), IKE phases, IKE encoding.

UNIT-II

3. Adhoc Networks: Features, advantages and applications, Adhoc versus Cellular networks, Network architecture, Protocols: MAC protocols, Routing protocols, Technologies.

UNIT-III

4. Wireless Communication Systems: Evolution, examples of wireless communication systems, 2G Cellular networks, Evolution for 2.5G TDMA Standards, IS-95B for 2.5G CDMA.

UNIT-IV

5. 3G Wireless Networks: Wireless local loop (WLL), Local Multipoint Distribution System (LMDS), Wireless local Area Networks (WLANs), Bluetooth and Personal Area Networks.

6. Wireless System Design: Introduction, Frequency reuse, channel assignment strategies, handoff strategies, interference and system capacity, improving coverage and capacity in cellular systems.

Recommended Books

1. Theodore S. Rappaport, 'Wireless Communication: Principles and Practices', 2nd Edn., Pearson Education.
2. Charlie Kaufman, Radio Perlman, Mike Speciner, 'Neywork Security', 2nd Edn., PHI.
3. Sunilkumar S. Manvi, Mahabaleshwar S. Kakkasageri, 'Wireless and Mobile Networks: Concepts and Protocols', Wiley India.
4. Michael A. Gallo & William M. Hancock, 'Computer Communications and Networking Technologies', Cengage Learning / Thomson Brooks / Cole.
5. S. Keshav, 'An Engineering Approach to Computer Networking', Pearson Education. Mayank Dave, 'Computer Networks', Cengage Learning.

Course Outcomes

Upon successful completion of this course, the student will be able to:

1. Able to define the Fundamentals of network security, Characteristics of IPv6 and their addressing format and schemes.
2. Acquire the Knowledge about various concepts of IPSec and able to explain about various concepts of Ad-hoc and Cellular Networks.
3. Acquire the Knowledge about wireless communication systems and their generations with different Technologies.
4. Able to explain about Third Generation Networks, their Technologies, wireless System Design and their various strategies

CYBER LAWS AND IPR

Subject Code: **BITE2-556** **L T P C** **3 1 0 4** **Duration: 45 Hrs.**

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Course Objectives:

The objective of the course is to offer good understanding of Cyber law and awareness of intellectual property rights.

1. Basics of Computer & Internet Technology: Internet, ISP & domain name; Network Security; Encryption Techniques and Algorithms; Digital Signatures.

2. Introduction to Cyber World: Introduction to Cyberspace and Cyber Law; Different Components of cyber Laws; Cyber Law and Netizens.

3. E-Commerce: Introduction to E-Commerce; Different E-Commerce Models; E-Commerce Trends and Prospects; E-Commerce and Taxation; Legal Aspects of E-Commerce.

4. Intellectual Property Rights: IPR Regime in the Digital Society; Copyright and Patents; International Treaties and Conventions; Business Software Patents; Domain Name Disputes and Resolution.

5. IT ACT 2000: Aims and Objectives; Overview of the Act; Jurisdiction; Role of Certifying Authority; Regulators under IT Act; Cyber Crimes-Offences and Contraventions; Grey Areas of IT.

6. Project Work: Candidates will be required to work on a project. At the end of the course students will make a presentation and submit the project report.

Recommended Books

1. Nandan Kamath, 'A Guide to Cyber Laws & IT Act 2000 with Rules & Notification'.
2. Keith Meril l& Deepti Chopra (IK Inter.), 'Cyber Cops, Cyber Criminals & Internet'.
3. Diane Row Land, 'Information Technology Law'.

4. Vakul Sharma, 'Handbook of Cyber Laws', McMillian.

Course Outcomes:

Upon successful completion of this course, the student will be able to:

1. To describe how can stay safe from cybercrime.
2. To understand the features of Intellectual Property rights.
3. To understand about attacks and their properties.

COMPUTER GRAPHICS

Subject Code: **BITE2-557** **L T P C** **Duration: 45 Hrs.**
3 1 0 4

Course 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.

UNIT-I

1. Introduction: Computer Graphics and its applications, Elements of a Graphics, Graphics Systems: Video Display Devices, Raster Scan Systems, Random Scan Systems, Input devices.

2. Basic Raster Graphics: Scan Conversion-Point plot technique, Line drawing, Circle generating and Ellipse generating algorithms.

UNIT-II

3. Two-dimensional Geometric Transformations: Basic Transformations-Translation, Rotation and Scaling, Matrix Representation and Homogeneous Coordinates, Composite Transformations, Reflection and Shearing transformations.

4. Clipping: Window to viewport transformation, Clipping Operations- Point Clipping, Line Clipping, Polygon Clipping and Text Clipping.

UNIT-III

5. Filling Techniques: Scan line algorithms, Boundary-fill algorithm, Flood-fill algorithm, Edge fill and fence fill algorithms

6. Elementary 3D Graphics: Plane projections and its types, Vanishing points, Specification of a 3D view.

UNIT-IV

7. 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.

8. Advance Topics: Introduction of Rendering, Raytracing, Antialiasing, Fractals, Gourard and Phong shading.

Recommended Books

1. Donald Hearn and M. Pauline Baker, 'Computer Graphics', 2nd Edn., PHI/Pearson Education.
2. Zhigandxiang, Roy Plastock, Schaum's Outlines, 'Computer Graphics', 2nd Edn., Tata McGraw Hill.
3. C. Foley, Van Dam, Feiner and Hughes, 'Computer Graphics Principles & Practice', 2nd Edn., Pearson Education.

Course Outcomes:

Upon successful completion of this course, the student will be able to:

1. To provide comprehensive introduction about computer graphics system, design algorithms and two dimensional transformations.

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2. To make the students familiar with techniques of clipping, three dimensional graphics and three dimensional transformations.
3. The computer graphics course prepares students for activities involving in design, development and testing of modeling, rendering, shading and animation.

LINUX AND SHELL PROGRAMMING

Subject Code: **BITE2-558** **L T P C** **Duration: 45 Hrs.**
3 1 0 4

Course Objectives:
This Linux Bash Shell Programming training course is designed to give delegates practical experience in developing and writing LINUX shell scripts. Most of the built-in shell commands are introduced together with the main program control structures. This course is not suitable for C shell programmers.

UNIT–I
Linux introduction and file system - Basic Features, Advantages, Installing requirement, Basic Architecture of Unix/Linux system, Kernel, Shell. Linux File System-Boot block, super block, Inode table, data blocks, How Linux access files, storage files, Linux standard directories. Commands for files and directories cd, ls, cp, md, rm, mkdir, rmdir, pwd, file, more, less, creating and viewing files using cat, file comparisons – cmp&comm, View files, disk related commands, checking disk free spaces. Partitioning the Hard drive for Linux, Installing the Linux system, System startup and shut-down process, init and run levels.

UNIT–II
Essential linux commands Understanding shells, Processes in linux-process fundamentals, connecting processes with pipes, tee, redirecting input output, manual help, Background processing, managing multiple processes, changing process priority with nice, scheduling of processes at command, cron, batch commands, kill, ps, who, sleep, Printing commands, find, sort, touch, file, file related commands-ws, sat, cut, dd, etc. Mathematical commands- bc, expr, factor, units. Creating and editing files with vi, joe & vim editor

UNIT–III
System administration Common administrative tasks, identifying administrative files – configuration and log files, Role of system administrator, managing user accounts-adding & deleting users, changing permissions and ownerships, Creating and managing groups, modifying group attributes, Temporary disable user's accounts, creating and mounting file system, checking and monitoring system performance file security & Permissions, becoming super user using su. Getting system information with name, host name, disk partitions & sizes, users, kernel. Backup and restore files, reconfiguration hardware with kudzu, installing and removing packages with rpm command. Configure X-windows desktop-redhat-config-Xfree86, understanding XF86config file, starting & using X desktop. KDE & Gnome graphical interfaces, changing X settings.

UNIT–IV
Shell Programming- Basic of shell programming, Various types of shell available in Linux, comparisons between various shells, shell programming in bash, read command, conditional and looping statements, case statements, parameter passing and arguments, Shell variables, system shell variables, shell keywords, Creating Shell programs for automate system tasks. Simple filter commands – pr, head, tail, cut, paste, sort, uniq, tr. Flter using regular expressions – grep, egrep, and sed. awk programming – report printing with awk.

Recommended Books
1. Sumitabha Das, 'UNIX – Concepts & Applications', 3rd Edn., Tata McGraw Hill.

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2. Graham Glass & King Ables, 'Unix for Programmers and Users', 3rd Edn., Pearson Education India. (Low Prices Edition).
3. Cristopher Negus, 'Red Hat Linux 9 Bible', IDG Books India Ltd.

Course Outcomes

1. Upon successful completion of this course, the student will be able to:
2. Writing simple scripts to enhance basic command output
3. Using the various shell quoting mechanisms appropriately
4. Manipulating shell variables and user-defined variables in scripts
5. Implementing conditional execution facilities
6. Using the shell's built-in loop constructs where appropriate
7. Writing scripts to trap user interrupts
8. User defined Functions
9. Developing menu-driven shell scripts

PROGRAMMING IN JAVA LAB.

Subject Code: **BITE2-523** **L T P C**
3 1 0 4

1. Implementation of classes.
2. Implementation of inheritance.
3. Implementation of packages and interfaces.
4. Implementation of threads.
5. Using exception handling mechanisms.
6. Implementation of Applets.
7. Implementation of mouse events, and keyboard events.
8. Implementing basic file reading and writing methods.
9. Using basic networking features.
10. Connecting to Database using JDBC.

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COMPUTER NETWORKS–II LAB.

Subject Code: **BITE2-524** **L T P C**
3 1 0 4

1. To configure the IP address for a computer connected to LAN and to configure network parameters of a web browser for the same computer.
2. To plan IPv6 address scheme for a local area network comprising of 'n' terminals.
3. To develop programs for implementing / simulating routing algorithms for Adhoc networks.
4. To install any one open source packet capture software like wireshark etc.
5. To configure Wireless Local Loop.
6. To plan Personal Area Network.
7. To configure WLAN.
8. To configure Adhoc networks.
9. To install and configure wireless access points.

SOFT SKILLS-III

Subject Code: BHUM0-F93 **L T P C** **Duration: 25 Hrs.**
0 0 2 1

UNIT-1

ART OF WRITING: Introduction, Importance of Writing Creative Writing, Writing tips, Drawback of written communication.

ART OF BUSINESS WRITING: Introduction, Business Writing, Business Letter, Format and Styles, Types of business letters, Art of writing correct and precise mails, Understand netiquette.

UNIT-2

BODY LANGUAGE: Introduction- Body Talk, Forms of body language, uses of body language, Body language in understanding Intra and Inter-Personal Relations, Types of body language, Gender differences, Gaining confidence with knowledge of Kinesics.

UNIT-3

TEAM BUILDING AND TEAM WORK: Introduction, Meaning, Characteristics of an effective team, Role of a Team Leader, Role of Team Members, inter group Collaboration Advantages, Difficulties faced, Group Exercises-Team Tasks and Role-Play, Importance of Group Dynamics.

UNIT-4

TIME MANAGEMENT: Introduction, the 80-20 Rule, three secrets of Time Management, Time Management Matrix, Effective Scheduling, Time Wasters, Time Savers, Time Circle Planner, Difficulties in Time Management, Overcoming Procrastination.

Recommended Books

1. K. Alex, S. Chand Publishers.
2. R.C. Sharma and Krishna Mohan, 'Business Correspondence and Report Writing', TMH, New Delhi, **2016**.
3. N. Krishnaswami and T. Sriraman, 'Creative English for Communication', Macmillan.
4. Penrose, M. John, et al., 'Business Communication for Managers', Thomson South Western, New Delhi, **2007**.
5. Holtz, Shel, 'Corporate Conversations', PHI, New Delhi, **2007.**

NETWORK PROGRAMMING

Subject Code: **BITE2-626** **L T P C** **Duration: 45 Hrs.**
3 1 0 4

Course Objectives:
To familiarize students with advanced concepts of networks, network programming in UNIX environment.

UNIT-I

1. OSI model, client server model, TCP/IP protocols, Introduction to Unix; Process, groups, job control and non-job control shells, reliable and unreliable signals, shell Programming.
2. 2.Inter process communication in Unix, pipes, half duplex and full duplex pipes, FIFOs, properties of pipes and FIFOs, POSIX message queues, system V message queues, semaphores, shared memory, mmap function and its use, RPC, authentication, timeout and retransmission, call semantics, XDR.

UNIT-II

3. Communication Protocol: Introduction, TCP, IP, XNS, SNA, NetBIOS, OSI protocols, comparisons.

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UNIT-III

4. Introduction to Berkeley sockets, socket addressing, TCP and UDP socket functions, sockets and Unix signals, socket implementation, client and server examples for TCP and UDP and their behavior under abnormal conditions.

UNIT-IV

5. Socket options, IPv4, IPv6, TCP, I/O multiplexing, Unix I/O models, select and poll functions.
6. System V Transport Layer, interface – Introduction Transport End Point address, TLI.

Recommended Books

1. W.R. Stevens, B. Fenner & A.M. Rudoff, 'Unix Network Programming', Vol. I, 3rd Edn., Pearson Education.
2. W.R. Stevens, 'Unix Network Programming', Vol. II, 2nd Edn., Pearson Education.
3. Comer and Stevens, 'Internetworking with TCP/IP', Vol. -I, -II, -III, PHI.
4. Christian Benvenuti, 'Understanding Linux Network Internals', O'Reilly.
5. W.R. Stevens, 'Advanced Programming in Unix Environment', Pearson Education.

Course Outcomes:

Upon successful completion of this course, the student will be able to:

1. To understand the use of client/server architecture, inter process communication and to explain the basic communication protocols.
2. To understand elementary socket system calls, advanced socket system calls and Java Socket API and to explain the basic concepts relating to TCP and UDP based sockets.
3. To understand File transfer protocol, remote login using pseudo terminal and RPC.

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SOFTWARE ENGINEERING

Subject Code: **BITE2-627**	**L T P C** **3 1 0 4**	**Duration: 45 Hrs.**

Course Objectives:

To enable the students to learn the principles and methodologies followed to develop a good software.

UNIT-I

1. 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

2. 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

3. 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

4. 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.

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.

Course Outcomes:

Upon successful completion of this course, the student will be able to:

1. To study how software engineering principles, evolve and to analyze the various software models that can be followed to develop a software.
2. To understand the software analysis and design step of software development.
3. To study coding, testing and reliability of a software.
4. To highlight the various management activities and related terms of a software.

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MOBILE APP DEVELOPMENT

Subject Code: **BITE2-659**	**L T P C** **3 1 0 4**	**Duration: 45 Hrs.**

Course 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.

UNIT-I

1. 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

2. 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

3. 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

4. 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**.
4. Onur Cinar, 'Beginning Android 4', 1st Edn., Apress Publication, **2012**.
5. David Mark, 'Beginning iPhone Development with Swift', Apress Publication, **2014**.
6. Android Developer Site: http://developer.android.com/index.html.

Course Outcomes:

Upon successful completion of this course, the student will be able to:
1. To be familiar with the Architecture of various Mobile Application Platform.
2. Ability to work on Android using various forms and menus.
3. Knowledge to publish your developed Mobile Application.
4. Using SQLite for connection to database type facilities.

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CRYPTOGRAPHY & NETWORK SECURITY

Subject Code: **BITE2-660** **L T P C** **Duration: 45 Hrs.**
3 1 0 4

Course 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.

UNIT-I

1. 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

2. Simple DES, Differential crypto analysis, DES –Modes of operation, Triple DES, AES, RC4, RSA, Attacks–Primality test –factoring.

UNIT-III

3. 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

4. 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**.

Learning Outcomes:

Upon successful completion of this course, the student will be able to:

1. To understand the tools and description of java scripts
2. To XML and the study of Java beans and introduction to EJB'S
3. To understand Java servelet HTTP package and security issues.
4. To understand JSP Application Development and database programming using JDBC.

WEB TECHNOLOGIES

Subject Code: **BITE2-661** | **L T P C** **3 1 0 4** | **Duration: 45 Hrs.**

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Course Objectives:

This course covers the major web development technologies and techniques. The topics covered include HTML5, Cascading Style Sheets, client side programming using JavaScript, HTML5, server side programming using ASP.NET, constructing web databases using PHP, XML, web services.

1. 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.

2. HTML5: Introduction to HTML5, Lists, adding graphics to HTML5 page, creating tables, linking documents, forms, frames, Cascading Style sheets.

3. Java Script: Introduction, programming constructs: variables, operators and expressions, conditional checking, functions and dialog boxes, JavaScript DOM, creating forms, introduction to Cookies, Jquery.

4. AJAX: Introduction, HTTP Request, XMLHttpRequest, AJAX Server Script.

5. PHP: Introduction, syntax, statements, operators, PHP and MySQL, PHP and AJAX.

6. Introduction to ASP.net, J2EE, POJO, Java servlets and JSP.

Recommended Books

1. Deitel, Nieto, Lin and Sadhu, 'XML How to Program?', Pearson Education.
2. Ivan Bayross, 'Web Enabled Commercial Application Development using HTML, DHTML, JavaScript, Perl CGI, BPB'.
3. Steven M. Schafer, 'HTML, CSS, JavaScript, Perl, Python and PHP', Wiley India Textbooks.
4. Paul S. Wang, G. Keller, S. Katila, 'An Introduction to Web Design + Programming', Cengage Learning.
5. Jeffery C. Jackson, 'Web Technologies: A Computer Science Perspective', Pearson Education.

6. Stephen Walhter, Kevin Hoffman, Nate Dudek, 'ASP.NET 4 Unleashed', Pearson Education.
7. James Keogh, 'ASP.NET 2.0 Demystified', McGraw Hill.
8. Scott Mitchell, Sams, 'Teach Yourself ASP.NET 4 in 24 Hours', SAMS, Pearson Education.
9. Robin Nixon, 'Learning PHP, MySQL, and JavaScript', Shroff/O'Reilly.

Course Outcomes:

Upon successful completion of this course, the student will be able to:

1. Analyze a web page and identify its elements and attributes.
2. Create web pages using XHTML and Cascading Styles sheets.
3. Build dynamic web pages using JavaScript (client side programming).
4. Write non-trivial programs using C#.
5. Build interactive web applications using ASP.NET and C#.
6. Build web applications using PHP.
7. Construct and manipulate web databases using ADO.NET.
8. Create XML documents.
9. Create XML Schema.
10. Build and consume web services.

CLOUD COMPUTING

Subject Code: **BITE2-662** **L T P C** **3 1 0 4** **Duration: 45 Hrs.**

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Course Objectives:

This course gives an introduction to cloud computing and its techniques, issues, and its services that will lead to design and development of a simple cloud service.

Introduction: Cloud Computing in a Nutshell, Layers and Types of Clouds, Desired Formats of Cloud, Cloud Infrastructure Management, Challenges and Risks

Virtualization: Virtualization of Computing, Storage and Resources.

Cloud Services: Introduction to Cloud Services IaaS, PaaS and SaaS

Software as a Service (SaaS): Evolution of SaaS, Challenges of SaaS Paradigm, SaaS Integration Services, SaaS Integration of Products and Platforms, Business – to Business Integration B2Bi Services.

Infrastructure as a Services (IaaS): Introduction, Background & Related Work, Virtual Machines Provisioning and Manageability, Virtual Machine Migration Services, VM Provisioning and Migration in Action, Provisioning in a Cloud Context.

Platform as a service (PaaS): Integration of Private and Public Cloud, Technologies and Tools for Cloud Computing, Resource Provisioning Services.

Map Reduce Programming models and Implementations: Introduction, Map Reduce Programming Model, Major Map Reduce Implementations for the Cloud, Map Reduce Impacts

Migrating into a Cloud: Cloud Services for Individuals, Cloud Services Aimed at the Mid-Market, Enterprise Class Cloud Offering, Introduction to File System & Hadoop.

Management and Monitoring: Accounts Monitoring, User profiles in Cloud, Resource Allocation and Pricing in Cloud.

Security: Introduction, Cloud Storage: from LANs to WANs, Technologies for Data Security in Cloud Computing, Security Concerns, Legal issues and Aspects, Securing the Private and Public Cloud Architecture.

Recommended Books

1. Rajkumar Buyya, James Broberg, Andrzej M. Goscinski, 'Cloud Computing: Principles and Paradigms', Wiley Publications.
2. Toby Velte, Anthony Velte, 'Cloud Computing: A Practical Approach', McGraw Hill Osborne Media.
3. George Reese, 'Cloud Application Architectures: Building Applications and Infrastructure in the Cloud', O'Reilly Publication.
4. John Rhoton, 'Cloud Computing Explained: Implementation Handbook for Enterprises', Recursive Press.

Course Outcomes:

Upon successful completion of this course, the student will be able to:

1. Understand the hardware, software concepts and architecture of cloud computing.
2. Contrast the key technical and commercial issues concerning cloud computing versus traditional software models.
3. Realize the importance of virtualization technology in support of cloud computing.
4. Explore the issues related to cloud computing.

ENTERPRISE RESOURCE PLANNING

Subject Code: **BITE2-663** **L T P C** **3 1 0 4** **Duration: 45 Hrs.**

Course 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.

1. 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.

2. ERP IMPLEMENTATION: Implementation Challenges, Strategies, Life Cycle, Methodologies Package selection, Project Teams, Vendors and Consultants, Data Migration, Project management.

3. 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.

4. 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**.

Course Outcomes:

Upon successful completion of this course, the student will be able to:

1. To understand the concepts of ERP and its related technologies.
2. To understand the implementation of ERP in an organization.
3. To have a deep understanding of different business modules of an organization.
4. To have a basic understanding of applications of ERP and various ERP software's.

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PARALLEL AND DISTRIBUTED COMPUTING

Subject Code: **BITE2-664** **L T P C** **Duration: 45 Hrs.**
3 1 0 4

Course Objectives:
To learn the advanced concepts of Parallel and Distributed Computing and its implementation for assessment of understanding the course by the students

UNIT-I

1. Introduction: Parallel Processing, Parallel Computers, Shared Memory Multiprocessing, Distributed Parallel Computing, Message Passing, Parallelism, Speedup, Utilizing Temporal Parallelism Utilizing Data Parallelism, Comparison of Temporal and Data Parallel Processing, Data Parallel Processing with Specialized processor.
2. Processes & Shared Memory Programming: Processes, Shared Memory Programming, forking for Creating Processes, Joining for Process Termination, Process Model Under UNIX.

UNIT-II

3. Basic Parallel Programming Techniques: Loop Splitting, self-scheduling, Contention and Mutual Exclusion, Introduction of Semaphores and Spin –Lock Implementation, Indirect scheduling, Barriers and Race Conditions Overcoming forward and backward data dependencies.
4. Thread-Based Implementation: Thread Management, Mutual Exclusion with Threads, Events and Condition Variables, Deviation Computation with Threads – POSIX/Java Threads.

UNIT-III

5. Distributed Computing Systems: Design goals, Transparencies, Fundamental Issues.
6. Distributed Coordination: Temporal ordering of events and global state detection, Process synchronization and Distributed mutual exclusion algorithms, inter process communication: Message passing model, Remote procedure call, Point to point and Group communication.

UNIT-IV

7. Issues in Distributed systems: Load balancing and Load sharing, Deadlock, MPI (Message passing Interface) and PVM (Parallel Virtual Machine) architecture and features.

Recommended Books

1. Steven Brawer, 'Introduction to Parallel Programming'.
2. M. Sasikumar, Dinesh Shikhare and P. Ravi Prakash, 'Introduction to Parallel Processing'.
3. Randy Chow, T. Johnson, 'Distributed Operating Systems and Algorithms', Addison Wesley.
4. A.S. Tanenbaum, 'Distributed Operating Systems', Prentice Hall.

Course Outcomes:
Upon successful completion of this course, the student will be able to:
1. Understand the concepts and issues related to parallel and distributed system.
2. Understand intricacies of parallel and distributed programming.
3. Design and develop the programs for parallel and distributed environment.
4. Manage security, performance reliability and other issues while designing in parallel and distributed environment.

NETWORK PROGRAMMING LAB.

Subject Code: **BITE2-628** **L T P C**
0 0 2 1

1. To study and implement various network commands like telnet, ftp, etc.

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2. To study various system calls.
3. Programs related to interprocess communication.
4. Programs related to message queues.
5. 5.Programs related to pipes.
6. Programs related to file handling.
7. Programs related to process control.
8. Programs using Socket Programming.

SOFTWARE ENGINEERING LAB.

Subject Code: BITE2-629 **L T P C**
0 0 2 1

1. Study and usage of OpenProj or similar software to draft a project plan.
2. Study and usage of OpenProj or similar software to track the progress of a project.
3. Preparation of a software requirement specification document, design document and testing phases related document for the same problem.
4. Preparation of software configuration management and risk management related documents.
5. Study and usage of any design phase CASE tool.
6. To perform unit testing and integration testing.
7. To perform various white box and black box testing techniques.
8. Testing a website.

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SOFT SKILLS-IV

Subject Code: BHUM0-F94 **L T P C** **Duration: 25 Hrs.**
0 0 2 1

UNIT-1

ART OF SPEAKING: Introduction. Communication process. Importance of communication, channels of communication. Formal and informal communication. Barriers to communication. Tips for effective communication. tips for conversation. Presentation skills. Effective multi-media presentation skills. Speeches and debates. Combating nervousness. Patterns and methods of presentation. Oral presentation, planning and preparation.

UNIT-2

GROUP DISCUSSION: Introduction. Importance of GD. Characters tested in a GD. Tips on GD. Essential elements of GD. Traits tested in a GD .GD etiquette. Initiating a GD. Nonverbal communication in GD. Movement and gestures to be avoided in a GD. Some topics for GD.

UNIT-3

PREPARING CV/RESUME: Introduction – meaning – difference among bio-data, CV and resume. CV writing tips. Do's and don'ts of resume preparation. Vocabulary for resume, common resume mistakes, cover letters, tips for writing cover letters.

UNIT-4

INTERVIEW SKILLS: Introduction. Types of interview. Types of question asked. Reasons for rejections. Post-interview etiquette. Telephonic interview. Dress code at interview. Mistakes during interview. Tips to crack on interview. Contextual questions in interview skills. Emotional crack an interview. Emotional intelligence and critical thinking during interview process.

Recommended Books

1. K. Alex, S. Chand Publishers.

2. Lucas, Stephen E., 'The Art of Public Speaking', 11th Edn., International Edn., McGraw Hill Book Co., **2014**.
3. Goleman, Daniel, 'Working with Emotional Intelligence', Banton Books, London, **1998**.
4. Thrope, Edgar and Showick Trope, 'Winning at Interviews', Pearson Education, **2004**.
5. Turk, Christopher, 'Effective Speaking', South Asia Division: Taylor & Francis, **1985**.

BUILDING ENTERPRISE APPLICATIONS

Subject Code: BITE2-730 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

COURSE OBJECTIVES:
This course aims to cover key concepts and design principles related to enterprise application architecture and enterprise application integration. It first provides students a business strategic perspective on adopting enterprise architecture, and then includes topics like layering structure, business logic organization, patterns for object/relational access layers, model-view-control patterns for Web, message-based enterprise application integration, and recent advances in enterprise application architecture.

Unit-I

Introduction to enterprise applications and their types, software engineering methodologies, life cycle of raising an enterprise application, introduction to skills required to build an enterprise application, key determinants of successful enterprise applications, and measuring the success of enterprise applications

Unit-II

Inception of enterprise applications, enterprise analysis, business modeling, requirements elicitation, use case modeling, prototyping, non-functional requirements, requirements validation, planning and estimation

Unit-III

Concept of architecture, views and viewpoints, enterprise architecture, logical architecture, technical architecture - design, different technical layers, best practices, data architecture and design – relational, XML, and other structured data representations, Infrastructure architecture and design elements - Networking, Internetworking, and Communication Protocols, IT Hardware and Software, Middleware, Policies for Infrastructure Management, Deployment Strategy, Documentation of application architecture and design

Unit-IV

Construction readiness of enterprise applications - defining a construction plan, defining a package structure, setting up a configuration management plan, setting up a development environment, introduction to the concept of Software Construction Maps, construction of technical solutions layers, methodologies of code review, static code analysis, build and testing, dynamic code analysis – code profiling and code coverage

Unit-V

Types and methods of testing an enterprise application, testing levels and approaches, testing environments, integration testing, performance testing, penetration testing, usability testing, globalization testing and interface testing, user acceptance testing, rolling out an enterprise application.

Suggested Readings/Books

Anubhav Pradhan, Satheesha B. Nanjappa et. al., 'Raising Enterprise Applications', Wiley India.

LEARNING OUTCOMES:
Upon successful completion of this course, the student will be able to:

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1. explains the principles behind different enterprise patterns and apply them for enterprise application development.
2. Describe the key design related issues and principles in enterprise application architecture
3. Explain how different design patterns for enterprise application architecture work.
4. Explain how different design patterns for enterprise application architecture work
5. Explain how the message-based integration pattern can be applied to enterprise application integration

SIMULATION AND MODELING

Subject Code: BITE2-731 **L T P C 3 1 0 4** **Duration: 45 Hrs.**

COURSE OBJECTIVES:

The objectives of this course are to:

1. Introduce students to the simulation and modelling techniques;
2. Provide students with opportunities to develop basic simulation and modeling skills with respect to carrying out research projects using any simulation method on the computer.

Unit-I Introduction

When simulation is appropriate and when not, advantages and disadvantages of simulation, application areas in communication, computer and software design, systems and systems environment, components of a system, discrete and continuous systems, model of a system, types of models, discrete-event simulation, steps in a simulation study. Simulation Examples- Simulation of queueing systems, on-demand and inventory systems, simulation for reliability analysis etc

Unit-II: General Principles

Concepts in discrete event simulation: event scheduling/time advance algorithms, world views. List Processing: properties and operations, data structures and dynamic allocation, techniques

Unit-III: Simulation Software

Integrated environments. Examples and review of some existing software popular and useful in the industry, e.g., Arena, AutoMod, Extend, Flexsim, Micro Saint, ProModel, Quest, SIMUL8, WITNESS etc. Simulation using languages and environments like C++/Java/GPSS/SSF etc. Experimentation and Statistical-Analysis Tools: common features and relevant current products.

Unit-IV: Statistical Models in Simulation

Terms and concepts. Statistical Models. Review of discrete and continuous distributions. Review of Poisson (stationary and non-stationary) processes. Empirical Distributions; Elementary Queueing Theory- Basic Structure of Queueing Models. Input Source (Calling Population). Queue, Queue Discipline, Service Mechanisms. Notations and relationships between L, W, Lq, and Wq. Little's Formula. Role of Exponential Distribution and Properties. Birth and Death Processes. M/M/s queues. Finite queue variation in M/M/s/K models with different s values. Finite Calling Population cases. Queueing Models involving Non-Exponential Distributions: M/G/1, M/D/s, M/Ek/s (involving Erlang distribution), Models without a Poisson Input, Models involving hyper-exponential distributions, Priority Discipline Queueing Models: Preemptive and Non- Preemptive with results, properties and server number variations, Queueing Networks: Equivalence Property. Infinite Queues in Series and Product Form Solutions. Jackson Networks

Unit-V: Application of Queueing Models

Review of Characteristics (calling population system capacity, arrival processes, behavior and disciplines, service times and mechanisms etc.) and notations, Application of Long-Run **Measures of Performance:** Time average in system, average time spent per customer, Little's

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Formula and server utilization, costs. Steady State behaviour of Infinite (M/G/1, M/M/c/infinity, M/M/c/N/infinity) and finite (M/M/c/K/K) Calling Population Models, Use of Network of Queues

Unit-VI: Random Number Generation

Properties. Generation of Pseudo-Random Numbers, Techniques for Generation of Pseudo-Random Numbers: Linear Congruential, Combined Linear Congruential, Random Number Streams. Tests for Random Numbers: Frequency Tests and Tests for Autocorrelation. Random Variate Generation- Inverse Transform Techniques for Exponential, Uniform, Weibull, Triangular and for Empirical Continuous Distributions. Acceptance-Rejection Techniques for Poisson (Stationary and Non- Stationary) Distribution and Gamma Distribution. Special Properties like the Direct Transformation for the Normal and Lognormal Distributions, Convolution Method and others.

Unit-VII: Input Modeling

Data collection, Identifying the Distribution with Data: Histograms, Selection of the Appropriate Family of Distributions, Quantile-Quantile Plots.100 Parameter Estimation: Sample Mean and Sample ariance and various biased and unbiased Estimators. Goodness of Fit Tests applied to Simulation inputs: Chi-Square and Chi-Square with Equal Probabilities, Kolmogorov-Smirnov Tests, p- Values and Best Fits. Verification and Validation of Simulation Models- Verification and Validation of Simulation Models. Calibration and Validation: Face Validity, Validation of Assumptions, Input-Out Transformation Validation.

Unit-VIII: Output Analysis of a Single Model

Output analysis and types of simulation. Stochastic Nature of the Output Data. Measures of Performance and Estimation: Point Estimation and Confidence-Interval Estimation. Output Analysis for Terminating Simulations and Estimation of Probabilities. Output Analysis of Steady State Simulations: Initialization Bias, Error Estimation, Replications, Sample Size and Batch Means for Interval Estimation.

Unit-IX: Comparison and Evaluation of Alternative System Designs

Comparison of Two System Designs.; Sampling with Equal and Unequal Variances. Common Random Numbers. Confidence Intervals with Specified Precision. Comparison of Several System Designs: Bonferroni Approaches to Multiple Comparisons and to Screening and to Selection of the Best. MetamodelingL Sample Linear Regression, Testing for Significance, Multiple Linear Regression. Random Number Assignment for Regression. Optimization via Simulation: Robust Heuristics.

Unit-X: Simulation of Computer Systems

Simulation Tools: Process Orientation and Event Orientation. Model Input: Modulated Poisson Process and Virtual-Memory Referencing. High-Level Simulation. CPU and Memory Simulations. Simulation of Computer Networks- Traffic Modeling, Media Access Control: Token- Passing Protocols and Ethernet, Data Link Layer, TCP, Model Construction.

Simulation Languages: Basic Introduction to Special Simulation Languages: -GPSS/ MATLAB/ Network Simulators.

Suggested Readings/Books

1. Jerry Banks, John S. Carson II, Barry L. Nelson and David M. Nicol, 'Discrete-Event System and Simulation', Prentice Hall of India, New Delhi, **2005.**
2. Averill M. Law, 'Simulation Modelling and Analysis (SIE)', Tata McGraw Hill India, **2007.**
3. David Cloud, Larry Rainey, 'Applied Modeling and Simulation', Tata McGraw Hill, India.
4. Gabriel A. Wainer, 'Discrete-event Modelling and Simulation: A Practitioner's Approach', CRC Press, **2009**.

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5. Bernard P. Zeigler, Herbert Praehofer, Tag Gon Kim, 'Theory of Modelling and Simulation: Integrating Discrete event and Continuous Complex Dynamic Systems, Academic Press, **2000**.
6. Walter J. Karplus, George A. Bekey, Boris Yakob Kogan, 'Modelling and Simulation: Theory and Practice', Springer, **2003**.
7. Stanislaw Raczynski, 'Modelling and Simulation: The Computer Science of Illusion', Wiley, **2006**.
8. Mohammad Salameh Obaidat, Georgios I. Papadimitriou, 'Applied System Simulation: Methodologies and Application', Springer, **2003**.
9. van Dijk, Nico M., Boucherie, Richard J. (Eds.). 'Queueing Networks: A Fundamental Approach', 798 p. 148 illus. Springer, **2011**.
10. Bhat, U. Narayan, 'An Introduction to Queueing Theory: Modelling and Analysis in Applications', Springer, **2008** (Birkhäuser Boston).
11. James J. Nutaro, 'Building Software for Simulation: Theory and Algorithms, with Applications in C++'. Wiley, **2010**.

LEARNING OUTCOMES:

Upon successful completion of this course, the student will be able to:

Problem formulation-

1. System definition
2. Model translation
3. Verification, validation
4. Experimental design
5. Analysis (Skills)-
   a) use the simulation software to:
   b) carry out simulation tasks;
   c) use graphs to present their results;
   d) write scripting languages to generate other reports.

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SIMULATION AND MODELING LAB.

Subject Code: BITE2-732 **L T P C**
0 0 4 2

1. Programming in MATLAB: Introduction, Branching statements, loops, functions, additional data types, plots, arrays, inputs/outputs etc.
2. Introduction regarding usage of any Network Simulator.
3. Practical Implementation of Queuing Models using C/C++.

BUILDING ENTERPRISE APPLICATIONS LAB.

Subject Code: BITE2-733 **L T P C**
0 0 4 2

Case Study: Students should work on one case study related to any enterprise (for Ex: - manufacturing. IT industry. etc.) to implement (and learn to use the tools to accomplish this task) the following (illustrative only)

Note: At the end of finishing each milestone of the case study, the student will write a report mentioning the conclusion drawn from that section, recommendations /or the improvement and any missing links in the enterprise software.

1. Development of Software Requirement Specification (SRS) document to -
   a) Understand or analyze a given business scenario and document the use case diagrams for the given scenario (use tools like MOOSE. smartdraw. visio etc.)

   b) Identify the functional and non-functional requirements for the given scenario and document it in the given template
2. Establishment of architecture of enterprise which
   a) Identifies different modules required in the given enterprise application
   b) Create a logical architecture of databases for the given business scenario documented in the use case diagrams
3. Determination of UI tool that best suits given applications
4. Determination of infrastructure (networking. internetworking. software, hardware, middleware, etc.) required for the given scenario.
5. Development of a comprehensive plan for the enterprise application (refer to the Unit IV of BTIT-701)
6. Create test cases (subset) as per the given template
7. Perform the manual and automated testing on the any code base using any testing tools (such as rational rose. QTP etc.)

INFORMATION SECURITY AND RISK MANAGEMENT

Subject Code: BITE2-765 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

COURSE OBJECTIVES:
The objectives of this course are to:
Provide you with a strategic and in-depth knowledge of the issues involved in the emerging field of Information Systems Risk Management. You will learn how to document the risks and threats that are encountered in modern information security applications and to identify the relationship between these risks and the more commonly occurring risks associated with business and project management.

Unit-I

Essentials of Information Security, Security Threats – Intruders, Viruses, Worms, and other Threats, Vulnerabilities, Cyber Crime and Hacker, Security Assessment, Analysis and Assurance, Role of Cryptography, The Data Encryption Standard (DES), Analyzing and Strengthening of DES, Introduction to Advance Encryption Standard (AES).

Unit-II

Concept and Characteristics of Public Key Encryption system, Introduction to Merkle-Hellman Knapsacks, Rivets – Shamir-Adlman (RSA) Encryption. Hash Algorithms, Message Digest Algorithms such as MD4 and MD5, Secure Hash Algorithms such as SH1 and SHA2. Digital Signature Standard.

Unit-III

Network Security Issues such as Impersonation, Message Confidentiality, Message Integrity, Code Integrity, Denial of Service, Firewalls, DMZs, Virtual Private Networks. Web Security, Email Security, Pretty Good Privacy

Unit-IV

Risk Management and Security planning –Risk management Process Overview and Life Cycle Activities, Information Security Life Cycle, Risk Analysis, Cost Benefit Analysis, Risk Assessment Process, Methodology, Threat assessment, Modes of risk analysis – Effective Risk analysis, Risk Mitigation, Qualitative Risk Analysis, Value Analysis, Case Study of IT Organization

Suggested Readings/Books

1. Principles of Cryptography, William Stallings, Pearson Education.
2. Cryptography & Network Security, Atul Kahate, TMH.
3. Matt Bishop, " Computer Security Art and Science", Pearson/PHI, 2002.

4. Thomas R Peltier, Information Security Risk Analysis, CRC Press,2001.

LEARNING OUTCOMES:

Upon successful completion of this course, the student will be able to:

1. Identify and analyses information security threats and risks arising in the Information Systems of diverse industries.
2. Explore and evaluate possible solutions to these risk scenarios acknowledging cost, complexity of implementation and system user impact.
3. Correlate identified information security risks to continuity management issues.
4. Utilize the principles of group dynamics and the people-centered nature of Information Security.
5. Discriminate between commenting on and copying information.
6. Identify and articulate (both in written form and orally to a peer audience) effective Information Systems risk management strategies.

DIGITAL IMAGE PROCESSING

Subject Code: BITE2-766	L T P C 3 1 0 4	Duration: 45 Hrs.

COURSE OBJECTIVES:

The objectives of this course are to:

1. To study the image fundamentals and mathematical transforms necessary for image processing.
2. To study the image enhancement techniques
3. To study image restoration procedures.
4. To study the image compression procedures.

Unit-I: Introduction to Image Processing

Digital Image representation, Sampling & Quantization, Steps in image Processing, Image acquisition, color image representation

Unit-II: Image Transformation & Filtering

Intensity transform functions, histogram processing, Spatial filtering, Fourier transforms and its properties, frequency domain filters, color models, Pseudo coloring, color transforms, Basics of Wavelet Transforms

Unit-III: Image Restoration

Image degradation and restoration process, Noise Models, Noise Filters, degradation function, Inverse Filtering, Homomorphic Filtering

Unit-IV: Image Compression

Coding redundancy, Interpixel redundancy, Psychovisual redundancy, Huffman Coding, Arithmetic coding, Lossy compression techniques, JPEG Compression.

Unit-V: Image Segmentation & Representation

Point, Line and Edge Detection, Thresholding, Edge and Boundary linking, Hough transforms, Region Based Segmentation, Boundary representation, Boundary Descriptors, Regional

Suggested Readings/Books

1. Gonzalez and Woods, 'Digital Image Processing', ISDN 0-201-600-781, Addison Wesley **1992**.
2. Boyle and Thomas, 'Computer Vision, A First Gurse', 2nd Edn, ISBN 0-632-028-67X, Blackwell Science, **1995**.
3. Pakhera Malay K., 'Digital Image Processing and Pattern Recognition', PHI.
4. Trucco & Verri, 'Introductory Techniques for 3-D Computer Vision', Prentice Hall.
5. Low, 'Introductory Computer Vision and Image Processing', McGraw Hill, **1991**, ISBN 0-07-707403-3.

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6. Jain, Kasturi and Schunk, 'Machine Vision', McGraw Hill, **1995** ISBN 0070320187.
7. Sonka, Hlavac, Boyle, 'Digital Image Processing and Computer Vision', First Edn., ISBN 978813150557, Cengage Learning, **2011**.

LEARNING OUTCOMES:

Upon successful completion of this course, the student will be able to:

1. Review the fundamental concepts of a digital image processing system.
2. Analyse images in the frequency domain using various transforms.
3. Evaluate the techniques for image enhancement and image restoration.
4. Categorize various compression techniques.
5. Interpret Image compression standards.
6. Interpret image segmentation and representation techniques.

SOFTWARE PROJECT MANAGEMENT

Subject Code: BITE2-767 **L T P C** **Duration: 45 Hrs.**

3 1 0 4

COURSE OBJECTIVES:

The objectives of this course are to:

Software development is a complex process involving such activities as domain analysis, requirements specification, communication with the customers and end users, designing and producing different artifacts, adopting new paradigms and technologies, evaluating and testing software products, installing and maintaining the application at the end-user's site, providing customer support, organizing end-user's training, envisioning potential upgrades and negotiating about them with the customers, and many more. The proposed subject will take students through the various processes involved in project management.

Pre-requisite Knowledge:

The basic understanding of concepts of Software engineering, computer networks and Database concepts.

Unit-I

Project Management Fundamentals: Basic Definitions, Project Stakeholders and Organizational, Influences on Project Management, Project Management Processes, Project Initiating Processes

Unit-II

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-III

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-IV

Project Monitoring and Controlling Processes: Verifying and Controlling Scope, Managing Schedule and Cost, Controlling Quality, Monitoring and Controlling Risks.

Unit-V

Integrated Change Control, Project Closing Process - Closing a Project.

Suggested Readings/Books

1. Software Engineering - Somerville (Addison Wesley).
2. Software Engineering-Pressmen.

Suggested Tools – Rational Team Concert, MS Project

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LEARNING OUTCOMES:

Upon successful completion of this course, the student will be able to:

1. Problem Solving and Critical Thinking (PS&CT)**,**
2. Communication and Interpersonal Skills (C&IS),
3. Ethical and Professional Responsibilities (E&PR).

ARTIFICIAL INTELLIGENCE AND EXPERT SYSTEMS

Subject Code: BITE2-834 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

COURSE OBJECTIVES:

The objectives of this course are to:

The objective of this course is to provide the student with an overview of topics in the field of artificial intelligence (AI). The course also provides the student with a working knowledge of designing an expert system and applying expert system technology in designing and analyzing engineering systems.

Unit-I: Introduction

What is intelligence? Foundations of artificial intelligence (AI). History of AI; Problem Solving- Formulating problems, problem types, states and operators, state space, search strategies.

Unit-II: Informed Search Strategies

Best first search, A* algorithm, heuristic functions, Iterative deepening A*(IDA), small memory A*(SMA); Game playing - Perfect decision game, imperfect decision game, evaluation function, alpha-beta pruning

Unit-III: Reasoning

Representation, Inference, Propositional Logic, predicate logic (first order logic), logical reasoning, forward chaining, backward chaining; AI languages and tools - Lisp, Prolog, CLIPS

Unit-IV: Planning

Basic representation of plans, partial order planning, planning in the blocks world, hierarchical planning, conditional planning, representation of resource constraints, measures, temporal constraints

Unit-V: Uncertainty

Basic probability, Bayes rule, Belief networks, Default reasoning, Fuzzy sets and fuzzy logic; Decision making- Utility theory, utility functions, Decision theoretic expert systems.

Unit 6: Inductive learning - decision trees, rule based learning, current-best-hypothesis search, least- commitment search, neural networks, reinforcement learning, genetic algorithms; Other learning methods - neural networks, reinforcement learning, genetic algorithms.

Unit-VII: Communication

Communication among agents, natural language processing, formal grammar, parsing, grammar.

Suggested / Readings & Books

1. Stuart Russell and Peter Norvig, 'Artificial Intelligence – A Modern Approach', Pearson Education Press, **2001**.
2. Kevin Knight, Elaine Rich, B. Nair, 'Artificial Intelligence', McGraw Hill, **2008**.
3. George F. Luger, 'Artificial Intelligence', Pearson Education, **2001**.
4. Nils J. Nilsson, 'Artificial Intelligence: A New Synthesis', Morgan Kauffman, **2002**.

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ARTIFICIAL INTELLIGENCE AND EXPERT SYSTEMS LAB.

Subject Code: BITE2-835 **L T P C**
0 0 4 2

1. Write A Program for DEPTH FIRST SEARCH
2. Write A Program for Best First Search
3. Write A Program to Generate the output for A* Algorithm.
4. Write a Lisp Program to solve Water Jug Problem Using Heuristic Function.
5. Write a Program to Show the Tic Tac Toe Game for 0 and X.
6. Write A Program for Expert System by Using Forward Chaining.
7. Write a program to implement tower of Hanoi.
8. Write a program to implement a heuristic search procedure.
9. Write a program to implement a production system.
10. Write a program to implement search problems of 3 x 3 puzzle.

OBJECT ORIENTED ANALYSIS AND DESIGN

Subject Code: BITE2-868 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

COURSE OBJECTIVES:

The objectives of this course are to:

The aim of the course is to teach methods and techniques for analysis and design of information systems based on an object-oriented approach. The course will, furthermore, discuss a variety of perspectives of development of information systems in order explore the relationship between programming, data bases and software engineering.

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Unit-I

Introduction to object oriented systems, Classes, Objects, Abstraction, Inheritance, Polymorphism, Encapsulation, Message Sending, Association, Aggregation, Iterative development and the Unified Process (UP), UP phases: Inception, Elaboration, Construction and Transition, Object-oriented metrics

Unit-II

Introduction to UML, Use Cases and functional requirements, Identifying and writing Use Cases, Decomposition of use cases, Modeling System Workflows using Activity Diagrams, modeling a System's Logical Structure using Classes and Class Diagrams, Modeling Interactions using Sequence Diagrams and Communication Diagrams, Timing Diagrams, Interaction Overview Diagrams, Component Diagram, Package diagram, State Machine Diagrams, Deployment Diagrams.

Unit-III

Introduction to Patterns, GoF Patterns, Creational Patterns, Structural Patterns, Behavioral Patterns, Software Architectural patterns, The Observer Pattern, The Template Method Pattern, Factory Patterns: Factory Method and Abstract Factory, The Singleton Pattern, The Iterator Pattern, The Composite Pattern, The Facade Pattern, The State and Strategy patterns, Command Pattern, The Adapter Pattern, The Proxy Pattern, The Decorator Pattern, The Visitor Pattern, AntiPatterns, Patterns for Assigning Responsibilities: GRASP Patterns.

Unit-IV

Domain modeling, assigning responsibility using sequence diagrams, mapping design to code, CASE tools, Unit, Cluster, and System-level testingof Object-oriented programs, Aspect-oriented and Service-oriented software.

Suggested Readings/Books

1. GradyBooch, JamesRumbaugh, Ivar Jacobson, 'The Unified Modelling Language User Guide', Pearson Education.
2. Hans-Erik Eriksson, Magnus Penker, Brian Lyons, David Fado, 'UML 2 Toolkit', WILEY-Dreamtech India Pvt. Ltd.
3. Meilir Page-Jones, 'Fundamentals of Object Oriented Design in UML', Pearson Education.
4. Pascal Roques, 'Modelling Software Systems Using UML2', WILEY- Dreamtech India Pvt. Ltd.
5. Atul Kahate, 'Object Oriented Analysis & Design', McGraw Hill Companies.
6. John W. Satzinger, Robert B. Jackson and Stephen D. Burd, 'Object-Oriented Analysis and Design with the Unified Process', Cengage Learning.
7. Gamma, et. al., 'Design Patterns - Elements of Reusable Object-Oriented Software', Addison-Wesley, **1994.**
8. Craig Larman, 'Applying UML and Patterns: An Introduction to Object-oriented Analysis and Design and Iterative Development', Pearson Education, **1998.**

LEARNING OUTCOMES:

Upon successful completion of this course, the student will be able to:

1. use an object-oriented method for analysis and design
2. analyses information systems in real-world settings and to conduct methods such as interviews and observations
3. have a general understanding of a variety of approaches and perspectives of systems development, and to evaluate other IS development methods and techniques
4. know techniques aimed to achieve the objective and expected results of a systems development process
5. know different types of prototyping
6. know how to use UML for notation

BIG DATA

Subject Code: BITE2-869	**L T P C** **3 1 0 4**	**Duration: 45 Hrs.**

COURSE OBJECTIVES:

The objectives of this course are to:

1. Store, manage, and analyze unstructured data
2. Select the correct big data stores for disparate data sets
3. Process large data sets using Hadoop to extract value
4. Query large data sets in near real time with Pig and Hive
5. Plan and implement a big data strategy for your organization

Unit-I

Analysis of data at Rest- Hadoop analytics: Limitations of existing distributing systems, Hadoop Approach, Hadoop Architecture, distributed file system: HDFS and GPFS, Internals of Hadoop MR engine, Need for High level language- JAQL and PIG

Unit-II

Introduction to Text Analytics: Using Regular expressions, Using AQL, Sentiment analysis

Unit-III

No SQL: JSON store, MongoDB, RDF, HBASE

Unit-IV

Analytics: Clustering, Classification, Segmentation, Linear regression, ML.

Unit-V

Search: Indexing and Indexing Techniques, create inverted index using JAQL, Lab using Data Explorer.

Unit-VI

Bundling Hadoop job: Application, Use BI tooling to create application, Publish applications.

Unit-VII

Analysis of data in motion – Real time analytics.

Unit-VIII

Introduction to streams computing, Challenges/limitations of conventional Systems, solving a real time analytics problem using conventional system, Challenges to be solved - scalability, thread pooling, etc., Understanding the challenges in handling streaming data from the real world and how to address those using stream computing, Benefits of stream computing in Big Data world, Real-time Analytics Platform (RTAP).

Suggested Readings/Books

1. Chris Eaton, Paul Zikopoulos, 'Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data'.
2. Frank J. Ohlhorst, 'Big Data Analytics: Turning Big Data into Big Money'.
3. Kord Davis, 'Ethics of Big Data'.
4. Michael Minelli, Michele Chambers, Ambiga Dhiraj, 'Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends'.

LEARNING OUTCOMES:

Upon successful completion of this course, the student will be able to:

1. Model and implement efficient big data solutions for various application areas using appropriately selected algorithms and data structures.
2. Analyse methods and algorithms, to compare and evaluate them with respect to time and space requirements, and make appropriate design choices when solving real-world problems.
3. Motivate and explain trade-offs in big data processing technique design and analysis in written and oral form.
4. Explain the Big Data Fundamentals, including the evolution of Big Data, the characteristics of Big Data and the challenges introduced.
5. Apply non-relational databases, the techniques for storing and processing large volumes of structured and unstructured data, as well as streaming data.
6. Apply the novel architectures and platforms introduced for Big data, in particular Hadoop and MapReduce.

SOFT COMPUTING

Subject Code: BITE2-870	**L T P C** **3 1 0 4**	**Duration: 45 Hrs.**

COURSE OBJECTIVES:

The objectives of this course are to:

1. To Conceptualize the working of human brain using ANN.
2. To become familiar with neural networks that can learn from available examples and generalize to form appropriate rules for inference systems.
3. To introduce the ideas of fuzzy sets, fuzzy logic and use of heuristics based on human experience.
4. To provide the mathematical background for carrying out the optimization and familiarizing genetic algorithm for seeking global optimum in self-learning situation

Unit-I: Introduction

What is soft computing? Differences between soft computing and hard computing, Soft Computing constituents, Methods in soft computing, Applications of Soft Computing.

Unit-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-III: Neural Networks

Concept, biological neural system, Evolution of neural network, McCulloch- Pitts neuron model, activation functions, feedforward networks, feedback networks, learning rules – Hebbian, Delta, Perceptron learning and Windrow-Hoff, winner-take-all.

Unit-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-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 Modeling, Classification and Regression Trees, Data Clustering Algorithms, Rulebase Structure Identification and Neuro-Fuzzy Control, Applications of neuro-fuzzy modeling.

Unit-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.

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Suggested Readings/Books

1. S.N. Shivanandam, ‘Principles of Soft Computing’, Wiley. ISBN13: 9788126527410, **2011.**
2. Jyh-Shing Roger Jang, Chuen-Tsai Sun, EijiMizutani, ‘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. 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**.

LEARNING OUTCOMES:

Upon successful completion of this course, the student will be able to:

1. Ability to analyse and appreciate the applications which can use fuzzy logic.
2. Ability to design inference systems.
3. Ability to understand the difference between learning and programming and explore practical applications of Neural Networks (NN).
4. Ability to appreciate the importance of optimizations and its use in computer engineering fields and other domains.
5. Students would understand the efficiency of a hybrid system and how Neural Network and fuzzy logic can be hybridized to form a Neuro-fuzzy network and its v.

3rd Semester		Contact Hrs.			Marks			Credits
Code	**Course**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
BMEE4-301	Strength of Materials- I	3	1	0	40	60	100	4
BMEE4-302	Theory of Machines-I	3	1	0	40	60	100	4
BMEE4-303	Machine Drawing	1	0	4	40	60	100	3
BMEE4-304	Applied Thermodynamics -I	3	1	0	40	60	100	4
BMEE4-305	Workshop Technology	3	1	0	40	60	100	4
BMEE4-306	Engineering Materials & Metallurgy	3	0	0	40	60	100	3
BMEE4-307	Engineering Materials & Metallurgy Lab.	0	0	2	60	40	100	1
BMEE4-308	Strength of Materials Lab.	0	0	2	60	40	100	1
BMEE4-309	Applied Thermodynamics Lab.	0	0	2	60	40	100	1
BMEE4-310	Training-I#	0	0	4	60	40	100	2
Total		**16**	**4**	**10**	**500**	**500**	**1000**	**27**

#Training will be imparted in the Institution at the end of 2nd semester for Four (04) weeks duration (Minimum 36 hours per week). Industrial tour will also form part of this training.

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4th Semester		Contact Hrs.			Marks			Credits
Code	**Course**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
BMEE4-411	Strength of Materials- II	3	1	0	40	60	100	4
BMEE4-412	Theory of Machines-II	3	1	0	40	60	100	4
BMEE4-413	Fluid Mechanics	3	0	0	40	60	100	3
BMEE4-414	Applied Thermodynamics - II	3	1	0	40	60	100	4
BMEE4-415	Basic Ship structure & Design-I	3	0	0	40	60	100	3
BMEE4-416	Fluid Mechanics Lab.	0	0	2	60	40	100	1
BMEE4-417	Workshop Technology Lab.	0	0	2	60	40	100	1
BMEE4-418	Theory of Machines Lab.	0	0	2	60	40	100	1
Total		**15**	**3**	**6**	**380**	**420**	**800**	**21**

5th Semester		Contact Hrs.			Marks			Credits
Code	Course	L	T	P	Int.	Ext.	Total	
BMEE4-519	Marine Auxiliary Machine	3	1	0	40	60	100	4
BMEE4-520	Ship Construction	3	1	0	40	60	100	4
BMEE4-521	Electrical Machines	3	1	0	40	60	100	4
BMEE4-522	Mechanics of Machines-I	3	1	0	40	60	100	4
BMEE4-523	Electronics	3	1	0	40	60	100	4
BMEE4-524	Workshop Practical (Marine)	0	0	2	60	40	100	1
BMEE4-525	Electrical Engg., Electronics & Microprocessor Lab.	0	0	2	60	40	100	1
BMEE4-526	Electrical Machine Lab.	0	0	2	60	40	100	1
BMEE4-527	Computer Aided Marine Engineering Design and Analysis Lab.	0	0	2	60	40	100	1
BMEE4-528	Training*	0	0	4	60	40	100	2
Total		**15**	**5**	**8**	**500**	**500**	**1000**	**26**

***The marks will be awarded on the basis of 06 weeks industrial training conducted after 4th semester**

6th Semester		Contact Hrs.			Marks			Credits
Code	Course	L	T	P	Int.	Ext.	Total	
BMEE4-629	Ship Operation Management	3	0	0	40	60	100	3
BMEE4-630	Design of Machines-I	3	1	0	40	60	100	4
BMEE4-631	Mechanics of Machines-II	3	1	0	40	60	100	4
BMEE4-632	Fluid Machinery	3	1	0	40	60	100	4
BMEE4-633	Naval Architecture	3	0	0	40	60	100	3
BMEE4-634	Marine Boilers Workshop	0	0	2	60	40	100	1
BMEE4-635	Fluid Machinery Lab.	0	0	2	60	40	100	1
BMEE4-636	Fire Fighting, Controls and Simulators Lab.	0	0	2	60	40	100	1
BMEE4-637	Material Testing Lab.	0	0	2	60	40	100	1
Total		**16**	**4**	**4**	**360**	**440**	**800**	**22**

Total Credits = 25 + 25 + 27 + 21 + 26 + 22 + 17 + 17 = 180

STRENGTH OF MATERIALS – I

Subject Code: BMEE4-301 **L T P C** **Contact Hrs.: 45**
3 1 0 4

Course Objectives and Expected Outcomes: 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 beam 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, stresses in struts and columns subjected to axial load; bending stress, slope and deflection under different loading and supporting conditions. After the study of this course, a student is expected to analyze different stresses, strains and deflection for designing a simple mechanical element under various loading conditions.

Unit–I

Simple, Compound Stresses and Strains: Stress and Strain and their types, Hook's law, longitudinal and lateral strain, Poisson's ratio, stress-strain diagram for ductile and brittle materials, extension of a bar due to without and with self-weight, bar of uniform strength, stress in a bar, elastic constants and their significance, relation between elastic constants, Young's modulus of elasticity, modulus of rigidity and bulk modulus. Temperature stress and strain calculation due to axial load and variation of temperature 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 ellipse of stress and their applications. Generalized Hook's law, principal stresses related to principal strains.

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Unit–II

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) Uniformity distributed loads over the whole span or part of span
c) Combination of concentrated and uniformly distributed load
d) Uniformly varying loads
e) Application of moments

Unit–III

Bending Stresses in Beams: Assumptions in the simple bending theory; derivation of formula and its application to beams of rectangular, circular and channel, I and T- sections. Combined direct and bending stresses in afore-mentioned sections, composite / flitched beams.

Torsion: Derivation of torsion equation and its assumptions and its application to the hollow and solid circular shafts. Torsional rigidity, combined torsion and bending of circular shafts; principal stress and maximum shear stresses under combined loading of bending and torsion.

Unit–IV

Columns and Struts: Introduction, failure of columns, Euler's formula, Rankine-Gordon's formula, Johnson's empirical formula for axially loaded columns and their applications.

Slope and Deflection: Relationship between moment, slope and deflection; method of integration, Macaulay's method, moment area method and use of these methods to calculate slope and deflection for the following:

a) Cantilevers
b) Simply supported beams with or without overhang
c) Under concentrated loads, uniformly distributed loads or combination of concentrated & uniformly distributed loads.

Recommended Books

1. D.S. Bedi, 'Strength of Materials', Khanna Book Publishing Company.
2. E.P. Popov, 'Mechanics of Materials', (SI Version), Prentice Hall India.
3. R.S Lehri and A.S. Lehri, 'Strength of Materials', Kataria and Sons.
4. S.S. Rattan, 'Strength of Materials', Tata McGraw Hill.
5. Timoshenko and Young, 'Elements of Strength of Materials', East West Press.
6. James M. Gere and Barry J. Goodno, 'Strength of Materials', Cengage Learning.

THEORY OF MACHINES-I

Subject Code: BMEE4-302	L T P C 3 1 0 4	Contact Hrs.: 45

Course Objectives &Expected 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 for different applications. 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

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 (including Corliolis Components).

Lower and Higher Pairs: Universal Joint, Calculation of maximum Torque, Steering Mechanisms including Ackerman and Davis approximate steering mechanism, Engine Indicator, Pentograph, Straight Line Mechanisms, Introduction to Higher Pairs with Examples.

Unit–II

Belts, Ropes and Chains: Material & Types of belt, Flat and V-belts, Rope & Chain Drives, Idle Pulley, Intermediate or Counter Shaft Pulley, Angle and Right Angle Drive, Quarter Turn Drive, 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 including consideration of Creep and Slip, Centrifugal Tensions and its effect on power transmission.

Unit–III

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 velocity, uniform acceleration and retardation, cycloidal Motion). Analysis of follower motion for circular, convex and tangent cam profiles.

Friction Devices: Concepts of friction and wear related to bearing and clutches. Types of brakes function of brakes. Braking of front and rear tires of a vehicle. Determination of braking capacity, Types of dynamometers, (absorption, and transmission).

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Unit –IV

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 used for engines and punching machines.

Governors: Function, types and characteristics of governors. Watt, Porter and Proell governors. Hartnell and Willson-Hartnell spring loaded governors. Numerical problems related to these governors. Sensitivity, stability, isochronisms and hunting of governors. 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 Mechanisms & Machines', Metropolitan Book Co.
3. Thomas Beven, 'Theory of Machines', Longman's Green & Co., London.
4. W.G. Green, 'Theory of Machines', Blackie & Sons, London
5. V.P. Singh, 'Theory of Machines', Dhanpat Rai.

APPLIED THERMODYNAMICS-I

Subject Code: BMEE4-304	L T P C 3 1 0 4	Contact Hrs.: 45

Course Objectives and Expected Outcomes: This course is designed for comprehensive study of combustion and thermal aspects in internal combustion engines, steam power plants and its allied components. This will enable the students to understand combustion phenomenon and thermal analysis of steam power plant components. The students will be able to identify, track and solve various combustion problems and evaluate theoretically the performance of various components involved in steam power plants and internal combustion engines.

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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 carburetor, 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; Pressure time/crank- Angle diagrams; Various phenomenon such as turbulence, squish and swirl, dissociation, pre-ignition/auto- ignition, and after burning etc.; Theory of knocking (i.e., 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; Emissions from SI and CI Engines and methods to reduce/control them. Logarithmic plotting of PV-diagrams. High speed Engine Indicators.

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; Working and constructional details of fire-tube and water-tube boilers: (Cochran, Lancashire, Babcock and Wilcox boilers); Merits and demerits of fire-tube and water-tube boilers; Modern high pressure boilers (Benson boiler, La Mont boiler) and Super critical boilers (Once through boilers-Tower type); Advantages of forced circulation; Description of boiler mountings and accessories: Different types of Safety Valves, Water level indicator, pressure gauge, Fusible plug, Feed pump, Feed Check Valve, Blow-off Cock, Steam Stop-Valve, Economiser, Super-heater; Air pre-heater and Steam accumulators; 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.

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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.

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;

Unit–IV

DeLaval Turbine: Compounding of impulse turbines: purpose, types and pressure and velocity variation, velocity diagrams/triangles, combined velocity diagram/triangle and calculations for force, axial thrust, work, power, blade efficiency, stage efficiency, overall efficiency and relative efficiency;

Impulse-Reaction Turbine: pressure and velocity variation, velocity diagrams/triangles, 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; Economic assessment; 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; Cooling towers: function, types and their operation.

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.

WORKSHOP TECHNOLOGY

Subject Code: BMEE4-305	L T P C 3 1 0 4	Contact Hrs.: 45

UNIT-I

1. Common workshop Tools: Description and uses of different types of Calipers, Straight edges, try squares, Vices, Hammers, Chisels, Scrapers, Files, Drills, Reamers, Tapes, V Blocks, Face plate, Marking blocks, Carpentry tools, pattern maker's tools, Smithy tools and Moulding tools. Application of hand tools as chisel, file and saw.

2. Metal cutting Machines: Kinematic analysis, specification, operation and inspection of the more important types of metal cutting machine tool including Centre lathes, Capstan and turret lathes, Automatic lathes, drilling and boring machines. Shaping slotting and planning machines, Milling and broaching machines.

UNIT-II

3. Machine Process & Machine Tools: The geometry of cutting processes, Chip formation, Cutting forces, Stresses and power; Friction of chip on tool. Generation and dissipation of heat ii cutting. Standard nomenclature for cutting tools. Cutting speeds and feeds, estimation of machining time. The fundamental Cutting process, geometrical control of the cutting edge Turning, Screw cutting and taper turning processes on Centre lathe.

4. Abrasive Process: Grinding, honing and lapping by hand and machines. Shears and punches. Wood working machines. Principles of jigs and fixtures Standardization.

UNIT-III

5. Measuring Instruments & Inspection: Description and use of steel rule, Vernier's scale, Micro-meter, Dial gauge, Depth gauge, thread gauge, Feeler gauge, Wire gauge, pattern maker's scale, Taper gauge, snap gauge, Plug gauge, Optical methods of measurement, Principles of interchange ability, limit system, Use of limit gauge.

6. Fitting and Overhauling: Types of packing and jointing materials and their uses, Design considerations and construction of various types of valves and cocks, Reducing valves for steam and air. Bedding of bearings, marking of engine parts for fitting, machining operations fitting of keys, cotters, Pipe work.

UNIT-IV

7. Safety Measures: Sources of danger and methods of protection. Types of guards and safety devices, Factory Act regulations.

MRSPTU

8. Welding: Welding Equipment & Applications, Electric welding (A.C & D.C) spot welding. Gas welding. Soldering & Brazing. Different welding & Electrodes, Solders & Brazing Fluxes. Defects in welding Safe working practices - Personal Protection Equipment

Recommended Books

1. A. Manna, 'A Textbook of Manufacturing Science and Technology', PHI Publishers.
2. H.S. Shan, 'Manufacturing Processes', Vol.-I, Pearson Publishers.
3. P.N. Rao, 'Manufacturing Technology, Foundry, Forming & Welding', Tata McGraw Hill.
4. R.S. Parmar, 'Welding Engineering & Technology', Khanna Publishers.
5. Serope Kalpakjian and Steven R. Schmid, 'Manufacturing Engineering and Technology', Pearson Publishers.

ENGINEERING MATERIALS & METALLURGY

Subject Code: BMEE4-306 **L T P C** **Contact Hrs.: 37**
3 0 0 3

Course Objectives and Outcomes: This course is designed to develop fundamental concepts of crystallography, phase transformation and heat treatment processes. The students will learn the atomic structure of metals, imperfections, diffusion mechanisms and theories of plastic deformation. They will also understand equilibrium diagrams, time-temperature transformation curves and heat treatment processes. Upon completion of the course, the students will be able to understand the concepts of crystal structure, microstructure and deformation. They will also be able to understand the phase diagrams which are useful for design and control of heat treating processes.

Unit–I

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, recrystallization.

Unit–II

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

Heat Treatment: Principles and applications. Processes viz. annealing, normalizing, hardening, tempering. Surface hardening of steels: Principles of induction and oxyacetylene flame hardening. Procedure for carburizing, 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

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. B. Zakharov, 'Heat Treatment of Metals', University Press.
2. T. Goel and R.S. Walia, 'Engineering Materials & Metallurgy'.
3. Sidney H. Avner, 'Introduction to Physical Metallurgy', Tata McGraw Hill.

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4. V. Raghavan, ‘Physical Metallurgy: Principles and Practice’, PHI Learning.
5. Y. Lakhin, ‘Engineering Physical Metallurgy’, Mir Publishers.

ENGINEERING MATERIALS & METALLURGY LAB.

Subject Code: BMEE4-307 **L T P C**
0 0 2 1

EXPERIMENTS

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.

STRENGTH OF MATERIALS LAB

MRSPTU

Subject Code: BMEE4-308 **L T P C**
0 0 2 1

EXPERIMENTS

1. To perform tensile test in ductile and brittle materials and to draw stress-strain curve and to determine various mechanical properties.
2. To perform compression test on Cast Iron.
3. To perform any one hardness tests (Rockwell, Brinell & Vicker’s test).
4. To perform impact test to determine impact strength.
5. To perform torsion test and to determine various mechanical properties.
6. To perform Fatigue test on circular test piece.
7. To perform bending test on beam and to determine the Young's modulus and modulus of rupture.
8. Determination of Bucking loads of long columns with different end conditions.
9. To evaluate the stiffness and modulus of rigidity of helical coil spring.

APPLIED THERMODYNAMICS LAB.

Subject Code: BMEE4-309 **L T P C**
0 0 2 1

EXPERIMENTS

1. Study of construction and operation of 2 stroke and 4 stroke Petrol and Diesel engines using actual engines or models.
2. To plot actual valve timing diagram of a 4 stroke petrol and diesel engines and study its impact on the performance of engine.
3. Study of working, construction, mountings and accessories of various types of boilers.
4. To perform a boiler trial to estimate equivalent evaporation and efficiency of a fire tube/ water tube boiler.

5. Determination of dryness fraction of steam and estimation of brake power, Rankine efficiency, relative efficiency, generator efficiency, and overall efficiency of an impulse steam turbine and to plot a Willian's line.
6. Determine the brake power, indicated power, friction power and mechanical efficiency of a multi cylinder petrol engine running at constant speed (Morse Test).
7. Performance testing of a diesel engine from no load to full load (at constant speed) for a single cylinder/ multi- cylinder engine in terms of brake power, indicated power, mechanical efficiency and specific fuel consumption and to measure the smoke density. Draw/obtain power consumption and exhaust emission curves. Also make the heat balance sheet.
8. Performance testing of a petrol engine from no load to full load (at constant speed) for a single cylinder/ multi- cylinder engine in terms of brake power, indicated power, mechanical efficiency and specific fuel consumption and to measure the exhaust emissions. Also draw/obtain power consumption and exhaust emission curves.
9. Study of construction and operation of various types of steam condensers and cooling towers.

STRENGTH OF MATERIALS-II

Subject Code: BMEE4-411 **L T P C** **Contact Hrs.: 45**
3 1 0 4

MRSPTU

Course 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 cross sections; stresses in helical, spiral and leaf springs; stress and strain analysis of thin, thick cylinder and spheres subjected to internal pressure; and various failure theories. The outcome of the course is to enhance deep and vigorous understanding of stress analysis in various machine elements, so that a student can properly analyze and design a mechanical member from the strength point of view under various conditions.

Unit–I

Strain Energy: Introduction to strain energy, energy of dilation and distortion. Resilience, stress due to suddenly applied loads. Castigliano's and Maxwell's theorem of reciprocal deflection.
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 to problems related to two dimensional stress systems.

Unit–II

Springs: Open and closed coiled helical springs under the action of axial load and/or couple. Flat spiral springs- derivation of formula for strain energy, maximum stress and rotation. Leaf spring deflection and bending stresses.
Thin cylinders and Spheres: Calculation of Hoop stress, longitudinal stress in a cylinder, effects of joints, change in diameter, length and internal volume. Principal stresses in sphere, change in diameter and internal volume.

Unit–III

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, hub shrunk on solid shafts, shrinkage allowance and shrinkage stress.

Bending of Curved Beams: Calculation of stresses in cranes or chain hooks, rings of circular and trapezoidal section, and chain links with straight sides.

Unit–IV

Shear Stresses in Beams: Shear stress distribution in rectangular, circular, I, T and channel section; built up beams. Shear centre and its importance.

Rotational Discs: Stresses in rotating discs and rims of uniform thickness; disc of uniform strength.

Recommended Books

1. D.S. Bedi, 'Strength of Materials', Khanna Book Publishing Company.
2. G.H. Ryder, 'Strength of Materials', Macmillan India Ltd.
3. R.S. Lehri and A.S. Lehri, 'Strength of Materials', Vol.-2, S.K. Kataria and Sons.
4. S.S. Rattan, 'Strength of Materials', Tata McGraw Hills.
5. Timoshenko and Gere, 'Mechanics of Materials', CBS Publishers.

THEORY OF MACHINES – II

Subject Code: BMEE4-412	L T P C 3 1 0 4	Contact Hrs.: 45

Course Objectives & 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

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

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

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 involute 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

Gyroscopic Motion and Couples: Effect on supporting and holding structures of machines. stabilization of ships and planes, Gyroscopic effect on two and four wheeled vehiclesand stone crusher.

Kinematic Synthesis of Mechanism: Freudenstien equation, Function generation errors in synthesis, two and three-point synthesis, Transmission angles, least square techniques.

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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.

FLUID MECHANICS

Subject Code: BMEE4-413 **L T P C** **Contact Hrs.: 38**
3 0 0 3

Course Objectives and Expected Outcomes: This course is designed for the undergraduate mechanical engineering students to develop an understanding of the behavior of fluids at rest or in motion and the subsequent effects of the fluids on the boundaries as the mechanical engineers has to deal with fluids in various applications. This course will also develop analytical abilities related to fluid flow. It is expected that students will be able to have conceptual understanding of fluids and their properties, apply the analytical tools to solve different types of problems related to fluid flow in pipes, design the experiments effectively and do the prototype studies of different types of machines and phenomenon.

Unit–I

Fundamentals of Fluid Mechanics: Introduction; Applications; Concept of fluid; Difference between solids, liquids and gases; Concept of continuum; Ideal and real fluids; Fluid properties: density, specific volume, specific weight, specific gravity, viscosity (dynamic and kinematic), vapour pressure, compressibility, bulk modulus, Mach number, surface tension and capillarity; Newtonian and non-Newtonian fluids.

Fluid Statics: Concept of static fluid pressure; Pascal's law and its engineering applications; Hydrostatic paradox; Action of fluid pressure on a plane submerged surface (horizontal, vertical and inclined): resultant force and centre 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; Pressure distribution in a liquid subjected to:

i) constant acceleration along horizontal, vertical and inclined direction (linear motion),
ii) constant rotation.

Unit–II

Fluid Kinematics: Classification of fluid flows; Lagrangian and Euler flow descriptions; Velocity and acceleration of fluid particle; Local and convective acceleration; Normal and tangential acceleration; Path line, streak line, streamline and timelines; Flow rate and discharge mean velocity; One dimensional continuity equation; Continuity equation in Cartesian (x, y, z), polar (r, θ) and cylindrical (r, θ, z) coordinates; Derivation of continuity equation using the Lagrangian method in Cartesian coordinates; Rotational flows: rotation, vorticity and circulation; Stream function and velocity potential function, and relationship between them; Flow net.

Unit–III

Fluid Dynamics: Derivation of Euler's equation of motion in Cartesian coordinates, and along a streamline; Derivation of Bernoulli's equation (using principle of conservation of energy and equation of motion) and its applications to steady state ideal and real fluid flows; Representation of energy changes in fluid system (hydraulic and energy gradient lines);

MRSPTU

Impulse momentum equation; Kinetic energy and momentum correction factors; Flow along a curved streamline; Free and forced vortex motions.
Dimensional Analysis and Similitude: Need of dimensional analysis; Fundamental and derived units; Dimensions and dimensional homogeneity; Rayleigh's and Buckingham's π - method for dimensional analysis; Dimensionless numbers (Reynolds, Froudes, Euler, Mach, and Weber) and their significance; Need of similitude; Geometric, kinematic and dynamic similarity; Model and prototype studies; Similarity model laws.

Unit–IV

Internal Flows: Laminar and Turbulent Flows: Reynolds number, critical velocity, critical Reynolds number, hydraulic diameter, flow regimes; Hagen – Poiseuille equation; Darcy equation; Head losses in pipes and pipe fittings; Flow through pipes in series and parallel; Concept of equivalent pipe; Roughness in pipes, Moody's chart.
Pressure and Flow Measurement: Manometers; Pitot tubes; Various hydraulic coefficients; Orifice meters; Venturi meters; Borda mouthpieces; Notches (rectangular, V and Trapezoidal) and weirs; Rotameters.

Recommended Books

1. D.S. Kumar, 'Fluid Mechanics and Fluid Power Engineering', S.K. Kataria and Sons Publishers.
2. S.K. Som, G. Biswas and S. Chakraborty, 'Introduction to Fluid Mechanics and Fluid Machines', Tata McGraw Hill.
3. C.S.P. Ojha, R. Berndtsson and P.N. Chandramouli, 'Fluid Mechanics and Machinery', Oxford University Press.
4. Y.A. Cengel and J.M. Cimbala, 'Fluid Mechanics - Fundamentals and Applications', Tata McGraw Hill.
5. B.R. Munson, D.F. Young, T.H. Okiishi and W.W. Huebsch, 'Fundamentals of Fluid Mechanics', John Wiley and Sons.
6. J.F. Douglas and J.M. Gasiorek, J.A. Swaffield and L.B. Jack, 'Fluid Mechanics', Pearson.
7. V.L. Streeter, E.B. Wylie and K.W. Bedford, 'Fluid Mechanics', Tata McGraw Hill.

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APPLIED THERMODYNAMICS-II

Subject Code: BMEE4-414	**L T P C** **3 1 0 4**	**Contact Hrs.: 45**

Course Objectives and Expected Outcomes: This course is designed for providing comprehensive understanding and thermodynamic analysis of positive displacement air compressors and thermal turbo machines used in power generation, aircraft, spacecraft and rocket propulsion. The students will be able to understand the thermodynamic working as well as performance of thermal turbo power machinery. They will also be able to select various thermal devices required for aforesaid applications.

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.

Unit–II

Positive Displacement Rotary Compressors: Introduction: Comparison of rotarypositive 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 aero foil 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

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(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; Dual Turbine system; Series and parallel arrangements; Closed and Semi-closed gas turbine cycle; Requirements of a gas turbine combustion chamber; Blade materials and selection criteria for these materials and requirements of blade materials; Gas turbine fuels.

Jet Propulsion: Principle of jet propulsion; Description of different types of jet propulsion systems like rockets and thermal jet engines, like,

(i) Athodyds (ramjet and pulsejet),
(ii) Turbo jet 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; Types of rocket motors (e.g. solid propellant and liquid propellant systems); Various common propellant combinations (i.e. fuels) used in rocket motors; Cooling of rockets; 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.

BASIC SHIP STRUCTURE & DESIGN-1

Subject Code: BMEE4-415	L T P C 3 0 0 3	Contact Hrs.: 38

UNIT-I

1. Ships Terms: Various terms used in ship Construction with reference to Ship's parameter e.g. L.B.P. Moulded Depth, Moulded draught etc. General Classification of Ships. Stresses in Ship's structure: Hogging, Sagging, Racking, Pounding, Panting, etc. and Strength members to counteract the same.

UNIT-II

2. Sections and Materials Use: Type of section like Angles, Bulb Plates. Flanged beams used in ship construction. Riveting & Welding. Testing of welds. Fabricated components. Bottom & side Framing: Double bottoms, Water tight floors, Solid and bracket floors, Longitudinal framing keels, side framing like Tank side brackets, Beam knee, Web Frame, etc.

MRSPTU

3. Shell & Decks: Planting system for shells, Deck plating & Deck girders, discontinuities like hatches and other openings. Supporting & closing arrangements, mid-ship Section of ships.

UNIT-III

4. Bulk heads & Deep Tanks: Water tight bulkheads, Arrangements of plating and stiffeners. Water tight openings through bulkheads for electric cables pipes and shafting. Deep tank for oil fuel or oil cargo corrugated bulk heads.

UNIT-IV

5. Theory of Fire: Introduction, safety and fire triangle, fire prevention Construction, operation and merits of different types of portable and non-portable fire extinguishers and fixed fire extinguishing installations for ships.

6. Firefighting Equipment: Fire pumps, construction, firefighting in port and dry dock, Action required and practical techniques adopted for extinguishing fires in accommodation, machinery spaces, boiler rooms, Cargo holds, galley etc. Fire fighting in port and dry dock.

Recommended Books

1. Djeyers, 'Ship Design'.
2. Reeds, 'Ship Design'.

FLUID MECHANICS LAB.

Subject Code: BMEE4-416 **L T P C**
0 0 2 1

MRSPTU

EXPERIMENTS

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 or 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.
9. To determine the velocity distribution for pipeline flow with a pitot static probe.
10. Experimental evaluation of free and forced vortex flow.

WORKSHOP TECHNOLOGY LAB.

Subject Code: BMEE4-417 **L T P C**
0 0 2 1

EXPERIMENTS

Casting:

1. To determine clay content, moisture content, hardness of a moulding sand sample.
2. To determine shatter index of a moulding sand sample.
3. To test tensile, compressive, transverse strength of moulding sand in green condition.
4. To determine permeability and grain fineness number of a moulding sand sample.

Welding:

1. To make lap joint, butt joint and T- joints with oxy- acetylene gas welding and manual arc welding processes
2. To study MIG, TIG and Spot welding equipment and make weld joints by these processes.

Machining and Forming:

1. To study constructional features of following machines through drawings/sketches:
   a) Grinding machines (Surface, Cylindrical)
   b) Hydraulic Press
   c) Draw Bench
   d) Drawing and Extrusion Dies
   e) Rolling Mills
2. To grind single point and multipoint cutting tools
3. To prepare job on Lathe involving specified tolerances; cutting of V- threads and square threads.
3. To prepare job on shaper involving plane surface,
4. Use of milling machines for generation of plane surfaces, spur gears and helical gears; use of end mill cutters.
5. To determine cutting forces with dynamometer for turning, drilling and milling operations.

Note: At least one industrial visit must be arranged for the students for the live demonstration of Casting, Welding, Forming and Machining processes.

THEORY OF MACHINES LAB.

MRSPTU

Subject Code: BMEE4-418	**L T P C**
	0 0 2 1

EXPERIMENTS

1. To draw displacement, velocity & acceleration diagram of slider - crank and four bar mechanism.
2. To study the various inversions of kinematic chains.
3. Conduct experiments on various types of governors and draw graphs between height and equilibrium speed of a governor.
4. Determination of gyroscopic couple (graphical method).
5. Balancing of rotating masses (graphical method).
6. Cam profile analysis (graphical method)
7. Determination of gear- train value of compound gear trains and epicyclic gear trains.
8. To draw circumferential and axial pressure profile in a full journal bearing.
9. To determine coefficient of friction for a belt-pulley material combination.
10. Determination of moment of inertia of flywheel.

MARINE AUXILIARY MACHINERY

Subject Code: BMEE4-519	**L T P C**	**Contact Hrs.: 45**
	3 1 0 4	

UNIT-I

ENGINE ROOM LAYOUT: Layout of main and auxiliary machinery in Engine Rooms in different ships.

Engine Room Piping Arrangements & Fittings: Steam and condensate system, water hammering in pipes, Expansion joints in pipelines, Bilge – ballast, fuel oil bunkering and transfer system, bunkering procedure, precautions taken, fuel oil service system to main and auxiliary engines, lubricating oil and Engine cooling system to main and auxiliary engines, central cooling and central priming systems, control and service air system, domestic fresh water and sea water (Hydrophore) service system, drinking water system, fire main system.

UNIT-II

VALVES AND COCKS: Straight way cocks, right angled cock, 'T' cock, spherical cock, Boiler gauge glass cock (cylindrical cock).

Valves: Globe valves, SDNR valve, swing check valve (storm valve), gate valves, butterfly valves, relief valves, quick closing valves, pressure reducing valves, control valves, change over valve chests, fuel oil transfer chest, valve actuators, steam traps.

Jointings: Packings, Insulation of materials, Types, - Various applications. Seals – purpose of bearing seal, description and application of non-rubbing seals and rubbing seals, simple felt seal, seals suitable for various peripheral speeds, V-ring seals, Lip seals.

Filters and Strainers: Filtration, filter elements basket strainers, duplex strainers, edge type strainers, autokleen strainers, back flushing strainers, magnetic filter, rotary filters, fine filters.

OPERATION & MAINTENANCE: Prevention of oil, garbage, sewage, air pollution and IMO requirement as per MARPOL act. Operation,
construction, maintenance of oil water separator both manual and automatic versions. Construction, operation, maintenance of incinerator and the of sewage plant.

UNIT-III

THEORY OF OIL PURIFICATION: Construction, operation, maintenance of fuel oil and lub oil purifiers, clarifiers together with self de sludge operation. Theory of air compression and uses of compressed air on board. construction, operation, maintenance of main air compress and emergency air compressors. Types of bow thrusters, operation, maintenance of the same and Deck machinery, operation, maintenance of cargo winches, windless mooring winches.

METHODS OF SHAFT ALIGNMENT: Construction, operation, maintenance of - thrust block. - intermediate shaft. Construction, operation, maintenance stern tube and stern tube bearing both water cooled and oil cooled together with sealing glands
Stresses in shafting, i.e. intermediate shaft, thrust shaft and screw shaft.

UNIT-IV

DRY DOCKING: Preparation and procedure to dry docking vessel. Maintenance of hull, underwater fittings and machine maintenance and repairs during dry dock Removal and maintenance of rudder and propeller. Removal and maintenance of tail shaft and stern tube bearing.

LINE SYSTEMS: Piping diagrams - Drawing and working principle of the line diagram of – Bilge-Ballast- Fuel oil transfer Fuel oil Service-. Cooling Water – Lubricating oil – Compressed Air - Steam Line – Exhaust Gas – Feed Water.

Recommended Books

1. D.W. Smith, 'Marine Auxiliary Machinery', 6th Edn., Butterworth, London, **1987**.
2. H.D. McGeorge, 'Marine Auxiliary Machinery', 7th Edn., Butterworth, London, **2001**.
3. D.W. Smith, 'Marine Auxiliary Machinery', 6th Edn., Butterworth, London, **1987**.
4. H.D. McGeorge, 'Marine Auxiliary Machinery', 7th Edn., Butterworth, London, **2001.**

SHIP CONSTRUCTION

Subject Code: BMEE4-520 **L T P C** **Contact Hrs.: 45**
3 1 0 4

UNIT-I

SHIP TERMS: Various terms used in ship construction with reference to ship's parameter e.g. L.B.P. – Moulded Depth - Moulded draught etc. - General classification of ships. Stresses in Ship's structure: Hogging – Sagging – Racking – Pounding – Panting etc., and Strength members to counteract the same.

Sections and Materials Use: Type of sections like angles – Bulb plates flanged beams used in ship construction – Riveting & Welding testing of welds – Fabricated components.

UNIT-II

BOTTOM & SIDE FRAMING: Double bottoms, watertight floors solid and bracket floors – Longitudinal framing keels –side framing like tank side brackets – Beam knee – Web frame etc.

Shell & Decks: Plating systems for shells – Deck plating & Deck Girders-discontinuities like hatches and other openings – supporting & closing arrangements-mid-ship section of ships.

Bulk heads & Deep Tanks: water tight bulkheads – Arrangement of platings and stiffeners – water tight sliding doors – Water tight openings through bulkheads for electric cables pipes and shafting – Deep tank for oil fuel or oil cargo corrugated bulkheads.

UNIT-III

FORE & AFT END ARRANGEMENTS: Fore end arrangement, arrangements to resist pounding bulbous bow – Types of sterns stern frame and rudder – Types of rudder – Supporting of rudder – Locking pintle –Bearing pintle – Pallister bearing shaft tunnel – Tunnel bearings.

FREE BOARD AND TONNAGE: Significance and details of markings various international Regulations. Shipyard Practice: layout of a shipyard – Mould loft –Optical marking – Automatic plate cutting, Fabrication and assembly etc.

Ship Types: Tankers – Bulk Carriers – Container ships – L.N.G., L.P.G., and Chemical carriers – Lash ships – Passenger ships – Dredgers – Tugs etc., - Constructional details and requirements.

UNIT-IV

OFFSHORE TECHNOLOGY: Drilling ships and Platforms – Supply vessels – firefighting arrangement – Pipe laying ships – special auxiliary service ships.

Ship Surveys: Survey rules – Functions of ship classification – Societies – Surveys during construction – Periodical surveys for retention of class.

Recommended Books

1. D.J. Eyres, 'Ship Construction', 4th Edn., Butterworth – Heinemann, Oxford, **1994**.
2. E.A. Stokoe, 'Reed's Ship Construction for Marine Engineers', 1st Edn., Thomas Reed Publication, London, **2000**.
3. A.J. Young, 'Ship Construction sketch & Notes', 1st Edn., Butterworth–Heinemann, London, **1980**.
4. H.J. Pursey, 'Merchant Ship Construction'.

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ELECTRICAL MACHINES

Subject Code: BMEE4-521	**L T P C** **3 1 0 4**	**Contact Hrs.: 45**

Alternators-general arrangement of alternators, construction of salient pole and cylindrical rotor types of stator windings, single and double layer windings, e.m.f. equation of an alternator, distribution and pitch factor, waveform of generated e.m.f., alternator on load, percentage regulation, internal voltage drops, production of rotating magnetic field, resultant magnetic field distribution, mathematical derivation of the rotating field condition, magneto-motive force or ampere-turn waveform distribution, reversal of direction of rotation of rotating field.

Synchronous alternator and motor Armature reaction in synchronous alternator, armature reactance, prediction of voltage regulation, open circuit test, short circuit test, synchronous impedance method, torque/angle characteristics, infinity bus bar, synchronizing current, torque and power, hunting of Phase swinging, parallel operation of alternators, a.c. generators in parallel excitation control, throttle control, load sharing –KW and KVA, principle of action of three-phase synchronous motor, effects of varying load and excitation, methods of starting, advantages and disadvantages of synchronous motor.

MECHANICS OF MACHINES - I

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Subject Code: BMEE4-522	**L T P C** **3 1 0 4**	**Contact Hrs.: 45**

UNIT-I

MECHANISMS: Introduction – science of mechanisms – terms and definitions – planar, spherical and spatial mechanisms, mobility classification of mechanisms (indexing mechanism, reciprocating mechanisms, etc.,) straight line generators – kinematic inversion – slider crank chain inversions – four bar chain inversions – Grashoff's law– mechanical advantage. Determination of velocities and acceleration in mechanisms – relative motion method (graphical) for mechanisms having turning, sliding and rolling pair – Coriolis acceleration – analysis using vector mathematics for a four bar mechanism - analysis using complex numbers and loop closure equations for slider crank mechanism, inverted slider crank mechanism – four bar mechanism.

UNIT-II

SYNTHESIS OF MECHANISMS: Classification of kinematics synthesis problems – Tchebycheff spacing – two points synthesis – slider crank mechanism – three position synthesis – four bar mechanism and slider crank mechanism – Freudenstein method – analytical and graphical design – four bar linkage for body guidance – design of four bar linkage as a path generator.

UNIT-III

CAMS: Types of cams and followers – follower's motions – uniform, parabolic, SHM, cycloidal and polynomial – synthesis of cam profiles for different followers – undercutting in cams – pressure angle – determination of minimum radius of curvature using design charts – Vamum's Nomogram – cams of specified contour – eccentric circle cam.

THEORY OF GEARING: Classification of gears, law of gearing, nomenclature – involutes as a gear tooth profile – lay out of an involute gear, producing gear tooth – interference and undercutting – minimum number of teeth to avoid interference, contact ratio, internal gears – cycloid tooth profiles – comparison of involutes and cycloidal tooth forms, non-stadard spur gears – extended centre distance system – long and short addendum system – epicyclic gear trains – inversions of epicyclic gear trains, specified ratio and torque calculations, automobile differential, Wilson four speed automobile gear box.

UNIT-IV

CONTROL MECHANISMS: Governors – gravity controlled and spring controlled – governor characteristics – governor effort and power, gyroscopes – gyroscopic forces and couple – forces on bearing due to gyroscopic action – gyroscopic effects on the movement of air planes and ships, stability of two-wheel drive and four-wheel drive, gyroscopic effects in grinding machines.

Recommended Books

1. J.S. Rao, and R.V. Dukkipatti, 'Mechanism and Machinery Theory', 2nd Edn., New Age International, Mumbai, **1992**.
2. S.S. Rattan, 'Theory of Machines', Tata McGraw Hill Publishing Company Ltd., New Delhi, **1998**.
3. J.E. Shingley & John Joseph Uivker, Jr., 'Theory of Machines and Mechanisms', 2nd Edn., McGraw Hill International Editions, London, **1981**.
4. A. Ghosh and A.K. Mallick, 'Theory of Mechanisms and Machines', Affiliated East-West Pvt. Ltd., New Delhi, **1988**.

ELECTRONICS

Subject Code: BMEE4-523 **L T P C** **Contact Hrs.: 45**
3 1 0 4

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Transistor: Transistor as a small signal amplifier and Frequency Response. Transistorised power amplifier. Relation between Maximum Output Power, Efficiency & Power Dissipation. Characteristics and applications of Field Effect Transistor (FET) &Injunction Transistor (UJT).
Regulated Power Supplies: Series & Shunt Regulated Power Supplies. Regulator ICs like 78XX,79XX, 723.
Oscillators: Requirements for Oscillations, phase shift Oscillators, Wein Bridge Oscillator, Crystal Oscillators, Decoupling Filters.
Transistor Power Amplifier: Design Theory, Basic Complementary symmetry, Pracitcal Complementary push-pull amplifier, Transistor, Phase inverter Relation between Maximum Output power and load resistance and Transistor dissipation.
Wave Shaping and Switching: Clipping, Clamping, time base or Sweep Generator, Multivibrators & Schmitt Triggers.
Operation Amplifier Theory: Concept of Differential Amplifiers. Its use in DP-AMPS. Linear OP –amp circuits.
Converters: Digital to Analog Converters (Binary weighted, R2R) with applications. Analog to Digital Converters (Simultaneous, Counter Type) with applications Digital Circuit &
Boolean Algebra: Logic systems, Logic Gates, Codes. Boolean Algebra and simplification of logical equations. Types of flip-flops, Shift Registers, Counters, Multiplexers and Demultiplexers.
TTL & CMOS Logic Families: TTL NAND gate. Different TTL Series with typical specifications. Development of CMOS Logic. Typical specifications of CMOS family.
Electronics Instruments: Cathode Ray Oscilloscope, Digital Voltmeters and frequency meters, Multimeters; Vacuum Tube voltmeter and signal Generators, Signal generation-operating principle – application; signal generation as used on board ship like measuring and

controlling various variables including rpm, pressure, flow, temperature level, strain. Q-meters.

Industrial Electronics: Silicon Controlled Rectifier (SCR) and other devices, VI characteristic. Application of Power rectification, Speed control of DC motor, Inverters. Photo Electric Devices. IC 555 Internal Block Diagram, application as Monostable & Bistable Multivibrator.

Communication Equipment Overview: Need of Modulation & Demodulation. Generation of AM & FM with waveforms. Pulse Communication. Radio Transmitter & Receivers. Introduction to RADAR.

Introduction to Microprocessors: 8085 Microprocessors architecture, instruction sets. Introduction to Microcontrollers.

Recommended Books

1. P.S. Bhimbra, 'Power Electronics'.
2. Malvino Leach, 'Digital Principles and Applications'.
3. Ramesh Gaonkar, 'Microprocessors and Microcomputers'.

WORKSHOP PRACTICAL (MARINE)

Subject Code: BMEE4-524 **L T P C**
0 0 2 1

EXPERIMENTS

1. Dismantling, overhauling, inspection & assembling of a A/E cyl. Head.
2. Dismantling, overhauling, inspection & assembling of Cylinder liner, piston & piston ring.
3. Dismantling, overhauling, inspection & assembling of main bearing & bottom end bearing.
4. C/Shaft deflection & inspection of C/case.
5. Dismantling & overhauling of M/E exhaust valve.
6. Dismantling & overhauling of M/E cylinder head relief v/v, Air staring v/v.
7. Dismantling & overhauling of Turbochargers.
8. Working principles & demonstration of working of a hydraulic steering gear system, safety checks & routine inspection.
9. Detection of cracks & dealing with cracked pieces
10. To fabricate & weld a pipe with given pipe length & flanges.
11. To repair leaks, pipe by fitting a doubler.
12. To make a pipe line with bends (welding).
13. Practice of welding.
14. Practice of Brazing & Soldering.
15. Detection of cracks & dealing with cracked pieces
16. Tracing of pipelines.
17. Turning, cutting and similar operations by Lathe machine.

Using a simulator, the Following experiments are to be performed

1. To start and stop the engine;
2. To change engine's load and speed;
3. To change ambient operating conditions;
4. To simulate engine faults in varying degrees;
5. To mix different simulations;
6. To watch engine operation parameters'
7. To watch functions inside the cylinder;

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8. To simulate the engine sound which varies with speed;
9. To carry out maintenance and repairs;
10. To try out different maintenance strategies;
11. To print engine data.

ELECTRICAL ENGINEERING, ELECTRONICS AND MICRO PROCESSOR LAB.

Subject Code: BMEE4-525 **L T P C**
0 0 2 1

EXPERIMENTS

(A) ELECTRICAL ENGG. LABORATORY

1. Load Test on D.C. Shunt Motor
2. Load Test on D.C. Series Motor
3. O.C.C. & load characteristic of self/separately excited D.C. Generator.
4. Parallel operation of D.C. Shunt Generator
5. Speed control of D.C. Shunt Motor.
6. Load O.C. & S.C. test on single-phase transformer.
7. Parallel operation of single-phase transformers.
8. To connect similar single-phase transformers in the following ways.
9. Y-Y, A-A, A-Y and Y-A.
10. Pole changing motor for various speeds.
11. Determination of characteristics of an A/C brush less generator.
12. Synchronization of 3-phase alternator.
13. Trouble shooting in Electric Motors and Transformers.
14. Exercises in Power Wiring and earthing.

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(B) ELECTRONICS / MICROPROCESSOR LABORATORY

1. To study the volt-ampere characteristics of a high current semiconductor diode.
2. To study the volt-ampere characteristics of a diode and Zener diode.
3. To study the half wave and full wave rectification circuit without and with filter circuit.
4. To study the volt-ampere characteristics of a Transistor.
5. To study the volt-ampere characteristics of Field Effect Transistor.
6. To study the characteristics of Silicon Control Rectifier.
7. To study the Transistor Feed Back Amplifier.
8. To study the Integrated Circuit operational amplifier.
9. To study the logic training board.
10. To study the speed control of D.C. motor using Thyristor.
11. Arithmetic operations using 8085
12. Logical operations using 8085
13. Array operations using 8085
14. Speed & Direction Control of Stepper motor using 8085.

ELECTRICAL MACHINES LAB.

Subject Code: BMEE4-526 **L T P C**
0 0 2 1

EXPERIMENTS

1. To study and run rotary convertor under different conditions to record the generated voltage on d.c. side against variation of load.

2. To perform load test on a 6-pulse, 2-way bridge rectifier and to obtain the characteristic curves.
3. To study the slip-torque characteristics of an induction motor and to find out the full load slip.
4. To study the different types of Motors, connect the motor AG. supply, run the motor and obtain its speed load characteristics. (The experimental multi-motor set).
5. To determine the regulation of a 3-phase alternator by synchronous impedance method.
6. To compute full load input, torque, slip, power factor and efficiency of 3-phase induction motor from circle diagram. Also to compare the results from the circle diagram with actual full load test on the motor.
7. Synchro-transmitter and Repeater.
8. Transformer connections.
9. Determination of phase-sequence of the given 3-phase supply.
10. Study of single-phase controller.
11. Observation of the wave-form of magnetizing current and hysteresis loop.
12. Study of transformer differential relay.

COMPUTER AIDED MARINE ENGINEERING DESIGN ANDANALYSIS LAB.

Subject Code: BMEE4-527 **L T P C**
0 0 2 1

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EXPERIMENTS

UNIT-I

ENGINEERING DESIGN AND COMPUTER AIDED DESIGN:
The design process, concept, analysis, feasibility, Selection of materials and manufacturing considerations in design, Design with reference to repairs and reconditioning, specifically for working out at sea with its restrictions and limitations. Role of computers - Computer Aided Engineering - Computer Aided Design - Design for Manufacturability – Computer Aided Manufacturing - Benefits of CAD.

UNIT-II

COMPUTER AIDED DESIGN AND FINITE ELEMENT ANALYSIS:
Creation of Graphic Primitives - Graphical input techniques - Display transformation in 2-D and 3-D – Viewing transformation - Clipping - hidden line elimination – Mathematical formulation for graphics - Curve generation techniques - Geometric Modeling – Wireframe, Surface and Solid models - CSG and B-REP Techniques - Features of Solid Modeling Packages - Parametric and features - Interfaces to drafting, Design Analysis -Exposure to FEA packages.

UNIT-III

TYPES OF LOADING AND DESIGN CRITERIA:
static loads, impact loads, repeated loads, variable and cyclic loads, combined and reversible loads. Stress concentration and design factors, fatigue strength, modes of failure, design stresses, factor of safety, theories of failure, wear, corrosion, design criteria, S-N curve Goodman and Soderberg equations.

UNIT-IV

JOINTS, SHAFTS AND COUPLINGS:
Design of cotter joints, knuckle joints, bolted joints, welded joints, riveted joints. Design of shafts and couplings – Drafting using CAD packages.

BELTS, FRICTION CLUTCHES AND BRAKES:
Design of Belt drives and hoists (Wire ropes), Multiple plate clutches, cone clutch, centrifugal clutch block brakes, internally expanding shoe brakes, external band brakes, differential band brakes - Solid modelling using CAD packages.

Recommended Books

1. Goutam Prohit and Goutam Ghosh, 'Machine Drawing with AutoCAD', 1st Impression, Dorling Kindersley (India) Pvt. Ltd., New Delhi, 2007.
2. J.E. Shigley, 'Mechanical Engineering Design', 1st metric Edn., McGraw Hill, New Delhi, **1986**.
3. R.S. Khurmi and J.K. Gupta, 'Machine Design', 5th Edn., Eurasia Publishing, New Delhi, **2005**.
4. Sadhu Singh, 'Computer Aided Design and Manufacturing', Khanna Publishers, New Delhi, **1998**.
5. Abdulla Sharif, 'Machine Design', 3rd Edn., Dhanpat Roy & Sons, New Delhi, **1995**.
6. Pandya & Shaw, 'Elements of Machine Design', 1st Edn., Charotar Publishing, Mumbai, **1997**.
7. Groover and Zimmers, 'CAD / CAM: Computer Aided Design and Manufacturing', Prentice Hall of India, New Delhi, **1994**.

SHIP OPERATION AND MANAGEMENT

Subject Code: BMEE4-629	**L T P C**	**Contact Hrs.: 37**
	3 0 0 3	

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Brief History of Shipping: Modern shipping practice. Marine vehicles and cargoes. Development in Shipping and cargo handling Principal shipping organizations. Liner and tramp shipping services, Conference systems. Chartering, Charter parties. Theory of freight rates and fares. Rate fixation machinery and government control. Bills of lading. Carriage of goods by sea act. Cargo Surveys and protests.

Role of Classification Society

Marine Insurance: Underwriting and loss adjusting principles applied to Marine cargo insurance. Hull policy, particular average General average, P & I Clubs. Ownerships of vessels, Shipping Company and its administration. Capitalization and finance, Ecemonics of new and second hand tonnage. Subsidies.

Ship Operations: Planning sailing schedules. Voyage estimates Economic factors. Commercial Shipping Practice. Manning of ships. Engagement and disadvantage of crew D. L. B. Seaman's welfare.

Merchant Shipping Act: Registration of ship. Ship's papers. Port Procedures. Pilotage, Duties regarding pollution. Collision, Explosion fire etc. Vessels in distress. Shipping casualty's penalties under Merchant Shipping Act.

MACHINE DESIGN-I

Subject Code: BMEE4-630	**L T P C**	**Contact Hrs.: 45**
	3 1 0 4	

UNIT-I

1. Meaning of design with special reference to machine design. Definition and understanding of various types of design, Elaborated Design process.

2. Design and Creativity: Systematic design conceptualization, product design definition, underlying principles of design in Aesthetics and ergonomics, free body diagram for components design.

UNIT-II

3. **General Design Considerations:**

a) Concept of tearing, bearing, shearing, crushing, bending etc.
b) Selection of materials, Basic criteria of selection of material, their designation, mechanical properties of those materials in brief.
c) Study of Stress concentration, factor of safety under different loading conditions.

3. Basic Design: Design for static loading, design for variable loading for both limited and unlimited life, concept of fatigue and endurance strength.

4. Design of fasteners:

a) **RIVETS:** Design of rivets for boiler joints, lozenge joints (uniform strength joint), eccentrically loaded riveted joints.
b) **BOLTS:** Understanding the various stresses/failure in bolted joints, design of cylindrical covers, basic and eccentrically loaded bolts
c) **WELDS:** Design for various loading conditions in torsion, shear or direct load, eccentrically loaded welded joints.
d) **MISCELLENEOUS:** Design of spigot and socket cotter joint, Gib and Cotter joint and knuckle joint.

UNIT-III

5. Design of Transmission Shaft Design of both solid and hollow shafts for transmission of torque, bending moments and axial forces, Design of shaft for critically speed, Design of shaft for rigidity and Design of stepped shafts for assembly.

6. Design of Keys and Couplings: Design of sunk keys under crushing and shearing, design of splines, design of sleeve and solid muff coupling, clamp or compression coupling, rigid and flexible flange coupling, design of universal joint

UNIT-IV

7. Lever Design: Basic lever design, design of foot and hand lever, cranked lever, bell crank lever, safety valve lever and shoe brake lever.

8. Design of Pipe Joints: Stresses in pipe joints, design of circular flange pipe joint, oval flanged pipe joints, square flange pipe joint.

Recommended Books

1. Shigley, 'Machine Design', Tata McGraw Hill.
2. Juvinal, 'Machine Design', John Wiley Publishers.
3. Spots, 'Machine Design', Prentice Hall.
4. Norton, 'Machine Design', Prentice Hall.
5. Khurmi, 'Machine Design'.
6. Goyal and Bahl, 'Machine Design', Standard Publishers.
7. 'Product Design and Development', Prentice Hall.
8. 'Design Data Book', Compiled by PSG College of Engineering & Technology, Coimbatore.

MECHANICS OF MACHINES – II

Subject Code: BMEE4-631 **L T P C** **3 1 0 4** **Contact Hrs.: 45**

UNIT-I

Toothed Gearing: Types of gears, condition for transmission of constant velocity; methods

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of avoiding interference; Transmission of power by gear trains on parallel shafts; Rack and pinion, Bevel gears, Worm and worm wheel, Spur gears Helical gears, Spiral gears; Epicylic gear trains, Torque on gear trains, acceleration of gear trains.

Balancing: Balancing of masses rotation in different planes, dynamic forces at bearings; Primary and secondary balance of multicylinder in-line Engines and configurations.

UNIT-II

Gyroscope: Gyroscopic couple. Vector representation to torque and angular movement, Steady rectangular precession, vector treatment; Steady conical precession; Motion involving Steady precession; Application to Ship's stabilization. Free Harmonic Vibrations, Linear motion of an elastic system, Angular motion of an elastic System. Differential equation of motion. Free Vibration of springs in series and parallel. Simple and compound pendulums. Single and two degrees of freedom.

UNIT-III

Torsional Vibrations: Single rotor system, rotor at end and rotor in the middle. Effect of inertia of Shaft. Two rotor system, rotors at both ends and rotors at one end. Three rotor and Multirotor system. Torsionally equivalent shafts, Geared system.

Forced Vibrations: Forced Linear and angular Vibrations, Periodic force transmitted to support, periodic movement of the support. Transverse vibrations of beams: Single Concentrated load, effect of the mass of the beam, Energy method-several concentrated Loads uniformly distributed load, Dunkerley's empirical method for several Concentrated loads. Whirling of Shafts-Whirling of shafts, critical speed, effect to slope of the disc, effect of end thrust.

UNIT-IV

Damped Vibrations: Idea of Viscous and Coulomb damping, Linear and angular vibrations with Viscous damping, Forced damped liner and angular Vibrations, Periodic movement of support.

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FLUID MACHINERY

Subject Code: BMEE4-632 **L T P C** **Contact Hrs.: 45**
3 1 0 4

UNIT-I

1. General Concepts: Impulse momentum principle; jet impingement on stationary and moving flat plates, and on stationary or moving vanes with jet striking at the centre 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 turbomachine and specifying the energy transfer in terms of fluid and rotor kinetic energy changes.

UNIT-II

2. 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

3. 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.

UNIT-III

4. 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.

5. Similarity Relations and Performance Characteristics: Unit quantities, specific speed and model relationships, scale effect; cavitation and Thoma's cavitation number; Concept of Net Positive Suction Head (NPSH) and its application in determining turbine / pump setting

UNIT-IV

6. 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.

7. Hydraulic Devices and Systems: Const., operation and utility of simple and differential accumulator, intensifier, fluid coupling and torque converter, Air lift and jet pumps; gear, vane and piston pumps.

Recommended Books

1. R.L. Daughaty, ‘Hydraulic Turbines’, McGraw Hill Book Co.
2. Jagdish Lal, ‘Hydraulic Machines’, Metropolitan Book Co. Pvt. Ltd.
3. D.S. Kumar, ‘Fluid Mechanics and Fluid Power Engineering’, S.K. Kataria and Sons, Delhi.

MRSPTU

NAVAL ARCHITECTURE

Subject Code: BMEE4-633 **L T P C** **3 0 0 3** **Contact Hrs.: 37**

UNIT-I

Geometry of Ship & Hydrostatic Calculation: Ships lines, Displacement Calculation, First and Second moment of area, Simpsons rules, application to area and volume, Trapezoidal rule, mean and mid-ordinate rue, Tchebycheff’s rule and their applications, Tonnes per Cm. Immersion. Coefficient of form, Wetted surface area, Similar figures. Centre of gravity, effect of addition and removal of masses, Effect of suspended mass.

UNIT-II

Transverse Stability of Ships: Statical stability at small angles of heel, Calculation of B.M. Metacentric, inclining experiment, Free surface effect, stability at large angles of heel, curves of statical stability, dynamical stability, angle of loll; stability of a wall sided ship. Resistance & Power: Frictional, Residuary & Total resistance, Froude’s Law of comparison, Effective power calculations, Ships correlation Factor (SCF), Admiralty co-efficient, Fuel Coefficient and Fuel consumption. Effect of viscosity and application of ITTC formula.

Longitudinal Stability and Trim: Longitudinal BM, Moment to change trim one Cm. Change of trim, change of L.C.B. with change of trim, Change of trim due to adding or deducting weights, alteration of draft due to change in density, flooding calculations, Floodable length curves, M.O.T. method for determination of floodable lengths, factors of subdivision, Loss of stability due to grounding, Docking stability. Pressure on chocks.

UNIT-III

Strength of Ships: Curves of buoyancy and weight, curves of load, shearing force and bending moments, Alternate methods, standard Conditions, Balancing Ship on wave, Approximation of max, shearing force and bending moment, method of estimating B.M. & Deflection. Longitudinal Strength, Moment of Inertia of Section Modulus.

Propulsion & Propellers: Definitions, apparent and real ship wake, thrust, relation between power, relation between mean pressure and speed, measurement of pitch, cavitation, propeller types, fixed pitch, Variable Pitch, ring propeller, Kort nozzles, Voith Schneider propeller, theory, Blade element theory, Law of similitude and model tests with propellers, propulsion test, Geometry and geometrical properties of screw propellers, ship model correlation ship trials.

UNIT-IV

Rudder Theory: Action of the Rudder in turning a ship, force on rudder, Torque on stock, calculation of force torque on non-rectangular rudder, angle of heel due to force torque on rudder, Angle of heel when turning. Types of rudder, model experiments and turning trials, Area and shape of rudder, position of rudder, stern rudder Bow rudders.

Motion of Ship on Waves: Theory of waves, Trochoidal waves, relationship between line of orbit centres and the undisturbed surface, Sinusoidal waves. Irregular wave pattern, Wave spectra, Wave amplitudes, rolling in unresisting media, rolling in resisting media, practical aspects of rolling, Antirolling devices, Forces caused by rolling and pitching, Heaving and Yawing.

MARINE BOILERS WORKSHOP

Subject Code: BMEE4-634 **L T P C**
0 0 2 1

MRSPTU

1. **Types of Marine Boilers:** Comparison of smoke tube and water boilers.
2. **Smoke Tube Boilers:** Various types in marine use, Principal dimensions and staying of flat surface of multitubular cylindrical Boilers. Vertical Auxiliary Boilers. Water Tube Boilers.
3. **Superheater:** Economizer, Air preheater & steam preheater; circulation and use of Unheated Down comers in highly rated boilers; Superheat temperature control.
4. **Attemperators and Desuperheaters:** Waster heat boilers; Waste heat recovery calculation.
5. **Safety Valves:** Improved High Lift, Full lift and full Bore type: Gauge glass- Ordinary plate type and remote Indicator.

FLUID MACHINERY LAB.

Subject Code: BMEE4-635 **L T P C**
0 0 2 1

EXPERIMENTS

1. Determination of various efficiencies of Hydraulic Ram
2. To draw characteristics of Francis turbine
3. To study the constructional features of reciprocating pump and to perform test on it for determination of pump performance
4. To draw the characteristics of Pelton Turbine
5. To draw the various characteristics of Centrifugal pump
6. Determine the effect of vane shape and vane angle on the performance of centrifugal fan.

FIRE FIGHTING, CONTROLS AND SIMULATOR LAB.

Subject Code: BMEE4-636 **L T P C**
0 0 2 1

1. Fire hazard aboard ships – inflammability, fire extinguishing use. Control of class A, B & C fires.
2. Fire protection built in ships, extinction systems, and escape means.
3. System for tankers, statutory requirements for firefighting systems and equipment on different vessels.
4. Firefighting equipment: fire pumps, hydrants and hoses, couplings, nozzles and International shore connection, Construction, Operation and merits of different types of portable extinguishers.
5. Non-portable and fixed fire extinguishers, installation for ships. Properties of chemical used, bulk cabondioxide, and inert gas systems.
6. Firemen outfit its use and care, maintenance, testing and recharging of appliances, preparation, and fire appliance survey.
7. Fire Control: Action required and practical techniques adopted for extinguishing fires in accommodation, machinery spaces, boiler rooms, Cargo holds, galley etc.,
8. Fire fighting in port and dry dock. Procedure for re-entry after putting off fire, rescue operations from affected compartments.
9. First aid, Fire organisation on ships. Fire signal and muster.

MATERIAL LAB.

Subject Code: BMEE4-637 **L T P C**
0 0 2 1

MRSPTU

EXPERIMENTS

1. To determine the behaviour of different materials when subjected to Tension and to obtain the following Tensile properties of materials on Universal Testing Machine:
   (i) UTS, (ii) Yield Stress, (iii) Young's Modulus, (iv) Breaking Stress, (v) Percentage Elongation, (vi) Percentage reduction in area and (vii) Plotting of Curve of –Stress vs. Strain.
2. To determine the behaviour of materials under direct shear force and to study the effect of it and to calculate the shear stress of material.
3. To study the behaviour of materials when subjected to bending and to find out the effect of such act on material and to calculate the bending stress of materials.
4. Determination of the behaviour of different materials when subjected to sudden shock and to the impact resistance quality or the impact strength of the materials.
5. To determine the hardness of materials by indenting a hardened steel ball into the specimen under test by an applied specified load on the ball.
6. Determination of behaviour of ductile materials when subjected to torsion and to obtain: i) Max. torsion stress ii) Modulus of rigidity iii) Plotting of curve of Angle of Twist vs. Torque.
7. To determine the stiffness of spring for a) round wire, b) square section wire when subjected to compression.
8. Determination of compressive stress and strain of materials under compressive force applied to the material.
9. To find out the Tensile stress of materials on hand operated Tensile testing machine.

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
BHUM0-F91	Soft Skills-I	0	0	2	60	40	100	1
BAGE2-308	Institutional Training*	0	0	4	60	40	100	2
Total		**15**	**5**	**10**	**440**	**460**	**900**	**25**

*** Institutional Training after 4th semester during summer vacations**

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
BAGE2-415	Theory of Machines Lab.	0	0	2	60	40	100	1
BAGE2-416	Soil & Water Conservation Engineering Lab.	0	0	2	60	40	100	1
BHUM0-F92	Soft Skills-II	0	0	2	60	40	100	1
Total		**16**	**3**	**8**	**440**	**460**	**900**	**23**

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SEMESTER 5TH		Contact Hrs.			Marks			Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
BAGE2-517	Agricultural Structure and Environmental Control	3	0	0	40	60	100	3
BAGE2-518	Soil and Water Conservation Structures	3	1	0	40	60	100	4
BAGE2-519	Dairy and Food Engineering	2	1	0	40	60	100	3
BAGE2-520	Tractor System, Controls & Operation	3	1	0	40	60	100	4
BAGE2-521	Soil and Water Conservation Structures Lab.	0	0	2	60	40	100	1
BAGE2-522	Tractor System, Controls & Operation Lab.	0	0	2	60	40	100	1
BAGE2-523	Dairy and Food Engineering Lab.	0	0	2	60	40	100	1
BAGE2-524	Training-II*	0	0	4	60	40	100	2
BHUM0-F93	Soft Skills-III	0	0	2	60	40	100	1
Open Elective – I		4	0	0	60	40	100	4
Total		**15**	**3**	**12**	**520**	**480**	**1000**	**24**

- **6 Months training after 5th semester during summer vacations**

SEMESTER 6TH		Contact Hrs.			Marks			Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
BAGE2-625	Engineering Hydrology	3	1	0	40	60	100	4
BAGE2-626	Engineering Properties of Biological Material& Food Quality	3	1	0	40	60	100	4
BAGE2-627	Drainage Engineering	2	1	0	40	60	100	3
BAGE2-628	Hands on Training in CAD/CAM	3	0	0	40	60	100	3
BAGE2-629	Engineering Hydrology Lab.	0	0	2	60	40	100	1
BAGE2-630	Engineering Properties of Biological Material & Food Quality Lab.	0	0	2	60	40	100	1
BAGE2-631	Drainage Engineering Lab.	0	0	2	60	40	100	1
BHUM0-F94	Soft Skills- IV	0	0	2	60	40	100	1
Open Elective – II		4	0	0	40	60	100	4
Total		**15**	**3**	**8**	**440**	**460**	**900**	**22**

After 6th semester, student will go for 8 Weeks in house / Industrial Training, present a seminar and submit a report in defined format to the department.

Overall

Semester	**Marks**	**Credits**
1st	1000	25
2nd	900	25
3rd	900	25
4th	900	23
5th	1000	24
6th	900	22
Total	**5600**	**144**

AGRICULTURE FOR ENGINEERS

Subject Code: BAGE2-301 **L T P C** **Duration: 48 Hrs.**
3 1 0 4

Course Objectives:
This course includes with a fairly good concept of the fundamentals of different topics related to Agriculture field like Soil Science, organic matter availability in soil, agronomy, horticulture and layout etc.

Course Outcomes:
The Students will understand the different types of soils, rocks, characteristics and Identifications.

1. The Students will understand the layout and planting methods of horticultural crops.
2. Identify the different types of soil and organic matters.
3. Identify the different types of equipment for tillage operations.
4. The students will able to understand about the essential plants nutrients.

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**,** 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. Soil water plant relationship**,** Crop rotation**,** cropping systems**,** Mixed cropping, Relay cropping

Unit - III (10 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,

Horticulture: Scope of horticultural and vegetable crops**,** Soil and climatic requirements for fruits Soil and climatic requirements for Vegetables**,** improved varieties of horticulture crops High-tech horticulture- Poly-houses for flowers and vegetables.

Unit –IV (14 Hrs.)

Criteria for Site Selection of Horticulture Crops: Layout and planting methods, Nursery raising, Macro and micro propagation methods, Pant growing structures, Pruning & training, Fertilizer application process, Fertigation, 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 MACHINERY

Subject Code: BAGE2-302 **L T P C** **Duration: 48 Hrs.**
3 1 0 4

Course Objectives:
Farm machinery is utilizing different sources of power and mechanization achieved through the design, development, testing and adaptation of farm implements and. Today farm labour is

becoming scarce and expensive day by day. It is also necessary to reduce the cost of cultivation of Different crops.

Course Outcomes:

1. To identify the need of farm mechanization in India and evaluation of tillage, sowing in farming.
2. To abreast the students with mathematical, experimental and computational skills for solving
3. different field problems.
4. To develop skills in the students required to develop and modification of farm machineries.
5. To identify the need of earth moving equipment and their importance in farming.

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 type, Hydraulic type 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, harvesting machinery- 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, 'Principles 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

Course Objectives:

This course is designed for comprehensive study of combustion and thermal aspects in internal combustion engines, steam power plants and its allied components. This will enable the students to understand combustion phenomenon and thermal analysis of steam power plant components.

Course Outcomes:

The students will be able to-

1. Understand the Basic principles of thermodynamics like conservation of mass, conservation of energy and the second law of thermodynamics.
2. Analyse the performance of various power cycles and to identify methods for improving thermodynamics performance.
3. Analyse the working, efficiency, process of Otto, diesel and dual cycle.
4. Carry out simple analysis on internal combustion engines.

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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, 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

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.)

Thermodynamic Air Cycle: Air Standard efficiency, Engine efficiencies and terms, Otto cycle, Diesel cycle, Dual cycle, mean effective pressure, Measurement of IP and BP, HBC.

Recommended Books

1. D.S. Kumar, 'Thermodynamics', Katson Publication 1st Edition, **2009**.
2. D.K. Jha, 'A Text Book of Thermodynamics', Discovery Publishing House.
3. R.S. Khurmi & J.K. Gupta, 'A Text Book of Thermal Engineering,' S. Chand & Company Limited, reprint **2002**.
4. P.K. Nag, 'Engineering Thermodynamics', TMH Publication.
5. R. Yadav, 'Thermodynamics and Heat Engines', Central Publishing House, **2002**.

MRSPTU

WASTELAND DEVELOPMENT

Subject Code: BAGE2-304	**L T P C** **3 1 0 4**	**Duration: 46 Hrs.**

Course Objectives:

To improve resources conservation (soil and water) and land use and maximizing productivity per unit area, per unit time and per unit of water. This course includes the study of how to wasteland land Reclamation by the different ways like Afforestation, reforestation, topographic condition of soil, conservative structures etc.

Course Outcomes:

The students will able to-

1. Theoretical knowledge of identifying the arid, semi-arid, humid and sub humid regions.
2. The students will able to conserving the land against its degradation.
3. The students will able to know about uses of structures in conservation of land.
4. The students will able to know about the wasteland treatment under micro irrigation.

Unit – I (10 Hrs.)

Land Degradation: Concept, classification - arid, semiarid, humid and sub-humid regions, denuded range land and marginal land, 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- Use 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. H.R. 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.**

IRRIGATION ENGINEERING

Subject Code: BAGE2-305 | **L T P C** **3 1 0 4** | **Duration: 46 Hrs.**

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Course Objectives:

To study the techniques of irrigation methods and understand the various technologies of irrigation. This course learns about the acquire knowledge of irrigation water, use of irrigation water in field, understand different irrigation methods and effective usage of water resources.

Course Outcomes:

1. To provide a sound theoretical knowledge applied to water resources and agricultural engineering.
2. The students will able to understand the requirements of crop water.
3. The Students will understand the importance of water quality for beneficial uses, especially irrigation and its management.
4. To develop innovative capacity of students for increasing agricultural production with scarce water resources available.

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, Design and evaluation of surface, sub-surface, overhead and drip irrigation systems; design of water conveyance systems including control structures, design principles, 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 Engg.' 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

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.

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FARM MACHINERY LAB.

Subject Code: BAGE2-307 **L T P C**
0 0 2 1

EXPERIMENTS

1. To study animal drawn and tractor drawn mould Board ploughs.
2. Introduction to various farm machineries.
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 equipment.
16. Working of seed-cum-fertilizer drills and their calibration.

SOFT SKILLS-I

Subject Code: **BHUM0-F91** **L T P C**
0 0 2 1

Course Objectives:
The course aims to cause a basic awareness about the significance of soft skills in professional and interpersonal communications and facilitate an all-round development of personality.

Course Outcomes:
At the end of the course, the student will be able to develop his/her personal traits and expose their personality effectively.

UNIT-1

Soft Skill: Introduction to Soft Skills, Aspects of Soft Skills, Identifying your Soft Skills, Negotiation skills, Importance of Soft Skills, Concept of effective communication.
Self-Discovery: Self-Assessment, Process, Identifying strengths and limitations, SWOT Analysis Grid.

UNIT-2

Forming Values: Values and Attitudes, Importance of Values, Self-Discipline, Personal Values - Cultural Values-Social Values-some examples, Recognition of one's own limits and deficiencies.

UNIT-3

Art of Listening: Proxemics, Haptics: The Language of Touch, Meta Communication, Listening Skills, Types of Listening, Listening tips.

UNIT-4

Etiquette and Manners: ETIQUETTE- Introduction, Modern Etiquette, Benefits of Etiquette, Taboo topics, Do's and Don'ts for Men and Women. MANNERS- Introduction, Importance of manners at various occasions, Professional manners, Mobile manners. CORPORATE GROOMING TIPS- Dressing for Office: Do's and Don'ts for Men and Women, Annoying Office Habits.

Recommended Books:
1. K. Alex, S. Chand Publishers.
2. Butterfield, Jeff, 'Soft Skills for Everyone', Cengage Learning, New Delhi, **2010**.
3. G.S. Chauhan and Sangeeta Sharma, 'Soft Skills', Wiley, New Delhi, **2016**.
4. Klaus, Peggy, Jane Rohman & Molly Hamaker, 'The Hard Truth About Soft Skills', Harper Collins E-books, London, **2007**.
5. S.J. Petes, Francis, 'Soft Skills and Professional Communication', Tata McGraw Hill Education, New Delhi, **2011**.

SURVEYING AND LEVELLING

Subject Code: BAGE2-409 **L T P C** **Duration: 48 Hrs.**
3 1 0 4

Course Objectives:
This course introduces to students the theory and application of surveying and to make well understands the fundamentals of surveying knowledge and being familiar with various aspects of surveying practice. It has ability to apply the knowledge of mathematics science and engineering to understand the measurement technique and equipment used in land surveying.

Course Outcomes:
The students should be able to-

1. Demonstrate knowledge of various surveying methods.
2. Conduct a chain survey and compass survey.
3. Conduct levelling survey and be able to do RL calculations.
4. Demonstrate knowledge of properties of various building materials.

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 and corrections, Selection of survey station and lines, offset measurement, Obstacles in chaining and ranging.

Unit – II (12 Hrs.)

Traversing: Methods of traversing, Prismatic compass, Surveyors compass Angle and bearing, quadrantal system, Local attraction, Dip of angle, magnetic declination, Plotting a traverse survey, Errors in compass survey, Bow ditch's rule, Transit rule.

Unit – III (10 Hrs.)

Plane Tabling: Plane tabling instruments and accessories, Methods and principal, two points problem, three points problem, Errors in plane tabling,

Theodolite: Theodolite traversing, Theodolite Surveying, Ranging by theodolite, Temporary and Permanent adjustment of theodolite.

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, types of levelling, Simple and differential levelling, Check levelling & reciprocal levelling, Precise levelling, profile levelling

Recommended Books:

1. B.C. Punamia, 'Surveying and Levelling', Vol-I & Vol-II, Laxmi Publications, **2005.**
2. Kanetkar & Kulkarni, 'Surveying and Levelling Part-1', Vidyarthi Griha Prakashan, Pune**.**
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.**

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THEORY OF MACHINES

Subject Code: BAGE2-410	**L T P C** **3 1 0 4**	**Duration: 46 Hrs.**

Course Objectives:

This course 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.

Course Outcomes:

The students should be able to-

1. Draw inversions and determine velocity and acceleration of different mechanisms.
2. Understand various parts involved in kinematics of machines.
3. Construct different types of cam profile for a given data.
4. Know about clutch, belt, gear system, governor system.

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,

Governor: Introduction, Types, Constructional details and Analysis of Watt, Porter, Proell governor, Sensitiveness, stability, hunting, isochronisms, power and effort of a governor, flywheel.

Recommended Books:

1. R.S. Khurmi, 'Theory of Machines', S. Chand Publication.
2. S.S. Rattan, 'Theory of Machines', 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

MRSPTU

Subject Code: BAGE2-411	L T P C 4 0 0 4	Duration: 46 Hrs.

Course Objectives:

This includes the study of trading, growth, money, income, depression, prices, and monopoly. Economics is important in the world because it can answer questions such as what causes of Inflation and why are people unemployed? Economics includes the study of labour, land, and investments, of money, income, and production etc.

Course Outcomes:

The Students should be able-

1. Understand the concept of macroeconomic equilibrium and implications for the management of the business cycle.
2. Understand the costs of production and profit-maximization.
3. Understand and apply supply and demand analysis to relevant economic issues.
4. Distinguish between perfect competition and imperfect competition and be able to explain the welfare loss in non-competitive markets.

Unit – I (12 Hrs.)

Economics: Definitions, Nature, Scope, Difference between Microeconomics and Macro-economics, theory of demand & supply; meaning, determinants, law of demand, law of supply Equilibrium between demand and 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.

Unit –IV (10 Hrs.)

Unemployment: Meaning, types, causes, remedies, Inflation- meaning, types, causes, measures to control, Money- meaning, functions, types, Monetary policy and Fiscal policy - meaning, objectives and tools**.** 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: BAGE2-412 **L T P C** **Duration: 44 Hrs.**
3 0 0 3

MRSPTU

Course Objectives:

Designing soil conservation works, repairing sites of degradation, controlling water retention, water logging and soil salinity and providing advice on water quality and pollution issues. Carrying out environmental impact studies and monitoring construction sites for environmental problems and assessing of irrigation and drainage requirements of soils.

Course Outcomes:

The student will be able to

1. Know about the causes about water scarcity and their solution to fight against the damage effects through soil and water conservation technologies.
2. Recognize different types of erosion, rainfall and runoff.
3. Design and construct a simple earth dam and ponds for farm use,
4. Understand the concept of Universal Soil Loss Equation (USLE) with respect to soil loss.

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 (12 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.

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 and 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, 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, **2009.**
4. V.V.N. Murthy, 'Land and Water Management Engineering', Kalyani Publishers, **2013.**
5. R.P. Tripathi and H.P. Singh, 'Soil Erosion and Conservation', 1st Edn., New Age Publishers, **1993.**
6. Bimal Chandra Mal, 'Introduction to Soil and Water Conservation Engineering', Kalyani Publishers, **2011.**

FARM POWER

Subject Code: BAGE2-413 | **L T P C 3 1 0 4** | **Duration: 46 Hrs.**

Course Objectives:

This course involves the use, maintenance, adjustment, calibration, and repair of the machines. The selection and operation of machines will be practiced. Safety will be stressed throughout and also Know the different power sources on a farm. In this subject learn the principles of operation of farm equipment.

Course Outcomes:

1. The students will be able to learn about different sources of farm power, construction and ii) functioning of CI and SI engines.
2. Identify all the power sources for farm operations.
3. Introduce students to the available power sources for farm operations.
4. Introduce students to selection and management of farm tractors and implements.

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) engine and deviation from ideal cycle.

Unit – II (12 Hrs.)

Engine & their components, their construction, operating principles and functions, valves and 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 – III (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 – IV (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', St. 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. Donnell Hunt, 'Farm Power and Machinery Management', Medtech, 10th Edn., **2013.**
5. Suresh, 'Farm Power and Machinery Engineering', Standard Publishers Distributors.

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SURVEYING & LEVELLING LAB.

Subject Code: BAGE2-414 **L T P C**
0 0 2 1

EXPERIMENTS

1. Chain survey of an area and preparation of map
2. Measurement of distance, ranging a line.
3. Compass survey of an area and plotting of compass survey.
4. Contour survey of an area and preparation of contour map.
5. Introduction of software in drawing contour.
6. Plane table survey, different methods of plotting, two point & three-point problem.
7. Measurement of bearing and angles with compass, adjustment of traverse by graphical method.
8. To study of different methods of levelling, height of instrument, rise & fall methods.
9. Advancement of Total stations.
10. Measurement of horizontal and vertical angle by theodolite.
11. Determination of height of an inaccessible object.
12. Determination of area of irregular figure by using planimeter.
13. Height of object by using theodolite.
14. Setting out of circular curves in the field using different methods.
15. Determination of tachometric constants and determination of reduced levels by tachometric observations.

MRSPTU

THEORY OF MACHINE LAB.

Subject Code: BAGE2-415 **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.
14. To study the static and dynamic balancing using rigid blocks
15. To draw displacement, velocity & acceleration diagram of four bar mechanism.

SOIL AND WATER CONSERVATION ENGINEERING LAB.

Subject Code: BAGE2-416 **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. Determination from nutrient availability in soil.
9. To demonstrate the conservation of tillage.
10. Study of erosion checked by row cropping pattern.
11. Study of contour cropping effect on soil erosion.
12. Study of bund /graded/contour bund.
13. Design of grassed water ways.
14. Computation of soil erosion by USLE/MUSLE.
15. Design of Trapezoidal water ways.

SOFT SKILLS-II

Subject Code: **BHUM0-F92** **L T P C**
0 0 2 1

Course Objectives:
The course aims to address various challenges of communication as well as behavioural skills faced by individual at work place and organisations. Also, it aims to enhance the employability of the students.

Course Outcomes:
At the end of the course the student will be able to understand the importance of goal setting. They will also be able to handle stress in their lives and future in a better way.

UNIT-1

Developing Positive Attitude: Introduction. Formation of attitude. Attitude in workplace. Power of positive attitude. Examples of positive attitudes. Negative attitudes. Examples of negative attitude. overcoming negative attitude and its consequences.
Improving Perception: Introduction. Understanding perception. perception and its application in organizations.

UNIT-2

Career Planning: Introduction. Tips for successful career planning. Goal setting-immediate, short term and long term. Strategies to achieve goals. Myths about choosing career.

UNIT-3

Art of Reading: Introduction. Benefits of reading. Tips for effective reading. the SQ3R technique. Different stages of reading. determining reading rate of students. Activities to increase the reading rate. Problems faced. Becoming an effective reader.

UNIT-4

Stress Management: Introduction. meaning. positive and negative stress. Sources of stress. Case studies. signs of stress. Stress management tips. Teenage stress.

Recommended Books:

1. K. Alex, S. Chand Publishers.
2. Rizvi, M. Ashraf, 'Effective Technical Communication', McGraw Hill.
3. Mohan Krishna & Meera Banerji, 'Developing Communication Skills', Macmillan.
4. Kamin, Maxine, 'Soft Skills Revolution: A Guide for Connecting with Compassion for Trainers, Teams & Leaders', Pfeiffer & Amp; Company, Washington, DC, **2013.**

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AGRICULTURAL STRUCTURE AND ENVIRONMENTAL CONTROL

Subject Code: BAGE2-517 **L T P C** **Duration: 44 Hrs.**
3 0 0 3

Course Objectives:
To provide the technical knowledge of structures on the farm and to expose the basic concepts of design.

Course Outcomes:
1. At the end of the course, students will be able to:
2. Study planning and layout of farmstead.
3. Construct and estimate the cost of farm structures.
4. Select the sites and orientation of sanitation buildings.
5. Use of renewable energy sources and environmental control.

Unit - I (10 Hrs.)

Planning and layout of farmstead, Physiological reactions of livestock to solar radiation and other environmental factors, Livestock production facilities, BIS, Standards for dairy, piggery, poultry and other farm structures.

Unit - II (12 Hrs.)

Design, construction and cost estimation of farm structures; animal shelters, compost pit, fodder silo, fencing and implement sheds, barn for cows, buffalo, poultry, etc.,: Design and construction of rural grain storage system, Engineering for rural living and development, rural roads, their construction cost and repair and maintenance.

Unit - III (12 Hrs.)

Sources of water supply, Norms of water supply for human being and animals, drinking water standards and water treatment suitable to rural community, Site and orientation of building in regard to sanitation, community sanitation system; sewage system its design, cost and maintenance, design of septic tank for small family.

Unit - IV (10 Hrs.)

Estimation of power requirement for domestic and irrigation, source of power supply, use of alternate source of energy, electrification of rural Housing, Scope, importance and need for environmental control, Renewable and non-renewable resources and their equitable use, concept of eco system, biodiversity of its conservation, environmental pollution and their control, solid waste management system, BOD and COD of food plant waste, primary and secondary treatment of food plant waste.

Recommended Books:
1. M.L. Hellickson and J.N. Walker, 'Ventilation of Agricultural Structures'.
2. L.P. Bengtsson, 'Farm Structures in Tropical Climates'.
3. J.H. Whitaker, 'Agricultural Buildings and Structures. National Food & Energy'.
4. R.E. Phillips, 'Farm Buildings: From Planning to Completion'.
5. ASAE, 'Environmental Control for Animals and Plants Textbooks'.
6. J.S. Boyd, 'Practical Farm Buildings', A Textbook & Handbook.

SOIL AND WATER CONSERVATION STRUCTURES

Subject Code: BAGE2-518 **L T P C** **Duration: 44 Hrs.**
3 1 0 4

Course Objectives:
This course includes functional requirement and design of soil conservation structures to check soil erosion due to excessive runoff. Site selection and design of farm ponds and cost estimation of these structures.

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Course Outcomes:

1. The Students will know about the different types of soil conservation structures.
2. The students will be able to understand the design principle of these structures.
3. Site selection criteria will be useful for application of knowledge in the field problems.

Unit – I (12 Hrs.)

Introduction and classification of structures, Functional requirements of soil erosion control structures. Flow in open channels, types of flow, state and regimes of flow. Concept of Specific energy and specific force. Runoff measuring structures-H flume and Parshall flume.

Unit – II (12 Hrs.)

Hydraulic jump and its application, Energy dissipation due to jump, jump efficiency and relative loss of energy, Runoff measuring structures; General description of straight drop spillway, structural parts and functions, advantages and disadvantages of spillway. Hydrologic and hydraulic design.

Unit - III (10 Hrs.)

Structural design of a drop spillway, Safety against sliding, overturning, crushing and tension, Chute spillway, general description and its components; Hydraulic design, energy dissipaters and design criteria of a SAF stilling basin and its limitations.

Unit –IV (10 Hrs.)

Drop inlet spillway, general description, functional use and design criteria. Design of diversions. Small earth embankments, types and design principles. Maintenance of earthen dams. Farm ponds, site selection and their design and construction. Cost estimation of structures.

Recommended Books:

1. V.V.N. Murty, 'Land and Water Management Engineering', Kalyani Publication.
2. R. Suresh, 'Soil and Water Conservation Engineering', Standard Publishers, Distributors.
3. Ghanshyam Das, 'Hydrology and Soil Conservation Engineering', PHI Learning Private Ltd.

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DAIRY AND FOOD ENGINEERING

Subject Code: BAGE2-519 | **L T P C** **2 1 0 3** | **Duration: 40 Hrs.**

Course Objectives:

This course helps the students to gain a good knowledge on the various processes and equipment used in the processing of milk and milk products. To introduce the students to dairy industry, properties and processing of milk, manufacture of dairy products, sanitation and effluent treatment in dairy industry.

Course Outcomes:

1. The students will gain knowledge about Dairy and Food process engineering
2. Students will understand the importance of quality control and food preservation and packaging.
3. To expose the students to the fundamental knowledge of food, its properties and different methods of food processing.

Unit - I (10 Hrs.)

Dairy development in India. Engineering, chemical and thermal properties of milk and milk products (In brief), Composition and proximate analysis of food products.

Unit - II (10 Hrs.)

Unit operation of various dairy and food processing systems, process flow charts for product manufacture, Deterioration in products and their controls.

Unit - III (10 Hrs.)

Working principles of equipment for receiving, pasteurization, sterilization, homogenization, filling & packaging (Production of butter, Pannier & Cheese) dairy plant design and layout, composition and proximate analysis of food products. Determination in products and their controls.

Unit - IV (10 Hrs.)

Physical, chemical and biological methods of food preservation, changes during processing, evaporation, drying, freezing juice extraction, filtration, membrane separation, thermal processing, plant utilities requirement.

Recommended Books:

1. Sharma, 'Dairy Science and Technology and Food and Dairy Engineering', 1st Edn., CBS, **2009.**
2. J.G. Brennan, Butters, Jr. N.D. Cowell and A.E.V. Lilly, 'Food Engineering Operations', Applied Science Publishers, **1976.**
3. A.W. Farrall, 'Engineering for Dairy and Food Products', Wiley Eastern Pvt. Ltd., New Delhi, **1967.**
4. H.G. Kessler, 'Food Engineering and Dairy Technology', V.A. Kessler, Frcising, Germany, **1981**.
5. Tufail Ahmad, 'Dairy Plant Engineering and Management', Kitab Mahal, **2003.**

TRACTOR SYSTEMS, CONTROL & OPERATION

Subject Code: BAGE2-520 **L T P C** **Duration: 44 Hrs.**
3 1 0 4

Course Objectives:

To provide the technical knowledge of various tractorsystems and their Control and operations of farm machinery.

Course Outcomes:

1. At the end of the course, students will be able to know about various tractor systems
2. Students will understand the control and operation of different mechanisms used in tractor and farm implements to perform different tasks.
3. To expose the students to the fundamental knowledge of different components of tractor and implements

Unit- I (10 Hrs.)

Study of transmission systems, clutch, gear box, differential and final drive mechanism. Familiarization of brake mechanism. Ackerman and hydraulic steering and hydraulic systems.

Unit-II (8 Hrs.)

Tractor power outlets: P.T.O., belt pulley, drawbar, etc. Tractor chassis mechanics and design for tractor stability.

Unit-III (10 Hrs.)

Ergonomic considerations and operational safety, Introduction to tractor maintenance procedure and trouble shooting. Scheduled maintenance after 10, 50, 100, 250, 500 and 1000 Hrs. of operation. Safety hints.

Unit-IV (12 Hrs.)

Top end overhauling. Fuel saving tips. Preparing the tractor for storage. Care and maintenance procedure of agricultural machinery during operation and off-season. Repair and maintenance and workshop requirements.

Recommended Books:

1. F.R. Jones, 'Farm Gas Engines and Tractors'.
2. E.L. Barger, Lijedehl, W.B. Carleton and E.G. Mc Kibben, 'Tractors and their Power Units'.
3. Radhey Lal and Dutta, 'Agricultural Engineering through solved examples'.
4. Irving Frazeee and V.E. Philip, 'Tractors and Crawlers'.

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SOIL AND WATER CONSERVATION STRUCTURES LAB.

Subject Code: BAGE2-521 **L T P C**
0 0 2 1

EXPERIMENTS

1. Study of different parts of H-flume and Parshall flume.
2. Construction of specific energy and specific force diagram.
3. Measurement of hydraulic jump parameters and amount of energy dissipation.
4. Design of drop spillway.
5. Stability analysis of drop spillway
6. Design of Chute spillway.
7. Design of drop inlet spillway.
8. Design of small earthen embankments.
9. Design of a SAF energy dissipater.
10. Design of water harvesting structures.
11. Cost estimation of structures.
12. Visit to a watershed to understand the runoff pattern.

TRACTOR SYSTEMS, CONTROL & OPREATION LAB.

Subject Code: BAGE2-522 **L T P C**
0 0 2 1

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EXPERIMENTS

1. Introduction to transmission systems and components.
2. Study of clutch functioning, parts and design problem on clutch system.
3. Study of different types of gear box, calculation of speed ratios, design problems on gear box.
4. Study on differential and final drive and planetary gears.
5. Study of brake systems and some design problems; Steering geometry and adjustments.
6. Study of hydraulic systems in a tractor, hydraulic trailer and some design problems.
7. Traction performance of a tractor wheel.
8. Finding C.G. of a tractor by weighing technique.
9. Finding CG of a tractor using suspension/balancing techniques; Finding moment of Inertia of a tractor.
10. Appraisal of various controls in different makes tractors in relation to anthropometric measurements.

DAIRY AND FOOD ENGINEERING LAB.

Subject Code: BAGE2-523 **L T P C**
0 0 2 1

EXPERIMENTS

1. Study of a composite pilot milk processing plant & equipment
2. Study of pasteurisers
3. Study of sterilizers
4. Study of homogenisers
5. Study of separators
6. Study of butter churners
7. Study of evaporators
8. Study of milk dryers
9. Study of freezers

10. Design of food processing plants & preparation of layout
11. Visit to multiproduct dairy product
12. Determination of physical properties of food products
13. Estimation of steam requirements
14. Estimation of refrigeration requirements in dairy & food plant
15. Visit to Food industry

ENGINEERING HYDROLOGY

Subject Code: BAGE2-625 **L T P C** **Duration: 40 Hrs.**
2 1 0 3

Course objectives:
The knowledge of hydrology is prerequisite for the irrigation engineering and also for design of hydraulic structure. So one of the objective of this course is to impart the knowledge of hydrology that deals with the occurrence, distribution, movement and properties of water on the earth.

Course Outcomes:
1. Students shall learn various components of hydrologic cycle that affect the movement of water in the earth.
2. Students can compute hydrologic mass balance in a closed basin.
3. Students can develop unit hydrographs based on stream flow data, and conduct basic unit hydrograph analysis.
4. Students understand basic concepts of hydrologic simulation modelling.

Unit – I (10 Hrs.)

Introduction: Hydrologic cycle; precipitation - forms, rainfall measurement, mass curve, hydrograph, mean rainfall depth, plotting position, estimation of missing data, test for consistency of rainfall records; interception infiltration; evaporation; evapo-transpiration estimation and measurement.

Unit – II (10 Hrs.)

Runoff: Factors affecting, measurement; stage and velocity, rating curve, extension of rating curve; estimation of peak runoff rate and volume; rational method, Cook's method, SCS method, Curve number method. Geomorphology of watersheds – stream number, stream length, stream area, stream slope.

Unit – III (8 Hrs.)

Hydrograph: Components, base flow separation, unit hydrograph theory, Unit hydrograph of different durations, dimensionless unit hydrograph, distribution hydrograph, synthetic unit hydrograph, uses and limitations of unit hydrograph.

Unit – IV (12 Hrs.)

Head Water Flood Control: Methods, retards and their location; flood routing – graphical methods of reservoir flood routing, Muskingum method of flood routing; hydrology of dry land areas - drought and its classification; Introduction to watershed management and planning, Horton's laws.

Recommended Books & References:
1. Rajesh Srivastava, Ashu Jain, 'Engineering Hydrology', 1st Edn., McGraw Higher Ed., **2017.**
2. V.V.N. Murty, 'Land and Water Management Engineering', Kalyani Publication.
3. K. Subramanya, 'Engineering Hydrology', McGraw Higher Ed. Publication, **2013.**
4. S.K. Garg, 'Water Resource Engineering and Hydrology**'**, 1st Edn., K.H. Publications, **2010.**
5. Engineers Zone Publications, 'Hydrology & Irrigation Engineering, 1st Edn., Engineers Zone Publications, **2016.**

MRSPTU

ENGINEERING PROPERTIES OF BIOLOGICAL MATERIAL & FOOD QUALITY

Subject Code: BAGE2-626 **L T P C** **Duration: 47 Hrs.**
3 1 0 4

Course Objectives:
This course gives an insight into the properties of different food materials and their quality standards. The objective of this course is to make the students understand the basic properties of food materials and enable them to process, preserve and use them for various applications.

Course Outcomes:
At the end of the course, students will be able to:

1. Describe the importance of engineering properties of biological materials.
2. Explain different physical and thermal characteristics of important biological materials.
3. Discuss the concept, need and objectives of quality control.
4. Apply different types of quality control processes.

Unit – I (8 Hrs.)

Importance of engineering properties of biological materials, Physical properties like shape, size, volume, density, roundness, sphericity, surface area.

Unit – II (10 Hrs.)

Thermal properties like thermal conductivity, specific heat & thermal diffusivity measurement of colour, flavour, consistency, viscosity, texture and their relationship with food quality and composition.

Unit – III (12 Hrs.)

Rheological characteristics like stress, strain time effects, rheological models and their equations, Aerodynamic characteristics and fractional properties of biological materials, Application of engineering properties in handling processing machines and storage structure.

Unit – IV (10 Hrs.)

Objectives and need of food quality; Measurement of colour, flavour, consistency, viscosity, texture and their relationship with food quality and composition; Sampling; purpose, sampling techniques, sampling procedures for liquid, powdered and granular materials.

Recommended Books & References:

1. O.P. Singhal and D.V.K. Samuel, 'Engineering Properties of Biological Materials', Saroj Prakashan, Allahabad, **2003.**
2. N.N. Mohenensin, 'Physical Properties of Plant and Animal Materials', Routledge Publication.
3. M.A. Rao and S.S.H. Rizvi, 'Engineering Properties of Foods', 4th Edn., CRC Press, **2014.**
4. B. Hallstrom, H.F. Meffert, Th., W.E.L. Speiss, 'Physical Properties of Food'.
5. S. Sahin, & S.G. Summu, 'Physical Properties of Foods', New York: Springer, **2006.**

DRAINAGE ENGINEERING

Subject Code: BAGE2-627 **L T P C** **Duration: 47 Hrs.**
3 1 0 4

Course Objectives:
The understanding of various drainage techniques is useful for reclamation for water logged area for crop production.

Course Outcomes:
At the end of the course, students will be able to:

1. To understand the different types of drainage systems.
2. To apply suitable engineering techniques for reclamation of the agricultural lands suffering from water logging.

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3. To understand conjunctive use of water resources for solutions to drainage problem on agricultural soils.

Unit – I (8 Hrs.)

Drainage, objectives of drainage, familiarization with the drainage problems of the state, Surface drainage, drainage coefficient, types of surface drainage.

Unit – II (10 Hrs.)

Subsurface drainage purpose and benefits, investigations of design parameters, hydraulic conductivity, drainable porosity, water table, drainage criteria, types and use of subsurface drainage system.

Unit – III (12 Hrs.)

Design of surface drains, interceptor and relief drains, Derivation of ellipse (Hooghoudt's) and Ernst's drain spacing equations. Steady and unsteady state groundwater condition, dynamic equilibrium concept, Design of subsurface drainage system. Drainage materials, drainage pipes, drain envelope, Layout construction and installation of drains.

Unit – IV (10 Hrs.)

Drainage Structures: Vertical drainage. Bio-drainage, Tile Drains; Drainage of irrigated and humid areas; Salt balance, reclamation of saline and alkaline soils; Leaching requirements, Conjunctive use of fresh and saline waters; Economic aspects of drainage.

Recommended Books & References:

1. J.N. Luthin, 'Drainage Engineering', Wiley Eastern Pvt. Ltd. New Delhi.
2. R.T. Thokal, Sunil Gorantiwar, A.G, Powar, 'Agricultural Drainage: Principles & Practices', 1st Edn., Westville Publishing House, New Delhi.
3. A.M. Michael and T.P. Ojha , 'Principles of Agricultural Engineering', Vol.-II, 5th Edn., Jain Brothers, **2018**.

MRSPTU

HANDS ON TRAINING IN CAD/CAM

Subject Code: BAGE2-628 **L T P C** **Duration: 40 Hrs.**
3 0 0 3

Course Objectives:

Learn how to integrate Design and Manufacturing Systems through incorporation of computers.

Course Outcomes:

Upon completion of the course, students shall be able to:

1. Understand use of computers in design and manufacturing systems.
2. Know about computerized manufacturing methods.
3. Select suitable manufacturing method for complex components.
4. Acquire the Knowledge of data bases, software s and hardware's for computer design in organization.

Unit - I (8 Hrs.)

First and third angle methods of projection, Preparation of working drawings from models and isometric views Drawing of missing views and different methods of dimensioning Concept of sections, revolved and oblique sections Sectional drawing of simple machine parts.

Unit - II (10 Hrs.)

Types of rivet heads and riveted joints, process of producing leak proof joints Threads nomenclature, profiles, mull start, left and right hand and conventional representation of threads Nuts and bolts- square headed, hexagonal, types of lock nuts, studs, machine screws, cap screw and wood screw, foundation bolts.

Unit - III (12 Hrs.)

Application of computers for design CAD, define, benefits, system components and computer hardware for CAD, display, input and output devices Graphic primitives, display file, frame buffer, display control, display processors, line generation, graphics software; Points and lines, polygons, filing of polygons, text primitive, windowing and clipping, view port Homogeneous coordinates, transformations, planners and space curves design.

Unit - IV (10 Hrs.)

Introduction to solid modelling, introduction to numeric control, basic components of NC system, NC coordinate and motion control system Computer numerical control, direct numerical control, combined CNC /DNC NC machine tools and control units, tooling for NC machines, part programming, punched tape coding and format, Manual and computer assisted programming**.**

Recommended Books & References:

1. M. Groover, E. Zimmers, 'CAD/CAM: Computer-Aided Design and Manufacturing', 1st Edn., Pearson Publisher, **2013.**
2. P. N. Rao CAD/CAM, 'Principles and Applications', 3rd Edn. 'McGraw Higher Publication, **2010.**
3. Hearn, 'Computer Graphics, C Version', 2nd Edn., Pearson Education India, **2002.**
4. Alison Beazley, 'Computer-Aided Pattern Design and Product Development', Wiley India Pvt. Ltd**., 2011.**

ENGINEERING HYDROLOGY LAB.

Subject Code: BTAG-629 **L T P C**
0 0 2 1

EXPERIMENTS

1. Study and use of anemometer.
2. Study and use of evaporimeters.
3. Study and use of hygrometer.
4. Study and use of sunshine recorder.
5. Study and use of solar radiation instruments.
6. Measurement of precipitation by rain gauges.
7. Analysis of rainfall data.
8. Study of stream gauging instruments and measurement.
9. Development of hydrograph.
10. Run-off- computations.
11. Graphical analysis of flood routing.
12. Study of stage recorders and current meters.
13. Exercises on flood routing problems.

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ENGINEERING PROPERTIES OF BIOLOGICAL MATERIAL & FOOD QUALITY LAB.

Subject Code: BTAG-630 **L T P C**
0 0 2 1

EXPERIMENTS

1. Determination of shape & size of agricultural Products.
2. Determination of volume and density.
3. Measurement of roundness.
4. Measurement of sphericity.
5. Determination of surface area of leaf.
6. Determination of thermal conductivity & thermal diffusivity.
7. Measurement of internal friction of product.
8. Measurement of viscosity of jam and jelly.
9. Measurement of texture of biscuits & confectionary.
10. Estimation of sulphur dioxide in foods.

11. Measurement of angle of repose and internal friction.
12. Determination of protein and carbohydrates in a given food sample.
13. Estimation of vitamin C in any food sample.

DRAINAGE ENGINEERING LAB.

Subject Code: BAGE2-631 **L T P C**
0 0 2 1

EXPERIMENTS

1. Determination of drainage coefficients.
2. In-situ measurement of hydraulic conductivity by inverse auger hole method.
3. In-situ measurement of hydraulic conductivity by single auger hole method.
4. Installation of piezometer and observation well.
5. Preparation of iso- bath and isobar maps.
6. Determination of drainable porosity.
7. Fabrication and testing of drainage tiles.
8. Design of surface drainage systems.
9. Design of subsurface drainage systems.
10. Determination of chemical properties of soil and water (EC, pH, ESP or SAR).
11. Cost analysis of surface and sub-surface drainage system.
12. Visit to subsurface drainage project and drainage material manufacturing industry.

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SOFT SKILLS-IV

Subject Code: BHUM0-F94 **L T P C** **Contact Hrs.: 25**
0 0 2 1

UNIT-1

Art of Speaking: Introduction. Communication process. Importance of communication, channels of communication. Formal and informal communication. Barriers to communication. Tips for effective communication. tips for conversation. Presentation skills. Effective multi-media presentation skills. Speeches and debates. Combating nervousness. Patterns and methods of presentation. Oral presentation, planning and preparation.

UNIT-2

Group Discussion: Introduction. Importance of GD. Characters tested in a GD. Tips on GD. Essential elements of GD. Traits tested in a GD .GD etiquette. Initiating a GD. Nonverbal communication in GD. Movement and gestures to be avoided in a GD. Some topics for GD.

UNIT-3

Preparing Cv/Resume: Introduction – meaning – difference among bio-data, CV and resume. CV writing tips. Do's and don'ts of resume preparation. Vocabulary for resume, common resume mistakes, cover letters, tips for writing cover letters.

UNIT-4

Interview Skills: Introduction. Types of interview. Types of question asked. Reasons for rejections. Post-interview etiquette. Telephonic interview. Dress code at interview. Mistakes during interview. Tips to crack on interview. Contextual questions in interview skills. Emotional crack an interview. Emotional intelligence and critical thinking during interview process.

Recommended Books:

1. K. Alex, S. Chand Publishers.
2. Lucas, Stephen E., 'The Art of Public Speaking', 11th Edn., International Edn., McGraw Hill Book Co., **2014**.
3. Goleman, Daniel, 'Working with Emotional Intelligence', Banton Books, London, **1998**.

4. Thrope, Edgar and Showick Trope, 'Winning at Interviews', Pearson Education, **2004**.
5. Turk, Christopher, 'Effective Speaking', South Asia Division: Taylor & Francis, **1985**.

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B. TECH. ELECTRCAL ENGINEERING

SEMESTER 3rd		Contact Hrs.			Marks			Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
BMAT0- 301	Mathematics-III	3	1	0	40	60	100	4
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	Electronic Devices & Circuits	3	1	0	40	60	100	4
BELE1-304	Electrical Measurement & Instrumentation	3	1	0	40	60	100	4
BELE1-305	Measurement & Instrumentation Lab.	0	0	2	60	40	100	1
BELE1-306	Electronic Devices & Circuit Lab.	0	0	2	60	40	100	1
BELE1-307	Training#	0	0	4	60	40	100	2
BHUM0-F91	Soft Skills-I	0	0	2	60	40	100	1
Total		**15**	**5**	**10**	**440**	**460**	**900**	**25**

#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.

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
BELE1- 413	Electrical Machine - I Lab.	0	0	2	60	40	100	1
BELE1-414	Control System Lab.	0	0	2	60	40	100	1
BELE1-415	Digital Electronics Lab.	0	0	2	60	40	100	1
BHUM0- F92	Soft Skills - II	0	0	2	60	40	100	1
Total		**15**	**5**	**8**	**440**	**460**	**900**	**24**

After 4th semester, student will go for 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.

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
BELE1-519	Power Electronics Lab.	0	0	2	60	40	100	1
BELE1-520	Electrical: Estimation & Costing Lab.	0	0	2	60	40	100	1
BELE1-521	Industrial Training#	0	0	4	60	40	100	2
BHUM0-F93	Soft Skills-III	0	0	2	60	40	100	1
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		3	0	0	40	60	100	3
Total		**15**	**3**	**10**	**440**	**460**	**900**	**23**

#Industrial training to be imparted at the end of 4th semester for six weeks

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
BELE1- 624	Electrical Machines-II Lab.	0	0	2	60	40	100	1
BELE1- 625	Programming in MATLAB	0	0	2	60	40	100	1
BHUM0-F94	Soft Skills-IV	0	0	2	60	40	100	1
Department Elective – II		3	0	0	40	60	100	3
BELE1-660	Electrical Power Utilization							
BELE1-661	Energy Auditing & Management							
BELE1-662	Substation Equipment & Design							
BELE1-663	Digital Control System							
Department Elective – III		3	0	0	40	60	100	3
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		3	0	0	40	60	100	3
Total		**15**	**2**	**6**	**380**	**420**	**800**	**20**

Students will undergo 8 weeks industrial training after end semester examinations of sixth semester and present a seminar along with submission of report in 7th semester

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
BELE1- 728	Minor Project*	0	0	4	60	40	100	2
BELE1- 729	Software Lab.	0	0	2	60	40	100	1
BELE1-730	Power System-II Lab.	0	0	2	60	40	100	1
BELE1-731	Industrial Training#	0	0	0	60	40	100	3
Department Elective – IV		3	0	0	40	60	100	3
BELE1-768	Industrial Automation							
BELE1-769	System Engineering and Reliability							
BELE1-770	Digital Signal Processing							
BELE1-771	EHVAC Transmission							
Open Elective – III		3	0	0	40	60	100	3
Total		**12**	**2**	**08**	**400**	**400**	**800**	**21**

***** *In this semester, the candidate shall submit a Minor Project (Hardware/Software) based on area of interest in consultation with his/her supervisor. Student has to deliver the seminar associated with the same work. The same work of minor project can be extended to Major Project in the next semester.*

 # Industrial training to be imparted at the end of 6th semester for eight weeks

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 Engineering	3	0	0	40	60	100	3
BELE1- 834	Major Project	0	0	12	60	40	100	6
BELE1-835	Power System Analysis and Design Lab.	0	0	2	60	40	100	1
Department Elective – IV		3	0	0	40	60	100	3
BEEE1-872	Electrical Machine Design							
BEEE1-873	HVDC Transmission							
BEEE1-874	Fuzzy Logic Systems							
BEEE1-875	Neural Networks							
Total		**9**	**1**	**14**	**240**	**260**	**500**	**17**

Total Credits

Semester	**Credits**
I	25
II	25
III	25
IV	24
V	23
VI	20
VII	21
VIII	17
Total	**180**

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.

TRANSFORMERS

Subject Code: BELE1-301 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

Course Objectives

1. To aware the students about the basics of Transformer.

2. To provide basic concepts of different types of transformer connections and their applications.
3. To impart knowledge of single phase transformer, auto transformer and three phase transformer.
4. To impart knowledge about analysis of different transformer connections.

Course Outcomes

1. Students will be having skills to analyse transformer connections.
2. Knowledge of different types of transformer operations and 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 transformers, applications of transformers.

UNIT-II (11 Hrs.)

Auto-Transformer: 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 materials 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’, Khanna Publishers, Delhi, **2004**
2. A.E. Fitzgerald, C. Kingsley and S.D. Umans, ‘Electric Machinery’, TMH, **2002.**
3. A.S. Langsdorf, ‘Theory of AC Machinery’, Tata McGraw Hill, **1955.**
4. Ashfaq Hussian, ‘Electrical Machines’, Dhanpat Rai and 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** **3 1 0 4** | **Duration: 45 Hrs.**

Course Objectives

1. To aware the students about the basics of networks.
2. To provide them basic concepts of different types of network theorems and their applications.
3. To impart knowledge about different circuits, analysing and synthesizing the circuits.

Course Outcomes

1. Students will be having skills to design, analyse and synthesize the circuits.
2. Knowledge of mathematical forms such as Laplace transforms and designing of filters circuits.

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UNIT-I (10 Hrs.)

Circuits Concepts: Independent and dependent sources, Standard test signals: Step, ramp, impulse, and doublet. Mesh and nodal analysis. Network Theorems: Superposition, Thevenin's, Norton's, Maximum Power Transfer, Millman’s, Tellegen’s and Reciprocity.

UNIT-II (11 Hrs.)

Time and Frequency Domain Analysis: Representation of basic circuits in terms of generalized frequency and their response, Laplace transform, transient and steady response, transfer function, poles and zeros, pole zero diagram, time domain behaviors from poles and zeros, Convolution Theorem.

UNIT-III (12 Hrs.)

Network Synthesis: Network functions, Impedance and admittance function, Transfer functions. Network function for two port network, Sinusoidal network in terms of poles and zeros, Real liability condition for impedance synthesis of RL, LCand 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. Bird John, ‘Electrical Circuit Theory and Technology’, Newnes, **2003.**
2. Abhijit Chakraborty, ‘Circuit Theory’, Dhanpat Rai, **2001.**
3. D. Roy Chaudhury, ‘Networks and Synthesis’, New Age International.
4. T.S.K. VIyer, ‘Circuit Theory’, Tata McGraw Hill, **2006.**
5. Mohan, Sudhakar Sham, ‘Circuits and Networks Analysis and Synthesis’, TMH, **2005.**
6. Van Valkenberg, ‘Network Analysis and Synthesis’, PHI Course, **2009.**

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ELECTRONICS DEVICES AND CIRCUITS

Subject Code: BELE1-303 **L T P C** **Duration: 45 Hrs.**

3 1 0 4

Course 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.

Course Outcomes

1. The students could have skills about the basic electronic circuits, their operational characteristics and their applications.
2. 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, different types of diodes, Drift current, diffusion current. Rectifiers.

UNIT-II (11 Hrs.)

Bipolar Junction Transistor: Working action of NPN and PNP. CE, CB and 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: 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, Concept of feedback in amplifiers: Positive and negative feedback, effect of negative feedback.

Oscillators: Principle of operation of different oscillator circuits-RC Phase shift, Wien Bridge, Hartley Bridge, Colpits and Crystal oscillators.

UNIT-IV (12 Hrs.)

Field Effect Transistors: FET construction and working, P-channel and N-channel JFETs. Comparison with BJT, Characteristics of JFET, JFET parameters- AC drain resistance, trans-conductance, amplification factor, dc drain resistance. Construction, working and characteristics of MOSFET. Comparison of BJT, JFET and MOSFET.

Recommended Books

1. Boylstad and Nashelsky, 'Electronic Devices and Circuits', Prentice Hall, **2010.**
2. Millman and Halkias, 'Integrated Electronics', McGraw Hill, **2001.**
3. Malvino, 'Electronic Principles', McGraw Hill, **2007.**
4. V.K. Mehta, 'Principles of Electronics', S. Chand, **2006.**
5. Donald L. Shilling and Charles Belowl, 'Electronic Circuits', TMH, **2009.**

ELECTRICAL MEASUREMENT & INSTRUMENTATION

Subject Code: BELE1-304 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

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Course Objectives

1. To aware the students about the basics of measurements and instrumentation systems.
2. To impart knowledge about different instruments for electrical measurements.
3. To provide them basic concepts of different types of sensors and transducers.

Course Outcomes

1. The students will be having skills to design, analyse and instruments.
2. To gain the skill knowledge of bridges and CRO operations.

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 and derived units. Instrument characteristics; accuracy, precision, repeatability and sensitivity. Different types of errors in measurement. Principle of operation and constructional features; D'Arsonval galvanometer, Moving Coil PMMC and Moving Iron instrument (Repulsion and Attraction type), Electrodynamics instruments.

UNIT-II (11 Hrs.)

Measurement of Resistance: Low, Medium and High resistance measurement using Kelvin Double Bridge, Ammeter-Voltmeter 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 (11 Hrs.)

Oscilloscope: Basic principle and 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.

UNIT-IV (11 Hrs.)

Transducers: 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. H. Cooper, 'Modern Electronic Instrumentation and Measurement Techniques', PHI, **1990.**
2. A.K. Sawhney, Electronic Instrumentation and Measurement', Dhanpat Rai & Sons, **2011.**
3. Jones and Chin, 'Electronic Instruments and Measurement', **2010**.
4. J. Toppin, 'Theory of Errors', Wessely Publishing, **2000.**

MEASUREMENT AND INSTRUMENTATION LAB.

Subject Code: BELE1-305 **L T P C**
0 0 2 1

Course Objectives:
1. To understand the working principal and construction of the measuring instruments and recorders.
2. To measure various electrical parameters using meters and transducers.
3. To calibrate the measuring devices such as meters and transducers.

Course Outcomes:
1. The students could have skills about the basic measurement circuits.
2. Ability to use the techniques and skills to operate CRO.

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 measure low resistance using wheat stone bridge.
4. To measure active and reactive power in 3-phase balanced load by one wattmeter
5. method.
6. 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 readings.
7. To study and calibrate single phase energy meter.
8. Measurement of resistance using Kelvin's Bridge.
9. Measurement of self-inductance using Anderson's Bridge.
10. Measurement of capacitance using Schering Bridge.
11. Plotting of Hysteresis loop for a magnetic material using flux meter.
12. Measurement of frequency using Wein's Bridge.
13. To study the connections and use of Current and Potential transformers and to find out ratio error.
14. Determination of frequency and phase angle using CRO.
15. Measurement of unknown voltage using potentiometer.
16. To find 'Q' of an inductance coil and verify its value using Q-meter.

Note: At least ten experiments should be performed in semester.

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ELECTRONICS DEVICES AND CIRCUIT LAB.

Subject Code: BELE1-306 **L T P C**
0 0 2 1

Course Objectives:

1. To understand the characteristics of various semiconductor devices.
2. To understand identification and selection of various electronic components.

Course Outcomes:

1. Ability to understand all types of electronics devices and circuits.
2. Ability to analyse and interpret data.

EXPERIMENTS

1. To analyse the response of Zener diode as regulator
2. To analyse the response of half wave, full wave and Bridge rectifiers.
3. To plot the input and output characteristics of CE configuration.
4. To plot the input and output characteristics of CB configuration.
5. To examine the characteristics of a Class-A amplifier.
6. To examine the characteristics of Class-B amplifier.
7. To analyse the characteristics of Class-B push-pull amplifier.
8. To analyse the characteristics of complementary symmetry amplifier.
9. To discuss the response of RC phase shift oscillator and determine frequency of oscillation.
10. To discuss the response of Hartley oscillator and determine frequency of oscillation.
11. To analyse the response of Colpitt's oscillator and determine frequency of oscillation.
12. To analyse the response of Wien Bridge oscillator and determine frequency of oscillation.
13. To study the characteristics and response of crystal oscillator.
14. To plot the characteristics of FET.
15. To plot the characteristics of MOSFET.

Note: At least ten experiments should be performed in semester.

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SOFT SKILLS-I

Subject Code: **BHUM0-F91** **L T P C** **Duration: 37 Hrs.**
0 0 2 1

Course Objectives

The course aims to cause a basic awareness about the significance of soft skills in professional and interpersonal communications and facilitate an all-round development of personality.

Course Outcomes

At the end of the course, the student will be able to develop his/her personal traits and expose their personality effectively.

UNIT-1

Soft Skills: Introduction to Soft Skills, Aspects of Soft Skills, Identifying your Soft Skills, Negotiation skills, Importance of Soft Skills, Concept of effective communication.
Self-Discovery: Self-Assessment, Process, Identifying strengths and limitations, SWOT Analysis Grid.

UNIT-2

Forming Values: Values and Attitudes, Importance of Values, Self-Discipline, Personal Values - Cultural Values-Social Values-some examples, Recognition of one's own limits and deficiencies.

UNIT-3

Art of Listening: Proxemics, Haptics: The Language of Touch, Meta Communication, Listening Skills, Types of Listening, Listening tips.

UNIT-4

Etiquette and Manners: ETIQUETTE- Introduction, Modern Etiquette, Benefits of Etiquette, Taboo topics, Do’s and Don’ts for Men and Women. MANNERS- Introduction, Importance of manners at various occasions, Professional manners, Mobile manners. CORPORATE GROOMING TIPS- Dressing for Office: Do’s and Don’ts for Men and Women, Annoying Office Habits.

Recommended Books

1. K. Alex, S. Chand Publishers.
2. Butterfield, Jeff, ‘Soft Skills for Everyone’, Cengage Learning, New Delhi, **2010**.
3. G.S. Chauhan and Sangeeta Sharma, ’Soft Skills’, Wiley, New Delhi, **2016**.
4. Klaus, Peggy, Jane Rohman & Molly Hamaker, ‘The Hard Truth About Soft Skills’, Harper Collins E-books, London, **2007**.
5. S.J. Petes, Francis, ‘Soft Skills and Professional Communication’, Tata McGraw Hill Education, New Delhi, **2011**.

DC MACHINES

Subject Code: BELE1-408	L T P C 3 1 0 4	Duration: 45 Hrs.

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Course Objectives

1. To understand the basic concepts of D.C machines.
2. To introduce different techniques of speed control of DC machines.
3. To study different types of testing methods.

Course Outcomes

1. To understand all basic concepts of DC motors and generators.
2. To understand operation and control of DC machines.

UNIT-I (12 Hrs.)

General Concepts of DC Machines: Principles and construction: generator action, motor action, commutator, commutation, interpolar and compensating windings, brushes, armature core, armature windings, winding pitch, commutator pitch, commutator segments, armature reaction: de-magnetizing and cross magnetizing effects.

UNIT-II (11 Hrs.)

DC Generators: Operation, emf 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, applications.

UNIT-III (10 Hrs)

DC Motors: Operation, concept of back emf, torque equation, power developed, Characteristics of DC motors (series, shunt and compound), effect of saturation and applications.

UNIT-IV (12 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, Testing of DC machines: Brake test, Swinburne’s test, Hopkinson’s test, Retardation test, Field’s test.

Recommended Books

1. P.S. Bimbhra, ‘Electrical Machinery’, Khanna Publishers.
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. Fitzgerald Kingsley, and Stephen Umans, 'Electric Machinery', McGraw Hill, **2002.**
5. J.B. Gupta, 'Theory and Performance of Electrical Machinery', S.K. Kataria and Sons.
6. B.L. Theraja and A.K. Theraja, 'A Text Book of Electrical Technology', S. Chand.

DIGITAL ELECTRONICS

Subject Code: BELE1-409 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

Course 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 inthe creation of solutions to design problems.

Course Outcomes:
1. An ability to understand all types of combinational and sequential digital circuits and their designing.
2. 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 numbers, binary operations: Addition, Subtraction. Multiplication and division. Subtractions using 1's and 2's compliment. ASCII code. Excess 3 codes and Gray code. Logic gates: OR, AND, NOT, NOR, NAND, Ex-OR gates, Basic theorems of Boolean algebra, sum of products and product of sums. Minimisation using theorems, minimisation using K-map up to 4 variables.

UNIT-II (10 Hrs.)

Combinational logic circuits: Combinational circuit design, multiplexer, demultiplexer, encoders, decoders, adders, subtractors, code converters, parity checkers, BCD display drive, magnitude comparators.

UNIT-III (11 Hrs.)

Sequential circuits: Flip Flop fundamentals, different flip flop configurations: SR, JK, D, T. Edge triggered and clocked flip flops, Registers: Types of Registers, series and parallel shift: circuit diagram, timing wave form and operations. Counters: synchronous and asynchronous, Johnson counter.

UNIT-IV (12 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. D.P. Kothari and J.S. Dhillon, 'Digital Circuits and Design', Pearson, **2015.**
2. R.P. Jain, 'Modern Digital Electronics', TMH, **2011.**
3. Malvino and Leach, 'Digital Principles and Applications', TMH, **1991.**
4. Fletcher, 'An Engg. Approach to Digital Design', PHI, Indian Ed., **2011.**

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ELECTRICAL ENGINEERING MATERIALS

Subject Code: BELE1-410 **L T P C** **Duration: 38 Hrs.**
3 0 0 3

Course Objectives:
1. To provide knowledge about basics of electrical engineering materials.
2. Students will obtain skills of application of materials in daily life.

Course Outcomes:
1. An ability to understand all types of magnetic and conducting materials.
2. To understand the various properties of electrical engineering materials.

UNIT-I (10 Hrs.)

Elementary Materials Science Concepts: Bonding and types of solids and its defects, resistivity, factors affecting resistivity, temperature dependence of resistivity, Skin Effect, Hall Effect.

UNIT-II (12 Hrs.)

Dielectric Properties of Insulators in Static and Alternating Field: Dielectric constant of gases, molecules and solids, internal field in solids and liquids, Properties of ferro-electric materials, polarization, types of polarizations, polarizability: atomic and molecular, frequency dependence of electronic and ionic polarizability, piezoelectricity and dielectric losses.

UNIT-III (12 Hrs.)

Magnetic Properties and Superconductivity: Magnetization of matter, magnetic material classification, ferromagnetic origin, Curie-Weiss law, soft and hard magnetic materials, Superconductivity and its origin, critical temperature, critical magnetic field, zero resistance and Meissner Effect, Type-I and Type-II superconductors, applications of superconductors.

UNIT- IV (11 Hrs.)

Conductivity of Metals: Drift velocity, relaxation time of electrons, collision time and mean free path, electron scattering and resistivity of metals.

Semiconductor Materials: Classification of semiconductors, semiconductor conductivity, temperature dependence, Carrier density and energy gap, fermi level, applications of semiconductors in electrical engineering.

Recommended Books

1. S.P. Seth, 'A Course in Electrical Engineering Materials', Dhanpat Rai and Sons, **2001.**
2. Electrical Engineering Materials, T.T.T.I, Madras, **1998.**
3. K.B. Raina and S.K. Bhattacharya, 'Electrical Engineering Materials', S.K. Kataria and 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

Course 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.

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Course Outcomes
1. The students will have skills to model the control systems.
2. Ability to analyse the stability of designed systems.

UNIT-I (10 Hrs.)

Introductory Concepts: Plant, Systems, Servomechanism, regulating systems, Open loop control system, closed loop control systems, linear and non-linear systems, time variant and invariant, Block diagrams, some illustrative examples.

UNIT-II (12 Hrs.)

Modeling: Force voltage analogy, force current analogy, Transfer function, Block diagram reduction technique, signal flow graphs and Mason's gain formula, characteristics equation.
Time Domain Analysis: Transient response of the first and second order systems, Time domain specifications, Steady state error and coefficients, Absolute and relative stability, Routh-Hurwitz Criterion.

UNIT-III (12 Hrs.)

Stability Analysis: Root locus technique, sketch of the root locus plot, Frequency domain analysis: Closed loop frequency response, bode plots, relative stability using bode plot. Frequency response specifications, relation between time and frequency response for second order systems. Nyquist criterion for stability.

UNIT-IV (11 Hrs.)

State Space Analysis: State space representations, transfer function from state model, 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 and Bishop Robert, 'Modern Control System', Addison-Wesley, Pearson, **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.**

Course Objectives:
1. To provide the knowledge about the time varying fields and Maxwell's equations.
2. To provide knowledge about the propagation of electromagnetic wave along different mediums.
3. Study of physical concept and all the important fundamental parameters of waveguides.

Course Outcomes:
1. The students will learn the concepts of electromagnetic field theory and fundamental field equations.
2. The students will have skills to identify, formulates and solves engineering problems related to electromagnetic fields.

UNIT-I (11 Hrs.)

Review of Electrostatic and Magnetostatic Fields: Review of vector algebra, Review of Cartesian, Cylindrical and spherical coordinate systems, Introduction to del operator, Use of del operator as gradient, divergence, curl. Introduction to coulomb's law, Gaussian law.

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Laplace's and Poission's equation in various coordinate systems. Introduction to Ampere's law, Magnetic vector potential.

UNIT-II (11 Hrs.)

Time Varying Fields and Maxwell's Equations: Equation of continuity, Inconsistency of Ampere's law for time varying fields, Concept of displacement current, Maxwell's equation in integral and differential form (for static fields, time varying fields, free space, good conductors, harmonically varying fields), Poynting theorem.

UNIT-III (12 Hrs.)

Uniform Plane Waves: Introduction, Uniform plane wave propagation, Wave equations: Wave equations for free space, Wave equations for conductors. Transverse nature of uniform plane waves, Reflection of electromagnetic waves by perfect conductor and perfect dielectric, wave impedance and propagation constant, depth of penetration, surface impedance.

UNIT-IV (11 Hrs.)

Wave Guides: Introduction, simple waveguides between two infinite and parallel conducting plates, Transverse Electric (TE) Waves or H-Waves, Transverse magnetic (TM) Waves or E-Waves, Characteristics of TE and TM waves, Transverse Electromagnetic (TEM) waves and its characteristics.

Recommended Books

1. Jordan and Balmain, 'Electromagnetic Wave', PHI and Radiation System, **2010.**
2. Kraus, 'Electromagnetics', T.M.H. **2003.**
3. W.H. Hayt and J.A. Buck, 'Problem and Solutions in Electromagnetics', Tata McGraw Hill, **1999.**
4. W.H. Hayt, 'Engineering Electromagnetic', Tata McGraw Hill, **2012**.

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ELECTRICAL MACHINE-I LAB.

Subject Code: BELE1-413 **L T P C**
0 0 2 1

Course Objectives

1. To understand the characteristics of D.C. Machines.
2. To understand speed control methods and testing methods.
3. To study universal motor.

Course Outcomes

1. To acquire skills to operate all types of dc machines.
2. Ability to analyse the speed control and efficiency of DC machine.

EXPERIMENTS

1. To study various components/cut-section of DC machines.
2. To perform starting techniques of various DC machines.
3. To obtain torque and speed characteristics of a D.C. Shunt motors.
4. To obtain external characteristics of a D.C. shunt generators.
5. To obtain external characteristics of a D.C. series generators.
6. To obtain external characteristics of DC compound generators.
7. Speed control of a dc shunt motor by varying armature circuit and field circuit methods.
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. To calculate the power rating of DC machines.
13. To determine losses and efficiency of DC machines.

Note: At least ten experiments should be performed in semester.

CONTROL SYSTEM LAB.

Subject Code: BELE1-414 **L T P C**
0 0 2 1

Course Objectives:
1. To understand the basics concepts of MATLAB software.
2. To introduce variety of control system strategies.
3. To comment about the stability of designed systems.

Course Outcomes:
1. To acquire skills to understand all types of control components
2. Ability to analyse the stability of control systems

EXPERIMENTS
1. Familiarization with MATLAB control system toolbox, MATLAB Simulink toolbox and PSPICE.
2. Determination of step response for first order and 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 and impulseresponsefortype-0, type-1and type-2 systems with unity feedback using MATLAB and PSPICE.
4. Determination of Root Locus, Bode-Plot, Nyquist Plot using MATLAB-Control system toolbox for 2^{nd} order system. Determination of different control system performance indices from the plots.
5. Experimental determination of approximate transfer function from Bode plot.
6. Evaluation of steady state error, settling time, percentage peak overshoot, gain margin, phase margin, with addition of lead compensator and by compensator in forward path transfer function for unity feedback control system using PSPICE.
7. Design of a second order linear time invariant control system and study of system response with unit step input.
8. To study the characteristics of potentiometers and to use 2-potentiometers as an error detector in a control system.
9. To study the synchro Transmitter-Receiver set and to use it as an error detector.
10. To study the Speed-Torque characteristics of an AC Servo Motor and to explore its applications.
11. To study the Speed-Torque characteristics of a DC Servo Motor and explore its applications.
12. To study various electro-mechanical transducers i.e. resistive, capacitive and inductive transducers.
13. To study the speed control of an A.C. Servo Motor using a closed loop and an open loop system.
14. To study the operation of a position sensor and study the conversion of position in to corresponding voltage

Note: At least ten experiments should be performed in semester.

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DIGITAL ELECTRONICS LAB.

Subject Code: BELE1-415 **L T P C**
0 0 2 1

Course Objectives:
1. To give students a practical knowledge about all types of digital circuits.
2. To give students a working knowledge to connect digital circuits and verify their truth

tables.
3. To give students knowledge of different combinational and sequential circuits.

Course Outcomes:
1. Anabilitytotestandverifyworkingandtruthtablesofcombinationalandsequentialcircuits.
2. To give knowledge of various logic families.

EXPERIMENTS
1. To Study Logic Gates: Truth-table verification of OR, AND, NOT, XOR, NAND and NOR gates and realization of OR, AND, NOT and XOR functions using universal gates.
2. To design Half Adder using Logic gates on bread board.
3. To design Full Adder using Logic gates on bread board.
4. To design Half Subtractor using Logic gates on bread board.
5. To design Full Subtractor using Logic gates on bread board.
6. To design 4-Bit Binary-to-Gray Code Converter on bread board.
7. To design 4-Bit Gray-to-Binary Code Converter on bread board.
8. To study and design 4-Bit magnitude comparator using logic gates on bread board.
9. Design and verification of Truth-table of multiplexer.
10. Realization of Half adder and Full adder using MUX.
11. Design and verification of Truth-table of Demultiplexer.
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: SIPO, SISO, PIPO, and PISO.
16. To Study digital logic families.

Note: At least ten experiments should be performed in semester.

SOFT SKILLS-II

Subject Code: **BHUM0-F92** **L T P C**
0 0 2 1

Course Objectives:
The course aims to address various challenges of communication as well as behavioral skills faced by individual at work place and organizations. Also, it aims to enhance the employability of the students.

Course Outcomes:
At the end of the course the student will be able to understand the importance of goal setting. They will also be able to handle stress in their lives and future in a better way.

UNIT-1

Developing Positive Attitude: Introduction. Formation of attitude. Attitude in workplace. Power of positive attitude. Examples of positive attitudes. Negative attitudes. Examples of negative attitude. overcoming negative attitude and its consequences.

Improving Perception: Introduction. Understanding perception. perception and its application in organizations.

UNIT-2

Career Planning: Introduction. Tips for successful career planning. Goal setting-immediate, short term and long term. Strategies to achieve goals. Myths about choosing career.

UNIT-3

Art of Reading: Introduction. Benefits of reading. Tips for effective reading. the SQ3R technique. Different stages of reading. determining reading rate of students. Activities to increase the reading rate. Problems faced. Becoming an effective reader.

UNIT-4

Stress Management: Introduction. meaning. positive and negative stress. Sources of stress. Case studies. signs of stress. Stress management tips. Teenage stress.

Recommended Books

1. K. Alex, S. Chand Publishers.
2. Rizvi, M. Ashraf, 'Effective Technical Communication', McGraw Hill.
3. Mohan Krishna & Meera Banerji, 'Developing Communication Skills', Macmillan.
4. Kamin, Maxine, 'Soft Skills Revolution: A Guide for Connecting with Compassion for Trainers, Teams & Leaders', Pfeiffer & Amp; Company, Washington, DC, **2013.**

ASYNCHRONOUS MACHINES

Subject Code: BELE1-516 **L T P C** **Duration: 48 Hrs.**
3 1 0 4

Course Objectives:
1. To impart knowledge of the constructional features and principle of operation of three-phase and single-phase induction machines.
2. To impart knowledge about methods of starting and speed control of induction motors.
3. To make the students aware about construction, principle of operation and applications of special purpose motors.

Course Outcomes:
1. The students will be having skills to analyse the performance of the asynchronous machines using the phasor diagrams and equivalent circuits.
2. To gain knowledge of speed control and testing of asynchronous machines.
3. To gain the knowledge to select appropriate asynchronous machine for any application and appraise its significance.

UNIT-I (18 Hrs.)

Three Phase Induction Motors: Constructional features, Production of rotating field in space distributed three-phase winding, Principle of operation, Concept of slip, rotor frequency, current, torque and power output, Types of induction motors, Analogy between induction motor and transformer, no load and blocked rotor test, Circle diagram, Equivalent circuit parameters, Phasor diagram, Torque-slip characteristics, Effect of rotor circuit resistance, Crawling and Cogging, Cage motors (double cage and deep bar motor).

UNIT-II (12 Hrs.)

Starting Methods and Speed Control: Starting methods of squirrel cage and slip ring induction motor, Different speed control methods, effect of voltage injection in rotor circuit of slip ring induction motor.

Induction Generator: Isolated and Grid mode operation, method of excitation, performance characteristics of three-phase self-excited induction generator, introduction to doubly fed induction generator.

UNIT-III (10 Hrs.)

Single Phase Motors: Introduction, Double revolving field theory, types of single phase motors (Split phase, capacitor start, capacitor run, capacitor start and run) and their characteristics, shaded pole motor: working principle and characteristics. Reluctance motor: construction, principle of operation and applications.

UNIT-IV (8 Hrs.)

Special Purpose Motors: Stepper Motor: construction, principle of operation and applications. Linear Induction Motor: construction, principle of operation and applications. Universal Motor: construction, principle of operation and applications.

Recommended Books

1. A.E. Fitzgerald, C. Kingsley and S.D. Umans, 'Electric Machinery', 6th Edn., McGraw Hill, **1998**.
2. E.H. Langsdorff, 'Principles of A.C. Machines', McGraw Hill, **2010**.
3. I.J. Nagrath and D.P. Kothari, 'Electrical Machines', 4th Edn., Tata McGraw Hill, **2011**.
4. P.S. Bimbhra, 'Electrical Machinery', Khanna Publishers, **1999**.
5. M.G. Say,' Alternating Current Machines', 5th Edn., Sir Isaac Pitman and Sons Ltd., **2004**.

POWER ELECTRONICS AND DRIVES

Subject Code: BELE1-517 | **L T P C 3 1 0 4** | **Duration: 48 Hrs.**

Course Objectives:
1. To make the students aware about the power electronic devices and construction, operation and characteristics of most popular member of thyristor family i.e. SCR.
2. To acquaint them with basic concepts of operation of different types of convertors.
3. To impart knowledge about application of converters to motor drives.

Course Outcomes:
1. The students will learn the operation and characteristics of power electronic devices
2. The students will be able to analyse operation of diffferent types of converter circuits such as; AC-DC, DC-DC, AC-AC and DC-AC.
3. The students will be able to understand application of converters for control of motor drives.

UNIT-I (14 Hrs.)

Introduction: Thyristor family and SCR, Constructional features of SCR, its static and dynamic characteristics, turn-on and turn-off methods and firing circuits, Ratings and protection of SCR'S, series and parallel operation, commutation circuits.

UNIT-II (12 Hrs.)

Phase Controlled Converters: Principle of phase control, single phase and three phase converter circuits with different types of loads, dual converters and their operation.

DC Choppers: Principle of chopper operation, control strategies, types of choppers, step up and step down choppers, voltage, current and load-commutated choppers.

UNIT-III (14 Hrs.)

Inverters: Single phase Voltage source bridge inverters, Modified Mc-Murray half bridge inverter, series inverters, three phase bridge inverters with 180^0 and 120^0 modes. Single phase PWM inverters, Current source inverters.

AC Voltage Controllers: Types of single-phase voltage controllers, single-phase voltage controller with R and RL type of loads.

Cycloconverters: Principle of operation, single phase to single phase step up and step down Cycloconverters, three phase to single phase cycloconverters.

UNIT-IV (08 Hrs.)

DC Motor Drives: DC motor drive – starting, braking, transient analysis, speed control, controlled rectifier converters for DC drives and chopper fed DC drives.

AC Motor Drives Induction motor drive – starting, braking, transient analysis, speed control, ac controller fed induction motor, voltage source inverter, current source inverter and cyclo-converter fed induction motor drive.

Recommended Books

1. G.K. Dubey, S.R. Doradla, A. Joshi, R.N.K. Sinha, 'Thyristorised Power Controllers', New Age International (P) Limited, Publishers, **2004**.
2. M. Rashid, 'Power Electronics', Prentice Hall of India Private Ltd., **2006**.

3. P.S. Bimbhra, 'Power Electronics', Khanna Publishers, **2004**.
4. Bimal Bose, 'Power Electronics and Motor Drives', Academic Press, **2006**.
5. P.C. Sen, 'Power Electronics', Tata McGraw Hill Company Ltd., New Delhi, **1992**.
6. C. Rai Harish, 'Power Electronics and Industrial Applications', 1st Edn., CBS Publishers & Distributors Pvt Ltd., **2018**.

GENERATION AND ECONOMICS OF ELECTRIC POWER

Subject Code: BELE1-518 | **L T P C 3 1 0 4** | **Duration: 48 Hrs.**

Learning Objectives:
1. To familiarize the students with different types of loads and load curves.
2. To apprise them with different types of costs involved in power plant and tariffs imposed on the electricity consumers
3. To impart knowledge about selection and economic operation of steam plants.
4. To impart knowledge about hydrothermal coordination.

Course Outcomes:
1. Students will get knowledge of different types of loads and related terminology.
2. They will learn about various costs involved in the power plants and tariffs imposed on different categories of consumers.
3. They will gain the knowledge about co-ordinated operation of Hydro and Steam power plants.

UNIT-I (10 Hrs.)

Loads and Load Curves: Types of load (fixed voltage loads, resistive loads, Inductive motor loads, mechanical load), effect of load on supply voltage, maximum demand, group diversity factor, peak diversity factor, types of load, chronological load curves, load-duration curve, mass curves, load factor, capacity factor, utilization factor, base load and peak load plants, load forecasting.

UNIT-II (12 Hrs.)

Power Plant Economics: Capital cost of plants, annual fixed cost, operating costs and effect of load factor on cost of energy, depreciation, tariffs and power factor improvement, objectives of tariff making, different types of tariff (domestic, commercial, agricultural and industrial loads). Need for power factor improvement, power factor improvement using capacitors, determination of economic power factor.

UNIT-III (14 Hrs.)

Selection of Plant: Plant location, plant size, number and size of units in plants, economic comparison of alternatives based on annual cost, rate of return, present worth and capitalized cost methods. Economic operation of steam plants, methods of loading turbo-generators, input- output curve, heat rate, incremental cost, method of Lagrangian multiplier, effect of transmission losses, co-ordination equations, and iterative procedure to solve co-ordination equations.

UNIT-IV (12 Hrs.)

Hydro-Thermal Co-ordination: Advantages of combined working of Run-off River plant and steam plant, reservoir hydro plants and thermal plants, long-term operational aspects, scheduling methods. Cogeneration: Definition and scope, Topping and Bottoming Cycles, Benefits, cogeneration technologies.

Recommended Books

1. M.V. Deshpande, 'Power Plant Engineering', Tata McGraw Hill, **2004**.
2. M.M. EI-Wakit, 'Power Plant Engineering', McGraw Hill, USA, **2010.**
3. D.P. Kothari and I.J. Nagrath, 'Power System Engineering', Tata McGraw Hill, **2008**.

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4. S.C. Arora and S. Dom Kundwar, 'A Course in Power Plant Engineering', 6th Revised Edn., Dhanpat Rai, **2011-12**.
5. P.K. Nag, 'Power Plant Engineering', Tata McGraw Hill, **2014**.
6. B.R. Gupta, 'Generation of Electrical Energy', S. Chand, **2017**.

POWER ELECTRONICS LAB.

Subject Code: BELE1-519 **L T P C**
0 0 2 1

Course Objectives:
1. To obtain the characteristics of SCR and UJT and to obtain triggering pulses for them.
2. To verify the performance of various converter circuits by measuring the currents and voltages at different points in the circuit and to display their waveforms.
3. To control speed of motors by using thyristors.

Course Outcomes:
1. Students will be able to verify the characteristics of SCR and UJT and triggering pulses for them.
2. They will be able to visualize and analyse the performance of various converter circuits.
3. They will be able to control the speed of motors using thyristors.

EXPERIMENTS
1. To obtain V-I characteristics of SCR and measure latching and holding currents.
2. To plot V-I Characteristics of UJT.
3. To obtain triggering wave forms for SCR using R and RC firing circuits.
4. To obtain output voltage waveforms of single phase half wave controlled rectifier for R-L load.
5. To obtain output voltage wave forms for single phase full-wave controlled rectifiers with resistive and inductive loads.
6. To simulate three phase bridge rectifier and draw load voltage and load current waveform for resistive and inductive loads.
7. To study different types of chopper circuits and obtain waveforms for at least one of them.
8. To simulate single phase inverter using different modulation techniques and obtain load voltage and load current waveform for different types of loads.
9. To simulate single phase full wave ac voltage controller and draw load voltage and load current waveforms for inductive load.
10. To study single phase cycloconverter.
11. To study speed control of induction motor using thyristor.
12. To study speed control of DC motor using thyristor.

Note: At least ten experiments should be performed in the semester.

Recommended Books

1. K.R. Varmah, K. John Ginnes, Abraham Chikku, 'Power Electronics, Design, Testing and Simulation, Laboratory Manual', 1st Edn., CBS Publishers & Distributors Pvt. Ltd., **2017**.
2. O.P. Arora, 'Power Electronics Laboratory, Theory, Practice and Organization', Narosa Publishing House, **2007.**

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ELECTRICAL: ESTIMATION AND COSTING LAB.

Subject Code: BELE1-520 **L T P C**
0 0 2 1

Course Objectives:
1. To know about layout of wiring circuits of electrical installations of a residential building or/and an educational institute or/and an industry.
2. To estimate the various costs involved in these electrical installations.
3. To know about wiring arrangements of motor control circuits and to do energy audit of a small utility.

Course Outcomes:
1. The students will become familiar with the layout of wiring circuits of electrical installations and those of motor control circuits.
2. They will be able to estimate the various costs involved in these electrical installations.
3. They will learn to do energy audit of a small utility.

EXPERIMENTS

1. To study Indian electricity act 2003.
2. To carry out wiring diagram of residential building/educational institute/industry.
3. To study design parameters of electrical panel boards.
4. To estimate the cost of a domestic installation (Residential building/laboratory/drawing hall) with concept of illumination design.
5. To estimate the cost of industrial installation.
6. To estimate the cost of overhead service connection.
7. To estimate the cost of underground service connection.
8. To estimate the load and cost of any five electrical appliances.
9. To estimate the cost of repair and maintenance of any five domestic appliances.
10. To study various types of light sources and lighting schemes.
11. To draw wiring diagrams of motor control circuits for starting of induction and synchronous motors.
12. To carryout electrical energy audit of laboratory/office/workshop**.**

Note: At least ten experiments should be performed in semester.

Recommended Books

1. Singh Surjit, 'Electrical Estimating and Costing', Dhanpat Rai & Co., **Reprint 2013**.
2. Deb Tanmoy, 'Installation, Testing, Commissioning and Maintenance of Electrical Apparatus', Dhanpat Rai & Co., **Reprint 2013.**

SOFT SKILLS-III

Subject Code: **BHUM0-F93** **L T P C** **Duration: 27 Hrs.**
0 0 2 1

Course Objectives:
The course aims to equip the students with effective writing skills in English. Also, to make the students understand their role as team players in organizations.

Course Outcomes
At the completion of the course, the student will become well –versed with the behavioural skills. They will also understand the role of body language and non-verbal communication during the interview process.

UNIT-1

ART OF WRITING - Introduction, Importance of Writing Creative Writing, Writing tips, Drawback of written communication.

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Art of Business Writing: Introduction, Business Writing, Business Letter, Format and Styles, Types of business letters, Art of writing correct and precise mails, Understand netiquette.

UNIT-2

Body Language: Introduction- Body Talk, Forms of body language, uses of body language, Body language in understanding Intra and Inter-Personal Relations, Types of body language, Gender differences, Gaining confidence with knowledge of Kinesics.

UNIT-3

Team Building and Team Work: Introduction, Meaning, Characteristics of an effective team, Role of a Team Leader, Role of Team Members, inter group Collaboration-Advantages, Difficulties faced, Group Exercises-Team Tasks and Role-Play, Importance of Group Dynamics.

UNIT-4

Time Management: Introduction, the 80-20 Rule, three secrets of Time Management, Time Management Matrix, Effective Scheduling, Time Wasters, Time Savers, Time Circle Planner, Difficulties in Time Management, Overcoming Procastination.

Recommended Books

1. K. Alex, S. Chand Publishers.
2. R.C. Sharma and Krishna Mohan, 'Business Correspondence and Report Writing', TMH, New Delhi, **2016.**
3. N. Krishnaswami and T. Sriraman, 'Creative English for Communication', Macmillan.
4. Penrose, John M., et al., 'Business Communication for Managers', Thomson South Western, New Delhi, **2007**.
5. Holtz, Shel, 'Corporate Conversations', PHI, New Delhi, **2007**.

POWER PLANT ENGINEERING

Subject Code: BELE1-556 **L T P C** **Duration: 40 Hrs.**
3 0 0 3

Course Objectives:

1. To introduce the students to the classification of steam and hydro-electric power plants and make them familiar with the main equipment and machinery used in them.
2. To provide them basic concepts of nuclear, gas and diesel power plants.
3. To impart knowledge about pollution control and combined operation of different plants.

Course Outcomes:

1. The students will acquire knowledge about various equipment used in thermal, hydro and nuclear power generation.
2. They will also become familiar with equipment used in gas and diesel power plants.
3. They will come to know about the importance of co-ordinated operation of different power plants and methods of pollution control.

UNIT-I (14 Hrs.)

Steam Generators, Condensers and Turbines: Classification of steam generators, Types of condensers, effect of air in condensers, steam nozzles, types of steam turbine efficiencies.
Steam Power Plant: Classification, Operation, Description of Rankin cycle, coal handling system, combustion system, Ash handling, Feed pumps, Heat exchangers, Economizers, Super heaters, Reheaters, Air preheaters, Feed water heaters, Evaporators.

UNIT-II (10 Hrs.)

Hydro-Electric Power Plants: Hydrological cycle, Hydrograph, Flow duration curve, Classification of hydro plants, Selection of water turbines for hydro power plant.

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Nuclear Power Plants: Nuclear physics, Binding energy, Radioactive decay. Fertile material, Mass defect, Nuclear reactions type and application, Generation of nuclear energy by fission, Nuclear reactors. Safety measures, Future of nuclear power.

UNIT-III (8 Hrs.)

Gas Turbine: Elements of gas turbines, Open and closed cycles for gas turbines, Performance terms, Plant layout, applications.

Diesel Power Plants: Classifications of IC Engines and their performance, four stroke and two stroke diesel engines, combustion phenomenon; Essential components, Cetane number, knocking, super charging, operation and layout of diesel power plant.

UNIT-IV (8 Hrs.)

Combined Operation of Different Power Plants: Advantages of combined operation of plants, load division between power stations, coordination of different types of Power Plants.

Pollution Control: Pollution from thermal and nuclear plants, Particulate emission and control, electrostatic precipitator, solid waste disposal.

Recommended Books

1. Chakrabarti, Soni, Gupta and Bhatanagar, 'A Textbook on Power System Engineering', Dhanpat Rai & Co., **2013**.
2. M.M. EI-Wakil, 'Power Plant Technology', 2nd Reprint, Tata McGraw Hill Edn., **2010**.
3. R.K. Rajput, 'Power Plant Engineering', 4th Edn., Luxmi Publications, **2010**.
4. P.C. Sharma, 'Power Plant Engineering', Kataria and Sons, **2009**.
5. B.G.A. Skrotzki and W.A. Vapot, 'Power Station Engineering and Economy', 31st Reprint, Tata McGraw Hill Education Pvt. Ltd., **2009**.
6. P.K. Nag, 'Power Plant Engineering', 4th Edn., McGraw Hill Education (India) Pvt. Ltd., **2014**.
7. G.R. Nagpal, 'Power Plant Engineering', 16th Edn., Khanna Publishers, **2013**.
8. S.C. Arora, S. Domkundwar, 'Power Plant Engineering', 6th Edn., Dhanpat Rai, **2013**.

MRSPTU

SIGNALS AND SYSTEMS

Subject Code: BELE1-557 **L T P C** **Duration: 40 Hrs.**
3 0 0 3

Course Objectives:
1. To understand the classification of signals.
2. To apply Fourier series and Fourier Transformation to periodic and aperiodic signals.
3. To introduce the concepts of probability of occurrence of random events.
4. To understand different types of noise associated with signals.

Course Outcomes:
1. The students will learn about various types of signals and systems.
2. They will be able to analyse these signals using Fourier series and transform.
3. The students will learn to analyse various types of noise in the system.

UNIT-I (10 Hrs.)

Introduction: Classification of Signals and Systems, Linear time invariant systems, Convolution, Representation of signals in terms of impulses, Signal Representation using Fourier Series, Complex and Exponential Fourier Series, Fourier Series Representation of Periodic Signals, Properties of Fourier series, Parseval's theorem.

UNIT-II (10 Hrs.)

Signal Analysis: Aperiodic Signal Representation using Fourier Transforms, Fourier Transforms of Periodic Power Signals, Signal Transmission through Linear Networks, Convolution Theorem and its graphical interpretation, Sampling Theorem, Correlation, Autocorrelation.

UNIT-III (10 Hrs.)

Probability: Introduction to Probability Theory, Definition of Probability of Random Events, Joint and Conditional Probability, Cumulative Distribution Function (CDF), Probability Density Functions (PDF) and Statistical Averages of random variables, introduction to random processes.

UNIT-IV (10 Hrs.)

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.

Recommended Books

1. V. Oppenheim Alan, 'Signals and Systems', Prentice Hall, **1997**.
2. S. Haykins and B.V. Veen, 'Signals and Systems', John Wiley and Sons, **2007.**
3. M.J. Roberts, 'Fundamentals of Signals and Systems', SIE Edn., McGraw Hill Education, **2007**.
4. B.P. Lathi, 'Linear Systems and Signals', Oxford University Press, **2009**.
5. Sanjay Sharma, 'Signals and Systems', Katson Publishers, **2013**.
6. Rajeswari K. Raja, Rao B. Visvesvara, 'Signals and Systems', PHI Learning Pvt. Ltd., **2014**.
7. M. Nahvi, 'Signals and Systems', McGraw Hill Education, **2015.**

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MICROPROCESSORS AND MICROCONTROLLERS

Subject Code: BELE1-558 **L T P C** **Duration: 40 Hrs.**
3 0 0 3

Course Objectives:
1. To acquire detailed knowledge about architecture and operation of 8085 microprocessor
2. To study 8051 microcontrollers in detail.
3. To interface peripheral devices with microprocessors and microcontrollers.

Course Outcomes:
1. The students will learn about architecture, operation, instruction set and programming of 8085 microprocessors.
2. The students will learn about architecture, operation, instruction set and programming of 8051 microcontrollers.
3. Students will learn how to interface 8085 and 8051 with peripheral devices

UNIT-I (10 Hrs.)

History and Evolution: Background history of Microprocessors, Introduction to Basic features, General Architecture of Microprocessors, Recent trends and Applications.
8085 Microprocessor: Architectural Block Diagram, Schematic and Pin diagrams, Pin functions, Bus Organization, Internal operations and registers, externally initiated operations, Timing and Control Unit, Microprocessor communication, Multiplexing of address/data bus, Generation of control signals, 8085 machine cycles, Timing Diagrams Addressing Modes, Instruction Set, Interrupts, Programming Examples, Direct Memory Access. Peripheral Controllers: USART (8251), RS-232C, Programmable Peripheral Interface (8255), Programmable Interrupt Controller (8259) and their applications.

UNIT-II (13 Hrs.)

8051 Microcontroller Architecture: Introduction to MCS -51 Family microcontrollers, Architectural block Diagram, Pin diagram and Pin Functions, General Purpose and Special

Function Registers, Oscillator and clock circuit, Reset circuit, I/O Port circuits, Memory organization, Internal program and data memory.
Introduction to Program Development Tools (IDE): Concept of IDE, Editor, Assembler, Compiler, Linker, Simulator, Debugger and assembler directives.
8051 Assembly language programming: Programming model of 8051, Addressing modes, data transfer instructions, I/O Port programming, Arithmetic and Logical instructions, Bit level instructions, Branching instructions (Jump and loop Jump and call), Concept of stack, subroutine and related instructions, writing programs (like time delay using loop, data conversions HEX to ASCII, BCD to ASCII, use of look up table etc.) in assembly language 8051 and testing the same using IDE.

UNIT-III (10 Hrs.)

External Memory Interfacing: Memory address decoding, interfacing 8031/8051 with ROM/EPROM and Data ROM.
8051 Timer/Counter and Programming: Use of counter as timer, Timer/Counters and associated registers, Various modes of timer/counter operations, Time delay programs in Assembly language/ Embedded C.
8051 Serial Port and Programming: Basics of serial communication, RS232 standards, 8051 connections to RS232, Serial data input/output and associated registers, Various modes of serial data communication, serial data communication programs in Assembly language/ Embedded C.
8051 Interrupts: Concept of Interrupt, interrupt versus polling, Types of interrupts in 8051, Reset, interrupt control and associated registers, interrupt vectors, Interrupt execution, RETI instruction, software generated interrupt, interrupt handler subroutine for timer/counter and serial data transmission/reception in Assembly language/ Embedded C.

UNIT-IV (7 Hrs.)

Applications and design of microcontroller based systems: Interfacing of LEDs, 7 Segment display device, LCD display, DIP Switches, Push Button switches, Key debounce techniques, Keyboard connections, load per key and matrix form, Interfacing A/D converter, D/A converter, Relay, Opto-isolator, stepper motor and DC motor

Recommended Books

1. R.S. Gaonkar, 'The 8085 Microprocessor- Architecture, Programming and Interfacing', Penram International Publishing (India) Pvt. Ltd. 6th Edn., **2013**.
2. D.V. Hall, S.S.S.P. Rao, 'Microprocessors and Interfacing', 3rd Edn., McGraw-Hill Education, **2012**.
3. M.A. Mazidi, J.G. Mazidi and R.D. Mckinlay, 'The 8051 Microcontroller and Embedded Systems: using Assembly and C', Pearson Education, **2007**.
4. Sunil Mathur, 'Microprocessor 8085 & its Interfacing', 2nd Edn., Prentice Hall of India, **2011.**
5. Mandal Soumitra Kumar, 'Microprocessors and Microcontrollers: Architecture, Programming and Interfacing Using 8085, 8086 and 8051', McGraw Hill Education, **2017**.
6. B. Ram, 'Fundamentals of Microprocessors and Microcontrollers', Dhanpat Rai Publications (P) Ltd., **2008**.

INSTRUMENTATION ENGINEERING

Subject Code: BELE1-559	**L T P C** **3 0 0 3**	**Duration: 40 Hrs.**

Course Objectives:

1. To acquire knowledge about the various elements of instrumentation systems.

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2. To acquire knowledge about working of data acquisition and corresponding signal conditioning.
3. To know about different types of display devices and recorders.

Course Outcomes:

1. Student will get knowledge about various types of transducers, signal conditioning and data acquisition systems.
2. Students will get acquainted with digital measurement systems, display devices and recorders.
3. Students will be able to know about data transmission and telemetry.

UNIT-I (12 Hrs.)

Transducers: Introduction to sensors, transducers, detectors, actuators, Electrical transducers, and its classification, Characteristics and choice of transducers, Resistive and Capacitive transducers, Potentiometers, Strain gauges and its types, Thermistors, RTD, Thermocouples, LVDT, RVDT, Piezo electric transducers, Hall effect transducers, Encoders, Synchros.

UNIT-II (10 Hrs.)

Signal Conditioning: Introduction, role of operational amplifiers in signal conditioning, characteristics of op-amps, instrumentation amplifier, filters, general consideration of A/D and D/A convertors.

Data Acquisition Systems: instrumentation systems and its types, Analog data acquisition system, Digital data acquisition system, recorders, multiplexing and sample/hold circuits in data acquisition system.

UNIT-III (10 Hrs.)

Display Devices: Introduction, digital display methods, segmental displays, Dot Matrices, rear projection display, LED, LCD, segmental gas discharge displays, Electronic counters, digital voltmeters and its types.

Recorders: Requirement of recording, Analog and digital recorders, Graphic recorders, Strip chart recorders, Null type recorders, Potentiometric type recorders, single and multi-point recorders, X-Y records, Ultraviolet recorders, magnetic tape recorders, Frequency and pulse duration modulation type recording, Introduction to direct recording.

UNIT-IV (8 Hrs.)

Digital Measurement Systems: Introduction, types of tools used in digital systems, digital instruments and its types, microprocessor based instrumentation

Data Transmission and Telemetry: methods of data transmission, general telemetry systems, types of telemetry systems, modulations in telemetry, transmission and media channels.

Recommended Books

1. Halfrick Albert D. and Cooper Willium D., 'Modern Electronic Instrumentation and Measurement Techniques', PHI, **1990**.
2. A.K. Sawhney, 'Electronic Instrumentation and Measurement', 19^{th} Edn., Dhanpat Rai and Sons, **2011**.
2. Jones Larry D. and Chin A. Foster, 'Electronic Instruments and Measurement', 2^{nd} Edn., **1995**.
3. Morris Alan S. and Langari Reza, 'Measurement and Instrumentation, Theory and Applications', Academic Press, Elsevier, **2016**.
4. Malaric Roman, 'Instrumentation and Measurement in Electrical Engineering', Brown Walker Press, Boca Raton, Florida, USA, **2011**.
5. David Bell, 'Electronic Instrumentation and Measurements', 2^{nd} Edn., PHI, **2003**.
6. M.M.S. Anand, 'Electronic Instruments and Instrumentation Technology', PHI, **2004**.
7. H.S. Kalsi, 'Electronic Instrumentation', 2^{nd} Edn., TMH, **2004**.

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SYNCHRONOUS MACHINES

Subject Code: BELE1-622 **L T P C** **Duration: 48 Hrs.**
3 1 0 4

Course Objectives:
1. To make the students aware about the general aspects of synchronous machines.
2. To apprise the students about the construction, operation and characteristics of alternators and synchronous motors.
3. To make them to understand the underlying aspects of parallel operation of alternators.

Course Outcomes:
Students will be able to
1. Understand about the general aspects and winding terminology used in 3-ϕ synchronous machines and 1-ϕ synchronous motors.
2. Analyse the various methods of voltage regulation and EMF equations of alternators.
3. Memorize power-angle characteristics of synchronous machines and the working and characteristics of synchronous motors.
4. Understand the concepts about parallel operation and transient conditions of alternators.

UNIT-I (10 Hrs.)

General Aspects: Construction and working principle of synchronous machines, Excitation systems, Production of sinusoidal electromotive force (EMF) and its equation, flux and magnetomotive force (MMF), phasor diagrams, cylindrical and salient pole rotors, pitch factor, distribution factor.

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UNIT-II (14 Hrs.)

Alternators: Construction, Phasor diagram of cylindrical rotor alternator, ratings, armature reaction, determination of synchronous reactance; open-circuit and short- circuit characteristics, short-circuit ratio, short-circuit loss. Determination of voltage regulation: EMF, MMF and zero power factor method. Power flow through inductive impedance, Power-angle characteristics of cylindrical and salient pole synchronous machines, Two-reaction theory of salient pole machines, power factor control.

UNIT-III (12 Hrs.)

Synchronous Motors: Operating characteristics, power-angle characteristics, condition for maximum power, V-curves and inverted V-curves, methods of starting, synchronous motor applications, synchronous condenser, Hunting, damper windings, Hysteresis motors.

UNIT-IV (12 Hrs.)

Parallel Operation of Alternators: Conditions for synchronization of single phase and three phase alternators, conditions for parallel operation, synchronizing power, current and torque, effect of increasing excitation of one of the alternators, effect of change of speed of one of the alternators, effect of unequal voltages, load sharing.

Recommended Books

1. P.S. Bimbhra, 'Electrical Machinery', Khanna Publishers, **2010.**
2. A.E. Fitzgerald, C. Kingsley and S.D. Umans, 'Electric Machinery', 6th Edn., McGraw Hill.
3. I.J. Nagrath and D.P. Kothari, 'Electrical Machines', 4th Edn., Tata McGraw Hill, **2011**.
4. M.G. Say, 'Alternating Current Machines', 5th Edn., Sir Isaac Pitman and Sons Ltd., **2004**.
5. S. Sarma Mulukutla and Mukesh K. Pathak, 'Electric Machines', 3rd Indian Reprint, CENGAGE Learning, **2009**.

POWER SYSTEM-I (TRANSMISSION AND DISTRIBUTION)

Subject Code: BELE1-623 **L T P C** **Duration: 48 Hrs.**
3 1 0 4

Course Objectives:

1. To introduce the students to the structure of power and distribution systems.
2. To introduce them to overhead transmission lines and underground cables and make them to understand their operating characteristics.
3. To make them familiar with the components and the mechanical design aspects of overhead transmission lines.

Course Outcomes:

1. Students will be able to understand power distribution systems.
2. Students will be skilled to analyse performance of transmission lines and underground cables.
3. Students will be able to select and design overhead line insulators and transmission lines.

UNIT-I (12 Hrs.)

Structure of Power System: Growth of power systems: Indian overview, Interconnections and their advantages, Electricity act 2003, Environmental and safety measures.

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 and uniformly distributed loads on distributors; one and both ends, ring distribution, sub mains and tampered mains.

UNIT-II (12 Hrs.)

Overhead Transmission Lines: Materials and 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 and long lines. Line performance: regulation and efficiency of short, medium and long lines, series and shunt compensation.

UNIT-III (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 towers, sag-tension calculations, Corona-losses, radio and audio noise, transmission line–communication line interference, Comparison of EHVAC and HVDC transmission systems.

UNIT-IV (12 Hrs.)

Underground Cables: classification of cables based upon voltage and dielectric material, insulation resistance and capacitance of single core cable, dielectric stress, capacitance of 3 core cables, methods of laying, heating effect, Maximum current carrying capacity, cause of failure, comparison with overhead transmission lines.

Recommended Books

1. D.P. Kothari and I. J. Nagrath, ‘Power System Engineering’, Tata McGraw Hill, **2007**.
2. J.B. Gupta, ‘Transmission and Distribution of Electrical Power’, Katson Books, **2013**.
3. C.L. Wadhwa, ‘Electric Power Systems’, 7th Edn., New Age International Publishers, **2016**.
4. J. Grainger John and Jr. W.D. Stevenson, ‘Power System Analysis’, McGraw Hill, **1994**.

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ELECTRICAL MACHINES-II LAB.

Subject Code: BELE1-624 **L T P C**
0 0 2 1

Course Objectives:

1. To plot speed-torque characteristics of three-phase and single-phase induction motors.
2. To obtain equivalent circuit parameters of three-phase and single-phase induction motors.
3. To study speed control of induction motors using different techniques.
4. To plot characteristics of a three-phase alternator and a synchronous motor.
5. To synchronise two 3-phase alternators by different methods

Course Outcomes:

Students will be able to

1. Obtain equivalent circuit parameters of single-phase and three- phase Induction motors.
2. Control speed of Induction motors by different methods.
3. Draw open and short circuit characteristics of three-phase alternator and V and inverted V curves of synchronous motor.
4. Find out voltage regulation of an alternator by different tests.
5. Synchronise two or more 3-phase alternators.

EXPERIMENTS

1. To perform load-test on three-phase induction motor and to plot speed-torque characteristics.
2. To perform no-load and blocked rotor test on three-phase induction motor to obtain equivalent circuit parameters and to draw circle diagram.
3. To study the speed control of three-phase induction motor by Kramer's method.
4. To study the speed control of three-phase induction motor by cascading of two induction motors.
5. To study star- delta starters and
   a) To draw electrical connection diagram.
   b) To start the three-phase induction motor using it.
   c) To reverse the direction of three-phase induction motor.
6. To start a three-phase slip ring induction motor by inserting different levels of resistance in the rotor circuits and to plot speed- torque characteristics.
7. To perform no-load and blocked rotor test on single-phase induction motor and to determine the parameters of equivalent circuit.
8. To perform load test on single-phase induction motor and plot speed-torque characteristics.
9. To perform no load and short circuit test on three-phase alternator and draw open and short circuit characteristics.
10. To find voltage regulation of an alternator by zero power factor (ZPF) method.
11. To study effect of variation of field current upon the stator current and power factor of synchronous motor running at no load and draw V and inverted V curves of motor.
12. To synchronise two 3-phase alternators using dark lamp method, and two-bright & one dark lamp method.
13. To start a synchronous motor using appropriate method.

Note: At least ten experiments should be performed in the semester.

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PROGRAMMING IN MATLAB

Subject Code: BELE1-625 **L T P C**
0 0 2 1

Course Objectives:
1. To introduce to BASIC built in functions of MATLAB and blocks of SIMULINK.
2. To learn to do various programming operations in MATLAB and develop Simulink models in SIMULINK.
4. To learn to plot various types of graphs in MATLAB.

Course Outcomes:
1. Students will know about BASIC built in functions of MATLAB and blocks of SIMULINK.
2. They will learn to do various programming operations in MATLAB and develop Simulink models in SIMULINK.
3. They will be able to draw 2-D and 3-D plots in MATLAB.

EXPERIMENTS
1. Introduction to Fundamentals of MATLAB Programming.
2. To perform Arithmetic and logic operations in MATLAB.
3. To perform branch and loop operations in MATLAB.
4. To use basic built-in function of Matrices in MATLAB.
5. To develop a user defined function file in MATLAB.
6. To plot 2-D & 3-D graphs in MATLAB, such as plots, subplots, logarithmic plots and multiple plots etc.
7. To plot 3-phase AC supply voltage in MATLAB.
8. To develop MATLAB program to calculate ABCD parameters of transmission line.
9. Introduction to commonly used blocks of SIMULINK.
10. To develop Simulink model to show series resonance phenomenon and to plot voltage & current waveforms and frequency vs impedance graph.
11. To develop Simulink model to show parallel resonance phenomenon and plot voltage & current waveforms and frequency vs admittance graph.
12. To develop a Simulink model of symmetrical three phase power system supplying a three phase balanced load and to display the three phase voltage, current, active and reactive power.
13. To develop Simulink model of three phase transformer and to display the primary and secondary voltages and currents.
14. To develop Simulink model for speed control of dc motors.

Note: At least ten experiments should be performed in semester.

Recommended Books
1. Tyagi Agam Kumar, ‘Matlab and Simulink for Engineers’, Oxford Publishers, **2012**.
2. S. Swapna Kumar, S.V.B. Lenina, ‘MATLAB Easy Way of Learning’, PHI, **2016**.
3. Stephen J. Chapman, ‘MATLAB Programming for Engineers’, Cengage Learning, **2015**.

SOFT SKILLS-IV

Subject Code: **BHUM0-F94** **L T P C** **Duration: 27 Hrs.**
0 0 2 1

Course Objectives:
The course aims at the key areas like conversation skills, group skills and persuasion skills required during the interview process in an organization.

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Course Outcomes:
At the end of the course, the student will be able to:
1. Demonstrate soft skills required for business situations.
2. Analyze the value of soft skills for career enhancement.
3. Apply soft skills to workplace environment.
4. Confidently participate in GD and interview process.

UNIT-1

Art of Speaking: Introduction. Communication process. Importance of communication, channels of communication. Formal and informal communication. Barriers to communication. Tips for effective communication. tips for conversation. Presentation skills. Effective multi-media presentation skills. Speeches and debates. Combating nervousness. Patterns and methods of presentation. Oral presentation, planning and preparation.

UNIT-2

Group Discussion: Introduction. Importance of GD. Characters tested in a GD. Tips on GD. Essential elements of GD. Traits tested in a GD .GD etiquette. Initiating a GD. Non-verbal communication in GD. Movement and gestures to be avoided in a GD. Some topics for GD.

UNIT-3

Preparing Cv/Resume: Introduction – meaning – difference among bio-data, CV and resume. CV writing tips. Do's and don'ts of resume preparation. Vocabulary for resume, common resume mistakes, cover letters, tips for writing cover letters.

UNIT-4

Interview Skills: Introduction. Types of interview. Types of question asked. Reasons for rejections. Post-interview etiquette. Telephonic interview. Dress code at interview. Mistakes during interview. Tips to crack on interview. Contextual questions in interview skills. Emotional crack an interview. Emotional intelligence and critical thinking during interview process.

Recommended Books

1. K. Alex, S. Chand Publishers.
2. Lucas, E. Stephen, 'The Art of Public Speaking', 11th Edn., International Edn., McGraw Hill Book Co., **2014**.
3. Goleman, Daniel, 'Working with Emotional Intelligence', Banton Books, London, **1998**.
4. Thrope, Edgar and Showick Trope, 'Winning at Interviews', Pearson Education, **2004.**
5. Turk, Christopher, 'Effective Speaking', South Asia Division: Taylor & Francis, 1**985**.

ELECTRICAL POWER UTILIZATION

Subject Code: BELE1-660	L T P C 3 0 0 3	Duration: 40 Hrs.

Course Objectives:
1. To acquire knowledge about various elements of A.C and D.C electric motor drives and their characteristics.
2. To acquire detailed knowledge about electric traction systems.
3. To know various phenomena related to electrolytic processes and illumination.

Course Outcomes:
1. Students will get knowledge about D.C and A.C electric motor drive characteristics and select them for particular traction systems.
2. They will be able to explore and control various electric heating and welding methods and processes.
3. They will be able to calculate illumination requirements.

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UNIT-I (14 Hrs.)

Electric Drives: Introduction concept of electric drives, classification of electric drives, nature of load, factors effecting selection of drive, Running characteristics of D.C, Series and shunt motor, 3-phase induction motor, 3-phase synchronous motor and A.C series motors, Starting methods of D.C series and shunt motors, starting methods of 3-phase induction motors, examples, starting methods of synchronous motors and single-phase induction motor. Speed control of D.C series and shunt motors, examples, Speed control of 3- phase induction motor, examples, Methods of electric braking of D.C motor, examples. Braking of 3-phase induction motor, Mechanical features of electric drive, Load equalization, flywheel calculations, examples. Temperatures rise of electric drives, heating and cooling curves, standard ratings of motors, examples Applications of electric drives and selection of drives for particular service, conservation approach to be considered.

UNIT-II (10 Hrs.)

Electrical Traction: Introductions, different traction systems, various systems of electric traction. Locomotives, tramways, trolleys, track electrification, comparison between A.C and D.C systems of railway electrification, Types of speed and speed-time curves, examples. Mechanics of train movement, tractive effort, power, output, examples., Energy output from driving axles, energy output using simplified speed-time curves, examples, Factors affecting energy consumption, dead weight, accelerating weight, adhesion weight, examples., Traction motors and their characteristics, starting and speed control of D.C series and shunt motors, examples, Starting and speed control of A.C series and 3-phase induction motors, Braking of traction motors and mechanical considerations, conservation approach to be considered.

UNIT-III (8 Hrs.)

Electrical Heating and Welding: Advantages of electric heating, modes of transfer of heat, classification of electric heating methods, Resistances heating methods, requirements of heating elements, design of heating elements, methods of temperature control, problems, Induction heating: principle, types of induction furnaces, direct core type, vertical core type, indirect core type, core less type, advantages and disadvantages, eddy current heating, applications examples., Arc-furnace: principle, types, direct and indirect arc furnaces, power supply and control, condition for maximum output, examples., Dielectric heating: principles, advantages and disadvantages, applications, choice of frequency, examples., Electric welding: different types of resistance welding and electric arc welding, conservation approach to be considered.

UNIT-IV (8 Hrs.)

Electrolytic Process: Principle, Faradays laws of electrolysis, current efficiency, energy efficiency etc., Rating of metals, production of chemicals, Electro deposition, electroplating, power supply for electrolytic processes.

Illumination: Nature of light, definitions, laws of illumination, different types of lamps, tungsten lamp, discharge lamp, sodium vapour lamp, fluorescent lamp, design of lighting scheme, methods of lighting, calculations, examples, flood lighting, factory lighting and street lighting, examples., conservation approach to be considered.

Recommended Books

1. Deb Tanmoy, 'Utilization of Electric Power and Traction', Ane Books-New Delhi, **2012.**
2. R.K. Rajput, 'Utilization of Electrical Energy', Luxmi Publications Pvt. Ltd., **2006**.
3. J.B. Gupta, 'Utilization of Electric Power & Electric Traction', S.K. Kataria and Sons, Katson Books, **2013**.
4. C.L. Wadhwa, 'Generation, Distribution and Utilization of Electrical Energy', New age International Pvt. Ltd., Publishers, **2005**.

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5. Tarlok Singh, 'Utilization of Electric Energy', S.K. Kataria and Sons, Katson Books, **2010**.

ENERGY AUDITING AND MANAGEMENT

Subject Code: BELE1-661	**L T P C** **3 0 0 3**	**Duration: 38 Hrs.**

Course Objectives:
1. To understand the importance of energy management and Audit.
2. To study various types of energy dissipating systems such as electrical, compressed air system, HVAC and refrigeration systems.
3. To understand energy audit processes of these systems used in the industry.

Course Outcomes:
1. Students will gain the knowledge about various types of energy dissipating systems.
2. Students will be able to perform the energy audit for various equipment used in daily life.
3. Students will learn the use of various instruments used in energy audit process.

UNIT-I (14 Hrs.)

Energy Scenario: 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.

Energy Management and Audit: 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

UNIT-II (10 Hrs.)

Material and Energy Balance: Facility as an energy system, Methods for preparing process flow, Material and energy balance diagrams.

Financial Management: Investment-need, Appraisal and criteria, Financial analysis techniques- Simple payback period, Return on investment, Net present value, Internal rate of return, Cash flows, Risk and sensitivity analysis, Financing options, Energy performance contracts and role of ESCOs.

UNIT-III (8 Hrs.)

Electrical System: Electricity tariff, Load management and maximum demand control, Power factor improvement, Distribution and transformer losses. Losses in induction motors, Motor efficiency, Factors affecting motor performance, Rewinding and motor replacement issues, energy efficient motors. Light source, Choice of lighting, Luminance requirements, and Energy conservation avenues

Compressed Air System: Types of air compressors, Compressor efficiency, efficient compressor operation, Compressed air system components, Capacity assessment, Leakage test Factors affecting the performance and efficiency

UNIT-IV (8 Hrs.)

HVAC and Refrigeration System: Vapor compression refrigeration cycle, Refrigerants, Coefficient of performance, Capacity, Factors affecting refrigeration and air conditioning system performance and savings opportunities, Vapor absorption refrigeration system: Working principle, Types and comparison with vapor compression system, Saving potential, Fans, Blowers and pumps- Types, Performance evaluation, efficient system operation, Flow control strategies and energy conservation opportunities.

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Recommended Books

1. Y.P. Abbi and S. Jain, 'Handbook on Energy Audit and Environment Management', T.E. R.I. Press, **2006**.
2. Doti Steve, PE, CEM, 'Commercial Energy Auditing Reference Handbook', CRC Press, Taylor & Francis Group, **2010**.
3. Sonal Desai, 'Handbook of Energy Audit', McGraw Hill Education, New Delhi, **2017**.
4. Al-Shemeri Tarik, 'Energy Audits, A workbook for Energy Management in Buildings', John Wiley & Sons, **2011**.
5. Capehart, Turner and Kennedy, 'Guide to Energy Management', CRC Press, Taylor & Francis Group, **2008**.

SUBSTATION EQUIPMENT AND DESIGN

Subject Code: BELE1-662 **L T P C** **Duration: 38 Hrs.**
3 0 0 3

Course Objectives:
1. To provide knowledge about substation, its layout and main equipment present in it.
2. To impart knowledge about power, current and potential transformer.
3. To understand the importance of reactive power management and the use of capacitor banks in reactive power management.
4. To introduce to elementary design considerations of substation equipment.

Course Outcomes:
1. Students will get familiar with main equipment used in substations and their design considerations.
2. They will be able to know the use of different types of transformers used in substations.
3. They will develop understanding about importance of reactive power and its management by use of capacitor banks.

UNIT-1 (10 Hrs.)

Substation: Introduction, classification and layout of substation, Single Bus bar, Mesh Substation, Factors affecting layout of substation, types of bus bars, Substation equipment specifications, testing of substation Equipment.

Power Transformer: Introduction and Working Principle of Power Transformer, Classification and their types, important characteristics of Transformer Oil.

UNIT-II (8 Hrs.)

Current Transformers (CT): Basic functions of Current Transformer, Rating and Performance of CTs, Burden, Theory and Operation of CT, Diagram of CT's Connection of Power Transformer and Selection of CT.

Potential Transformers (PT): Terminology, requirement of VA Burden, Testing and Commissioning of PTs, Capacitor Voltage Transformer.

Earthing: Introduction and purpose of Earthing, tolerable limits of body currents, soil resistivity, earth resistance and its measurement, tolerable and actual step and touch voltage, types of Earthing, Design of Earthing grid, impulse Behavior of Earthing system, grounded and ungrounded neutral system, Types, M ethods and selection of grounding neutral.

UNIT-III (8 Hrs.)

Reactive Power Management: Introduction to Reactive Power & its Importance in Power System, Sources of Generation & Absorption of Reactive Power, Reactive Power Compensation & its Advantages, Various types of Reactive Power Compensation and its Calculation, Static Synchronous Compensator, Unified Power Flow Controller.

Capacitor Banks: - Need for Reactive Compensation, Power Factor Improvement and its Benefits, Purpose of Installation of Capacitor Bank, Protection of Capacitor Bank and Pre-

Commissioning Checks and tests, Series and Shunt Compensators, Rating and operation of Shunt Capacitor banks.

UNIT-IV (12 Hrs.)

Station Battery and Charging Equipment: Introduction, Variable Load Battery and System Tester, Testing of Battery Charger and Battery, Types of Batteries, Basic Charging Methods.

Elementary Idea of Substation Equipment Design: Substation equipment ratings and its operation from design view point, selection of cables, Isolator Design, Overhead line terminations, bus bar size calculations and panel design, design of Surge Arrestor, selection of power transformer.

Computer Applications in Substation Engineering: Introduction, System Components, Communication Infrastructure and Methods, Trends in SCADA, Remote Terminal Unit, MODEM.

Recommended Books

1. R.S. Dahiya and Vinay Attri, 'Sub Station Engineering, Design, Concepts and Computer Application', S.K. Kataria & Sons, **2013.**
2. S. Rao, 'Electrical Substation Engineering and Practice', Khanna Publishers, **1992.**
3. P.S. Satnam and P.V. Gupta, 'Substation Design and Equipment', Dhanpat Rai Publications, **2013**.
4. Mcdonald John D., 'Electric Power Substations Engineering', 3rd Edn., CRC Press, **2012.**

DIGITAL CONTROL SYSTEMS

Subject Code: BELE1-663 | **L T P C 3 0 0 3** | **Duration: 38 Hrs.**

MRSPTU

Course Objectives:

1. To introduce to discrete data control systems, digital signals, sample and hold circuits etc.
2. To study transfer functions and application of z-transforms.
3. To study time response, frequency response and state space techniques of continuous data and discrete data digital control signals.

Course Outcomes:

1. The students will get knowledge about the basics of digital control systems.
2. They will be able to find out the time response and frequency response of these systems
3. They will get skilled to design digital control systems with digital controllers.

UNIT-I (10 Hrs.)

Introduction: Basic Elements of discrete data control systems, advantages of discrete data control systems, examples.

Signal Conversion and Processing: Digital signals and coding, data conversion and quantization, sample and hold devices, Mathematical modeling of the sampling process; Data reconstruction and filtering of sampled signals: Zero order hold, first order Hold and polygonal hold.

UNIT-II (10 Hrs.)

Review of z-Transforms, Applications of z-Transforms to Difference equations, Modified z- Transforms, transfer functions, Block diagrams, signal flow graphs: Introduction, Pulse Transfer function, and z-Transfer function, Discrete Data System with cascaded elements separated by a sampler and not separated by a sampler. Closed loop systems, characteristic equation in discrete domain, causality and physically realizable systems; The Sampled signal flow graph.

UNIT-III (10 Hrs.)

Time Response: Comparison of continuous data and discrete data, Steady state error analysis of digital control systems, correlation between time response and root locations in s-plane and z-plane, Root loci for digital control systems, Effects of adding poles and zeros to open loop transfer function, discrete data systems: Stability tests of discrete data systems: Bilinear transformation method, extension of RH criterion, Jury's Stability Test.

Frequency – Domain Analysis: Polar plot of GH (z), Nyquist stability criterion, Bode plot, Gain Margin and Phase margin, Nicholas chart, Band width considerations, sensitivity analysis.

Unit–IV (8 Hrs.)

State Space Techniques: Review of continuous data systems, state equations of discrete data systems with sample and hold devices, state diagrams of digital systems, Decomposition of discrete data transfer function, state variable analysis of response between sampling instants, Controllability, Observability of LTI discrete data systems.

Design of digital control systems with digital controllers through bilinear transformation. Digital PID controller, Design for dead-beat response, pole placement design by incomplete feedback or output feedback.

Recommended Books

1. B.C. Kuo, Digital Control Systems, Oxford University Press, **1995.**
2. K. Ogata, 'Discrete Time Control Systems', 2^{nd} Edn., Pearson, **2015**.
3. K. Ogata, 'Digital Control Engineering', Prentice Hall, Englewood Cliffs, **1995**.
4. M. Gopal, 'Digital Control Engineering', Wiley Eastern, **1988**.

MRSPTU

ENERGY EFFICIENT MACHINES

Subject Code: BELE1-664 **L T P C** **Duration: 40 Hrs.**
3 0 0 3

Course Objectives:

1. To make the students aware about the basics and need for energy efficient machines.
2. To make them familiar with the energy efficient motors and their applications.
3. To make them to understand the underlying aspects of economics of energy efficient systems.

Course Outcomes:

1. The students will become aware about the need for energy efficient machines.
2. They will come to know about the energy efficient motors and their applications.
3. They will understand the underlying aspects of economics of energy efficient systems.

UNIT-I (8 Hrs.)

Introduction: Need for energy efficient machines, energy cost and two-part tariff, energy conservation in industries and farms -a necessity, introduction to energy management and energy audit system.

UNIT-II (12 Hrs.)

Energy Efficient Motors: Review of induction motor characteristics, Standard motor efficiency, energy efficient motor, efficiency determination methods, Direct Measurement method, Loss segregation method, Comparison, motor efficiency labeling, energy efficient motor standards.

Power Factor: The power factor in sinusoidal systems, power factor improvement, power factor with nonlinear loads, Harmonics and power factor.

UNIT-III (10 Hrs.)

Application of Electric Motors: Varying duty applications, Voltage variation, Voltage Unbalance, over motoring, Poly-phase induction motors supplied by adjustable frequency power supplies.

UNIT-IV (10 Hrs.)

Induction Motors and Adjustable Drive Systems: Energy Conservation, adjustable speed systems, Application of adjustable speed systems to fans, pumps and constant torque loads.

Economics of Energy Efficient Systems: Motor life cycle, Direct Savings and pay back analysis, efficiency evaluation factor, present worth method with constant power costs, present worth method with increasing power costs, net present worth method.

Recommended Books

1. Andreas John C., 'Energy Efficient Electric Motors', CRC Press, **1992**.
2. Emadi Ali, 'Energy Efficient Electric Motors', 3rd Edn., CRC Press, **2004**.
3. Thuman Albert, 'Introduction to Efficient Electric Systems Design', The Fairmount Press Prentice Hall, **1991.**
4. S.C. Tripathi, 'Electric Energy Utilization and Conservation', Tata McGraw Hill, **1991**.
5. Charles Belove, 'Handbook of Modern Electronics and Electrical Engineering', John Wiley and Sons, **1986**.

VIRTUAL INSTRUMENTATION

Subject Code: BELE1-665 | **L T P C 3 0 0 3** | **Duration: 38 Hrs.**

MRSPTU

Course Objectives:

1. To understand Virtual instrumentation and to realize the architecture of VI.
2. To familiarize with the VI software and learn programming in VI.
3. To study various instruments, interfacing and data acquisition methods.

Course Outcomes:

1. The students will be having skills of programming techniques.
2. They will be able to do data acquisition by creating Virtual Instruments for practical works.
3. Students will gain knowledge of analysis tools.

Unit - I (10 Hrs.)

Review of Virtual Instrumentation: Historical perspective, Advantages of virtual instrumentation system, Block diagram and architecture of a virtual Instrument, examples.

Data-flow Techniques: Graphical programming in data flow, Front Panel, Block Diagram, Comparison with conventional programming, Instructions.

VI Programming Techniques: VIs and sub-VIs, Loops and charts, Arrays, Clusters and graphs, Case and sequence structures, Formula nodes, Local and global variables, String and file I/O.

Unit -II (10 Hrs.)

Data Acquisition: Data acquisition boards, A/D Convertors, D/A Convertors, Digital Input and Output, Counters and timers, PC Hardware' structure, Timing, Interrupts, DMA Software and hardware installation.

Common Instrumentation Interfaces: Serial ports: RS-232, USB, Parallel ports: IEEE-1284, GPIB standard IEEE-488.2.

Unit -III (10 Hrs.)

Analysis Tools: Fourier transforms, Power spectrum, Correlation methods, Windowing and filtering, VI Applications in various fields.

Advanced Interface Buses: System buses, USB, PCMCIA, PCI, VXI, SCXl, PXI, Networking basics for office and industrial applications, VISA and IVI, interfere tools for Image acquisition and processing, Motion Control.

Unit -IV (8 Hrs.)

Laboratory Work: Components of Lab VIEW, Celsius to Fahrenheit conversion, Debugging, Sub-VI, Multi-plot charts, Case structures, ASCII files, Function Generator, Waveform generation, use of Property Node, Formula node, shift registers, Array, Strings, Clusters, DC voltage measurement using DAQ, Application of Data Acquisition system for measurement of temperature, pressure, Electrical quantities.

Recommended Books

1. G. Johnson, 'LabVIEW Graphical Programming', McGraw Hill, **2006**.
2. L. Sokoloft, 'Basic Concepts of LabVIEW 4', Prentice Hall Inc., **2004**.
3. L.K. Wells and J. Travis, 'LabVIEW for Everyone', Prentice Hall Inc., **1996**.
4. S. Gupta and J.P. Gupta, 'PC Interfacing for Data Acquisition and Process Control', Instrument Society of America, **1988**.
5. 'LabView Tutorial Manual', National Instruments Corp., **1996-2010** www.ni.com.
6. 'LabVIEW Basics Course Manual', National Instruments Corp., USA, **1998-2010**.
7. Jerome Jovitha, 'Virtual Instrumentation using LABVIEW', PHI, **2010**.

FLEXIBLE AC TRANSMISSION SYSTEM

Subject Code: BELE1-666	L T P C	Duration: 40 Hrs.
	3 0 0 3	

MRSPTU

Learning Objectives:
1. To review the power electronics fundamentals.
2. To review power transmission fundamentals and to introduce the FACTS concept.
3. To introduce to the need of shunt and series compensation and UPFC.

Course Outcomes:
1. Students will refresh the power converters' fundamentals.
2. They will learn about need and applications of FACTS controllers.
3. They would develop understanding about shunt and series compensation and UPFC.

UNIT-I (10 Hrs.)

Power Electronics Fundamentals: Basic function of power electronics, Power semiconductor device for high power converters, Static power convertor structures, AC controller based structure, DC link convertor topologies, Convertor output and harmonic control.

UNIT-II (10 Hrs.)

Power Transmission Control: Fundamental of ac power transmission, Transmission problems and needs, the emergence of FACTS, FACTS control considerations, FACTS controllers.

UNIT-III (10 Hrs.)

Shunt and Series Compensation: Shunt SVC principles, Configuration and control, STATCOM, Configuration applications. Fundamental of series compensation using GCSC, TCSC and TSSC, Application of TCSC for different problems of power system, TCSC lay out, SSSC principle of operation.

UNIT-IV (10 Hrs.)

Unified Power Flow Controllers: Basic operating principles and characteristics, independent active and reactive power flow control, control of UPFC, installation, applications, UPFC model for power flow studies, comparison of UPFC with the controlled series compensators and phase shifters.

Recommended Books

1. A. Ghosh and G. Ledwich, 'Power Quality Enhancement Using Custom Power Devices', Kluwer Academic Publishers, **2005**.
2. N.G. Hingorani and L. Gyragyi, 'Understanding FACTS: Concepts and Technology of Flexible AC Transmission System', Standard Publishers and Distributors, **2005**.
3. Y.H. Sang and A.T. John, 'Flexible AC Transmission Systems', IEEE Press, **2006**.
4. R.M. Mathur and R.K. Verma, 'Thyristor Based FACTS Controllers for Electrical Transmission Systems', IEEE Press, **2002**.
5. T.J.E. Miller, 'Reactive Power Control in Electric Systems', John Wiley, **1982**.

NON-CONVENTIONAL ENERGY SOURCES

Subject Code: BELE1-667	L T P C 3 0 0 3	Duration: 40 Hrs.

Course Objectives:

1. To obtain knowledge about renewable energy sources and solar energy and their utilization.
2. To introduce to wind energy conversion and bio-mass energy conversion systems.
3. To introduce to geothermal energy and energy from ocean. To make them aware about hydrogen energy sources.

Course Outcomes:

1. Students will get knowledge about utilization of renewable energy sources and solar energy.
2. They will learn about wind energy conversion and bio-mass energy conversion systems.
3. They will become aware about geothermal energy, energy from ocean and hydrogen energy sources.

MRSPTU

UNIT-I (12 Hrs.)

Solar Energy: Conventional energy sources and availability, Introduction to new energy techniques & renewable energy sources; Solar Energy, Solar constant, Radiation geometry, Solar energy collectors, Concentrated and flat plate, Energy balance and collector efficiency, Solar energy storage, Application to space heating, distillation, cooking and greenhouse effect.

UNIT-II (12 Hrs.)

Wind Energy: Basic principle of wind energy conversion, site selection, analysis of aerodynamic forces acting on wind mill blades and estimation of power output.

Bio-energy: Biomass conversion technology, photosynthesis, biogas plant, thermal gasification.

UNIT-III (8 Hrs.)

Geothermal Energy: Sources- hydrothermal, hot dry rock, geothermal fossil system, prime movers for geothermal energy.

Energy from Ocean: Ocean thermal electric conversion, energy from tides, small-scale hydroelectric development.

UNIT-IV (8 Hrs.)

Hydrogen Energy Sources: Introduction, hydrogen production methods, storage, utilization, magneto hydrodynamic power, thermionic generation, nuclear fusion energy.

Recommended Books

1. G.D. Rai, 'Non-Conventional Energy Sources', Khanna Publishers, Delhi, **2011**.
2. S. Rao, B.B. Parulekar, 'Energy Technology: Non-Conventional Renewable and Conventional', Khanna Publishers, Delhi.

3. H.P. Garg and Jai Prakash, 'Solar Energy: Fundamentals and Applications', Tata McGraw Hill.
4. Saeed S. Hasan and D.K. Sharma, 'Non-Conventional Energy Resources', Katson Publishers, **2014**.
5. R.K. Rajput, 'Non-Conventional Energy Sources and Utilization', S. Chand Publishers, **2012**.
6. S.P. Sukhatme, 'Solar Energy: Principles of Thermal Collection and Storage', Tata McGraw Hill, N. Delhi, **1984**.
7. Sutton, 'Direct Energy Conversion', McGraw Hill Inc., **1966**.

NON-LINEAR AND DIGITAL CONTROL SYSTEMS

Subject Code: BELE1-726	L T P C 3 1 0 4	Duration: 48 Hrs.

Learning Objectives:
1. To make the students aware about digital control system, sampling process and Z-transform.
2. To introduce the students to state variable analysis and design of digital control systems.
3. To make them familiar with nonlinear control systems and to understand their stability criterion

Course Outcomes:
At the end of this course, students will demonstrate the ability to
1. Analyze discrete time systems
2. Design and analyze digital controllers.
3. Understand Non Linear control systems and analyze their stability

UNIT-1 (12 Hrs.)

Sampled Data Systems: Introduction to digital control system, Sampling process, mathematical analysis of sampling process. Reconstruction of sampled signal, zero order and first order hold, Z- transform, evaluation of Z-transform, inverse Z-transform, limitations of Z-transform, mapping of S plane into Z plane, pulse transfer function, solution of discrete time state equations. Stability analysis of discrete time systems, Jury's stability test, extension of Routh-Hurwitz criterion to discrete time systems.

UNIT-2 (14 Hrs.)

State Variable Analysis: State variable representation of discrete time systems, solution of state variable models, Controllability and Observability, effect of pole-zero cancellation.

Design of Digital Control System: Design of Discrete PID Controller, Design of discrete state feedback controller. Design of set point tracker. Design of Discrete Observer for LTI System. Design of Discrete compensator.

UNIT-3 (12 Hrs.)

Non Linear Control Systems Analysis: Introduction and Characteristics, review of Fourier analysis.

Describing Function Analysis: Definition, limitations, use of describing function for stability analysis, describing function of ideal relay, relay with hysteris, dead zone, saturation, coulomb friction and backlash.

UNIT-4 (10 Hrs.)

Stability Methods: Lyapunov's direct method, generation of Lyapunov's function by Krasovskii's and Variable Gradient methods.

Phase Plane Analysis: Singular points, Method of isoclines, delta method, phase portrait of second order nonlinear systems, limit cycle.

Recommended Books

1. K. Ogata, 'Modern Control Engineering', Prentice Hall, India, **1995**.
2. I.J. Nagrath, M. Gopal, 'Control System Engineering', New Age Publications, **2008.**
3. M. Gopal, 'Digital Control and State Variable Methods', Tata McGraw Hill, **2012.**
4. B.C. Kuo and F. Golnaraghi, 'Automatic Control System', Wiley Publications, **2014.**
5. R.V. Dorf and R.H. Bishop, 'Modern Control Systems', Adison Wesley, **1995.**
6. M. Gopal, 'Digital Control Engineering', Wiley Eastern, **1988**.

POWER SYSTEM-II (SWITCHGEAR AND PROTECTION)

Subject Code: BELE1-727	L T P C 3 1 0 4	Duration: 48 Hrs.

Learning Objectives:
1. To provide knowledge about principle and components of protective system.
2. To impart knowledge about basics of Substation, Isolator and Fuses
3. To provide knowledge about operating Principle, types of Relays and Circuit Breakers
4. To provide knowledge about protection of Feeder, Bus bar, Generator and Transformer

Course Outcomes:
1. Skill to understand about basic components of power system protection system
2. Skill to understand about basics of Substation, Isolator and Fuses
3. Skill to understand about Principle, Operation and types of Relays and Circuit Breakers
4. Skill to understand about Protection of Feeder, Bus bar, Generator and Transformer

UNIT- I (12 Hrs.)

Introduction to Components of Protection System: Need for Protective System, Nature and Causes of Faults, Types and Effects of Faults, Zones of Protection, Primary and Backup Protection, Essential Qualities of Protection, Basic Principle of Protective System, Components and Classification of Protective System, Brief Idea of Instrument Transformers, Circuit Breakers, Relays and related Terminologies.

Substation, Isolator and Fuses: Functions, Types, Classification, Main Equipment, Layout, Bus-bar Arrangement of Substation. Operation, Types and Rating of Isolators. Types, Rating and Characteristics of Fuses.

UNIT- II (12 Hrs.)

Circuit Breakers: Circuit Breaker Ratings, Arc Initiation and their Interruption Methods, Arc Quenching Theories, Re-striking voltage, Recovery Voltage, RRRV, Plain Break Oil Circuit Breaker, Minimum Oil Circuit Breaker, Air Circuit Breaker, Air Blast Circuit Breaker, Vacuum Circuit breaker and SF^6 Circuit Breaker. Introduction to D.C. Circuit Breaker.

Protective Relays: Introduction, Classification, Constructional Features; and Characteristics of Electromagnetic, Induction, Thermal, Over-current relays, Directional Over Current Relay, Distance relays (Impedance, Reactance and Mho relay), Differential Relays, Trans-lay, Negative sequence relay, introduction to Static and Numerical Relays.

UNIT-III (12 Hrs.)

Feeder or Transmission Line Protection: Over current Protection by Time Graded System, Current Graded and Time- Current Graded System, Protection of Parallel Feeder, Protection of Ring Mains, Over Current Earth Fault Protection, Distance Protection of Transmission lines (Impedance, Reactance and Mho Relay), Comparison between Distance Relays, Differential and Percentage Differential Protection, Pilot Relaying Protection of Feeder.

Bus-Bar Protection: Differential Protection of Bus Bars

UNIT- IV (12 Hrs.)

Transformer Protection: Over current protection, percentage differential protection, incipient faults in transformers, inter-turn fault, protection against over fluxing.

Generator Protection: Various faults and abnormal operating conditions, protection against unbalanced loading, over speeding, loss of excitation, loss of prime mover.

Recommended Books

1. C.L. Wadhwa, 'Electrical Power System', New Age International (P) Ltd.
2. D.N. Badri Ram, D.N. Vishakarma, 'Power System Protection and Switchgear'.
3. Ravindranath and M. Chander, 'Power System Protection and Switchgear'.
4. Dahiya and Attri, 'Substation Engineering', Khanna Publishers
5. B.R. Gupta, 'Power System Analysis and Design', S. Chand & Company (P) Ltd.
6. Nagrath and Kothari, 'Modern Power System Analysis', Tata McGraw Hill.
7. J. Grainger John and Jr. W.D. Stevenson, 'Power System Analysis', McGraw Hill, **1994**.
8. Sunil S. Rao, 'Switchgear Protection and Power Systems', Khanna Publishers.
9. S.L. Uppal, 'Electrical Power', Khanna Publishers.

MINOR PROJECT

Subject Code: BELE1-728 **L T P C**
0 0 4 2

The object of Minor Project is to enable the student to take up investigative study in the broad field of Electrical Engineering, either fully theoretical/practical or involving both theoretical and practical work to be assigned by the Department on an individual basis or three/four students in a group, under the guidance of a Supervisor. This is expected to provide a good initiation for the student(s) in R&D work. The assignment to normally include:

1. Survey and study of published literature on the assigned topic;
2. Working out a preliminary Approach to the Problem related to the assigned topic;
3. Conducting preliminary Analysis/Modelling/Simulation/Experiment/Design/Feasibility;
4. Preparing a Written Report on the Study conducted for presentation to the Department;
5. Final Seminar, as oral Presentation before a departmental committee.

MRSPTU

SOFTWARE LAB.

Subject Code: BELE1-729 **L T P C**
0 0 2 1

Learning Objectives:

To develop programs in C/C++/MATLAB software

1. For practical understanding of numerical methods.
2. To solve numerically algebraic equations, linear systems of equations and ordinary differential equations.
3. To carry out numerical differentiation, integration and interpolation.
4. To develop understanding of numerical error and applicability of a particular method.

Course Outcomes:

After studying this course, the students will be able to

1. Evaluate various iterative techniques for finding real roots of an equation.
2. Hypothesize and validate interpolation methods.
3. Develop programmes for solving simultaneous linear algebraic equations.
4. Analyze the techniques of numerical integration &differentiation.

EXPERIMENTS

To develop algorithms/programs in C/ C++/MATLAB language for the following methods:

1. Bisection method for finding a real root of an equation.
2. Newton-Raphson method for finding a real root of an equation.

3. Gauss-Seidal iterative method for linear algebraic equations.
4. Trapezoidal Rule for numerical integration
5. Simpson's 1/3rd rule for numerical integration.
6. Simpson's 3/8th rule for numerical integration.
7. Lagrange's method for interpolation.
8. Euler's method for solving ordinary differential equations.
9. Modified Euler's method for solving ordinary differential equations
10. R-K method for solving ordinary differential equations.

Note: At least eight experiments must be performed from the given list.

Recommended Books

1. E. Balagurusamy, 'Object Oriented Programming with C++', Tata McGraw Hill, New Delhi, **1999**.
2. J.N. Sharma, 'Numerical Methods for Engineers and Scientists', 2nd Edn., Narosa Publishing House, New Delhi/Alpha Science International Ltd. Oxford UK, **2007**.
3. Conte and de Boor, 'Numerical Analysis', McGraw Hill, New York, **1990**.
4. John H. Mathews, 'Numerical Methods for Mathematics, Science and Engineering', 2nd Edn., Prentice Hall, New Delhi, **2000**.

POWER SYSTEM-II LAB

Subject Code: BELE1-730 **L T P C**

0 0 2 1

Course Outcomes:

After studying this course, the students will be able to

1. Calculate the characteristics of various transmission lines
2. Understand operation of relays and circuit breakers.
3. Analyze various protection schemes in power system.
4. Plot characteristics of different types of relays.
5. Measure the resistance of earth electrode and resistivity of earth.

EXPERIMENTS

1. To study the performance of a transmission line. Also to find its ABCD parameters.
2. To find the operating characteristics of fuse (HRC or open type)
3. To find the resistance of earth electrode by three electrode method.
4. To find the resistivity of earth using four electrode method.
5. To study the radial feeder performance when
6. Fed at one end
7. Fed at both ends
8. To simulate different types of faults on transmission lines using demonstration panel/model or some available software.
9. To study different types of Insulators.
10. To obtain the Characteristics of over current relay.
11. To draw the characteristics of earth fault protection relay
12. To obtain the characteristics of under voltage and over voltage relay.
13. To obtain the characteristics of bimetallic miniature circuit breaker
14. To find the breakdown strength of transformer oil.
15. To demonstrate the operation of a Circuit breaker.
16. To draw the characteristics of Distance (Impedance, Reactance and Mho) Relay.

Note: At least ten experiments must be performed from the given list.

MRSPTU

INDUSTRIAL TRAINING

Subject Code: BELE1-731 **L T P C**
0 0 0 3

Note- This training is to be imparted at the end of 6th semester
Minimum of eight weeks of training in an Industry in the area of Electrical Engineering. The summer training should give exposure to the practical aspects of the discipline. In addition, the student may also work on a specified task or project which may be assigned to him/her. The outcome of the training should be presented in the form of a report.

INDUSTRIAL AUTOMATION

Subject: BELE1-768 **L T P C** **Duration: 38 Hrs.**
3 0 0 3

Learning Objectives:
1. To introduce the need of Automation in industry.
2. To expose to different types of transmitters, final control elements and actuators.
3. To teach students about the role of computers in Process Industries.
4. To familiarize students with typical case studies.

Course Outcomes:
1. Students will gain knowledge about the basics of Industrial Automation.
2. Students will be able to understand the hardware and software configurations of Automation.
3. They will be able to recommend right choice of automation systems for a given application.

UNIT-I (9 Hrs.)

Introduction: Need for automation, Architecture of Industrial Automation system. Introduction to Programmable Logic Controller (PLC), Supervisory Control and Data Acquisition (SCADA), Human machine interface (HMI) and Distributed Control System (DCS), Introduction to state load dispatch centre (SLDC), Industrial Data Networks.

UNIT-II (9 Hrs.)

Field Devices: Conventional and Smart Process Transmitters for Temperature, Pressure, Flow, Level, Power, power factor and pH Measurement, Final Control Elements, Pneumatic and electric actuators, Thyristor Power Controller, Introduction to DC and AC Servo Drives for motion control, Interfacing Field devices with I/O Sub Systems.

UNIT-III (10 Hrs.)

Computer Aided Measurement and Control Systems: Role of computers in measurement and control, Elements of computer aided measurement and control, Man-Machine Interface, computer aided process control hardware and software –Industrial Internet of things (I^2oT), Cloud computing, Cyber Security for Industrial automation.

UNIT-IV (10 Hrs.)

Case Studies: Industrial automation for Traffic light control, Bottle filling application and Elevator control, DCS/SCADA in cement plant and thermal power plant

Standards: introduction to different safety and quality standards.

Recommended Books

1. Bela G. liptak, 'Process Control and Optimization', 4th Edn., Taylor & Francis, **2003.**
2. S.K. Singh, 'Industrial Instrumentation', 2nd Edn., Tata McGraw Hill, **2003**.
3. C.D. Johnson, 'Process Control Instrumentation Technology', 8th Edn., Prentice Hall India, **2006**.
4. E.A. Parr, Newnes, 'Industrial Control Handbook', 3rd Edn., New Delhi, **2000**.

5. Gary Dunning, Thomson Delmar, 'Programmable Logic Controller', 3rd Edn., Cengage Learning, **2005**.

SYSTEM ENGINEERING AND RELIABILITY

Subject Code: BELE1-769 **L T P C** **Duration: 38 Hrs.**
3 0 0 3

Learning Objectives:
1. To understand the reliability of engineering systems using different techniques.
2. To understand the qualitative concept of availability and maintainability.
3. To study about improvement of availability and reliability of any system.

Course Outcomes:
After studying this course, the students will be able to
1. Retrieve basic concept of system engineering and reliability.
2. Comprehend different reliability functions.
3. Analyze the failure data and reliability management.

UNIT-I (8 Hrs.)

Basic Concepts of System Engineering and Reliability: Introduction to System Engineering, Reliability and Quality, History of Reliability, Failure Modes, Causes of Failure (Unreliable Systems).

UNIT-II (12 Hrs.)

Reliability Design and Analysis: Reliability and Cost, Failure Data Analysis, Failure Density, Failure Rate, Component Reliability, Mean Time to Failure (MTTF), Mean Time Between Failure(MTBF), Markov's Model of Reliability Function.

UNIT-III (16 Hrs.)

System Reliability Models: Introduction, System with Series and Parallel Components, k out of m Systems, Fault Tree Analysis (FTA), Reliability evaluation from Fault Tree.
Maintainability and Availability Concepts: Concept of Maintainability, Qualitative aspect of Availability, Availability Function, Concept of Preventive Maintenance.

UNIT-IV (12 Hrs.)

Reliability Management: Economic Issues Manufacture and Customer Cost, Reliability Achievement Cost Model, Reliability Management Policies, Objectives, Reliability Data Acquisition, Managing People for Reliability.

Recommended Books

1. M.L. Shooman, 'Probabilistic Reliability: An Engineering Approach', McGraw Hill.
2. E. Balaguruswamy, 'Reliability Engineering', McGraw Hill International DIGITAL
3. L.S. Srinath, 'Reliability Engineering', East-West Press Private Ltd.
4. R. Rama Kumar, 'Engineering Reliability', Prentice Hall, NJ.
5. R. Billinton, 'Power System Reliability Calculation', MIT Press, USA
6. Endreyni, 'Reliability Modeling in Electric Power System', John Wiley, New York.
7. https:// en.m.wikipedia.org/reliability engineering.
8. https://onlinecourses.nptel.ac.in

DIGITAL SIGNAL PROCESSING

Subject Code: BELE1-770 **L T P C** **Duration: 40 Hrs.**
3 0 0 3

Learning Objectives:
1. To familiarize the students with the basics of signal processing for analysis of discrete signals.

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2. To acquaint the students with the application of different tools required for the analysis of discrete signals.
3. Application of digital signals to real-life problems.

Course Outcomes:

At the end of this course, students will demonstrate the ability to

1. Represent signals mathematically in discrete-time, and in the frequency domain and analyze them using z-transform.
2. Understand the Discrete-Fourier Transform (DFT) and the FFT algorithms.
3. Design digital filters for various applications.
4. Apply digital signal processing for the analysis of real-life signals.

UNIT-I (10 Hrs.)

Discrete-time Signals and Systems: Discrete time signals and systems: Sequences; representation of signals on orthogonal basis; Representation of discrete systems using difference equations, Sampling and reconstruction of signals - aliasing; Sampling theorem and Nyquest rate.

Z-transform: Z-transform, Region of Convergence, Analysis of Linear Shift Invariant systems using Z- transforms Properties of Z-transform for causal signals, Interpretation of stability in Z-domain, Inverse Z-transforms, Introduction to bilateral Z-transforms.

UNIT-II (10 Hrs.)

Discrete Fourier Transform: Frequency Domain Analysis, Discrete Fourier Transform (DFT), Properties of DFT, Convolution of signals, Fast Fourier Transform Algorithm, Parseval’s Identity, Implementation of Discrete Time Systems

UNIT-III (12 Hrs.)

Digital Filter Structure: Describing Equation, Structures for FIR Systems and Structure for IIR Systems. Representation of Structures using Signal Flow Graph.

Design of Digital Filters: Design of FIR Digital filters, Window method, Park-McClellan's method, Design of IIR Digital Filters: Butterworth, Chebyshev and Elliptic Approximations, Low-pass, Band-pass, Band-stop and High-pass filters. Effect of finite register length in FIR filter design, Finite Word-length Effects, Parametric and non-parametric spectral estimation. Introduction to multi-rate signal processing.

UNIT-IV (8 Hrs.)

Applications of Digital Signal Processing: Correlation Functions and Power Spectra, Stationary Processes, Optimal filtering using ARMA Model, Linear Mean-Square Estimation, Wiener Filter.

Hardware Architecture of DSP Processor: Introduction, Desirable features of DSP processors, Types of architectures, Internal architecture of ADSP-21xx family, Features of ADSP-21xx family processors.

Recommended Books

1. S.K. Mitra, ‘Digital Signal Processing: A Computer based Approach’, McGraw Hill, **2011**.
2. A.V. Oppenheim and R.W. Schafer, ‘Discrete Time Signal Processing’, Prentice Hall, **1989**.
3. J.G. Proakis and D.G. Manolakis, ‘Digital Signal Processing: Principles’, Algorithms and Applications’, Prentice Hall, **1997**.
4. L.R. Rabiner and B. Gold, ‘Theory and Application of Digital Signal Processing’, Prentice Hall, **1992**.
5. J.R. Johnson, ‘Introduction to Digital Signal Processing’, Prentice Hall, **1992**.

EHVAC-TRANSMISSION

Subject: BELE1-771 **L T P C** **Duration: 40 Hrs.**

3 0 0 3

Learning Objectives:

1. To familiarize the students with the need and advantages associated with EHVAC Transmission.
2. To acquaint the students with the reactive parameters of lines and methods of voltage control.
3. To make them aware about voltage gradients of conductors and effects of corona.

Course Outcomes:

At the end of this course, students will become aware

1. About the advantages of EHVAC Transmission and problems associated with it.
2. About the reactive parameters of lines and methods of voltage control.
3. About the voltage gradients of conductors and associated corona effects.

UNIT– I (8 Hrs.)

Preliminaries: Necessity of EHV AC transmission, advantages and problems, power handling capacity and line losses, mechanical considerations, resistance of conductors, properties of bundled conductors, bundle spacing and bundle radius, Examples.

UNIT – II (12 Hrs.)

Line and Ground Reactive Parameters: Line inductance and capacitance, sequence inductances and capacitances, modes of propagation, ground return, Examples

Voltage Control: Power circle diagram and its use, voltage control using synchronous condensers, cascade connection of shunt and series compensation, sub synchronous resonance in series capacitor, compensated lines, static VAR compensating system.

UNIT – III (12 Hrs.)

Voltage Gradients of Conductors: Electrostatics, field of sphere gap, field of line charges and properties, charge, potential relations for multi-conductors, surface voltage gradient on conductors, distribution of voltage gradient on sub conductors of bundle, Electrostatic field, calculation of electrostatic field of EHV/AC lines, effect on humans, animals and plants, electrostatic induction in un-energized circuit of double-circuit line, electromagnetic interference, No load voltage conditions and charging current.

UNIT – IV (8 Hrs.)

Corona Effects: Power loss and audible noise (AN), corona loss formulae, charge voltage diagram, generation, characteristics, limits and measurements of AN, relation between 1-phase and 3-phase AN levels, Radio interference (RI), corona pulses: generation, properties, limits, frequency spectrum, modes of propagation, excitation function, measurement of RI, RIV and excitation functions.

Recommended Books

1. R.D. Begamudre, 'EHVAC Transmission Engineering', New Academic Science, 4th Edn., **2011**.
2. S. Rao, 'EHVAC and HVDC Transmission and Distribution Engineering', 3rd Edn., Khanna Publishers, **2008**.

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POWER SYSTEM ANALYSIS AND DESIGN

Subject: BELE1-832 **L T P C** **Duration: 48 Hrs.**
3 1 0 4

Learning Objectives:

1. To understand the importance of per unit system, single line diagram and impedance diagrams of electric networks in power system analysis.
2. To gain the information about various types of buses in the electric network and the type of data required for power flow studies.
3. To understand the different types of faults in the system and methods to analyze these faults.

Course Outcomes:

Students will be able to

1. Develop per unit system models of synchronous machines, transformers, transmission lines and static loads for power system studies.
2. Perform load flow studies by using bus admittance matrix and to do fault analysis by bus impedance matrix.
3. Compare features of Gauss-Siedel, Newton-Raphson and Fast decoupled methods of load flow analysis.
4. Analyze the effect of symmetrical and unsymmetrical faults on power system.
5. Analyze the effect of small and large disturbances on power system stability.

UNIT-I (18 Hrs.)

System Modelling: System modelling of synchronous machines, transformers, transmission lines and loads, Per Unit (p.u.) representation of power system, Single line diagram of electrical networks, p.u. single phase impedance diagrams corresponding to single line diagram, formulation of Bus Admittance Matrix and Bus Impedance Matrix for power system studies.

Load Flow Studies: Data for the load flow studies, Bus types, Formulation of power flow equations, Iterative solutions of load flow equations by the Gauss-Seidel and Newton-Raphson methods, Algorithms and flow charts of these methods, Line flows and line losses calculations. Introduction to Decoupled and Fast Decoupled method.

UNIT-II (12 Hrs.)

Fault Analysis: Transients on transmission line, Short circuit of synchronous machine, Selection of circuit breakers, Symmetrical fault analysis using Thevenin's theorem. Symmetrical Component Transformation, Construction of sequence networks of power systems. Analysis of Unsymmetrical LG (line to ground), LL (line to line), LLG (line line ground) faults using symmetrical components, Symmetrical and unsymmetrical faults analysis using Bus Impedance Matrix with algorithm and flow chart.

UNIT-III (10 Hrs.)

Power System Stability: Steady state stability, Dynamics of a synchronous machine, Power angle equation, Transient stability, Equal area criterion, Numerical solution of swing equation, Factors effecting transient stability.

UNIT-IV (08 Hrs.)

Design of Transmission Line: Choice of voltage, Selection of conductor size, Choice of span, No. of circuits, Conductor configuration, Insulation design, Selection of ground wire.

Recommended Books

1. O.I. Elgerd, 'Electric Energy Systems Theory', Tata McGraw Hill.
2. W.D. Stevenson, 'Elements of Power System Analysis', Tata McGraw Hill.
3. I.J. Nagrath and D.P. Kothari, 'Power System Engineering', Tata McGraw Hill.
4. J. Arrillaga and C.P. Arnold, 'Computer Aided Power System', Wiley.

5. Glenn W. Stagg. & El-abiad, ‘Computer Methods in Power System Analysis’, Tata McGraw Hill.
6. Kusic, ‘Computer Aided Power System Analysis’, Taylors and Francis Group.
7. T.K. Nagsarkar and M.S. Sukhija, ‘Power System Analysis’, Oxford University Press, **2016**.
8. D.P. Kothari & J.S. Dhillon, ‘Power System Optimization’, Prentice Hall of India.

HIGH VOLTAGE ENGINEERING

Subject Code: BELE1-833 **L T P C** **Duration: 40 Hrs.**
3 0 0 3

Learning Objectives:
1. To know about how power systems are subjected to over voltages and what are protection methods adopted against these over voltages.
2. To understand the basic physical phenomenon related to various breakdown processes in solid, liquid and gaseous insulating materials at high voltages.
3. To know about generation and measurement of D. C., A.C., & Impulse voltages.
4. To know about various tests on H. V. equipment and on insulating materials, as per the standards.

Course Outcomes:
At the end of the course, the students will be able to
1. Explain that how over-voltages arise in a power system, and protection against these over-voltages.
2. Understand the basic physical phenomenon occurring in various breakdown processes in solid, liquid and gaseous insulating materials.
3. Know about generation and measurement of D. C., A.C., & Impulse voltages.
4. Know about H. V. testing of equipment and insulating materials, as per the standards.

UNIT- I (14 Hrs.)

Over Voltages in Electric Power Systems: Causes of over voltages and their effect on power system – Lightning, switching surges and temporary over voltages-protection against over voltages.

Breakdown in Gases: Ionization processes and de-ionization processes, Types of Discharge, Gases as insulating materials, Breakdown in Uniform gap, non-uniform gaps, Townsend’s theory, Streamer mechanism, Corona discharges.

Breakdown in liquid and solid Insulating materials: Breakdown in pure and commercial liquids, Solid dielectrics and composite dielectrics, intrinsic breakdown, electromechanical breakdown and thermal breakdown, Partial discharge, applications of insulating materials.

UNIT- II (8 Hrs.)

Generation of High Voltages (7 Hours): Generation of high voltages, generation of high D.C. and A.C. voltages, generation of impulse voltages, generation of impulse currents, tripping and control of impulse generators.

UNIT- III (8 Hrs.)

Measurements of High Voltages and Currents: Peak voltage, impulse voltage and high direct current measurement method, cathode ray oscillographs for impulse voltage and current measurement, measurement of dielectric constant and loss factor, partial discharge measurements.

UNIT- IV (10 Hrs.)

High Voltage Testing of Electrical Apparatus and High Voltage Laboratories: Various standards for HV Testing of electrical apparatus, IS, IEC standards, testing of insulators and bushings, testing of isolators and circuit breakers, testing of cables, power transformers and some high voltage equipment, High voltage laboratory layout, indoor and outdoor laboratories, testing facility requirements, safety precautions in H. V. Labs.

Recommended Books

1. M.S. Naidu and V. Kamaraju, 'High Voltage Engineering', McGraw Hill Education, **2013**.
2. C.L. Wadhwa, 'High Voltage Engineering', New Age International Publishers, **2007**.
3. D.V. Razevig (Translated by Dr. M. P. Chourasia), 'High Voltage Engineering Fundamentals', Khanna Publishers, **1993**.
4. E. Kuffel, W.S. Zaengl and J. Kuffel, 'High Voltage Engineering Fundamentals', Newnes Publication, **2000**.
5. R. Arora and W. Mosch, 'High Voltage and Electrical Insulation Engineering', John Wiley & Sons, **2011**.
6. Various IS standards for HV Laboratory Techniques and Testing.

MAJOR PROJECT

Subject Code: BELE1-834 **L T P C**
0 0 12 6

The object of Major Project & Dissertation is to enable the student to extend further the investigative study taken up under Minor Project, either fully theoretical/practical or involving both theoretical and practical work, under the guidance of a Supervisor from the Department alone or jointly with a Supervisor drawn from R&D laboratory/Industry. This is expected to provide a good training for the student(s) in R&D work and technical leadership. The assignment to normally include:

1. In depth study of the topic assigned in the light of the Report prepared under Minor Project.
2. Review and finalization of the Approach to the Problem relating to the assigned topic;
3. Preparing an Action Plan for conducting the investigation, including team work;
4. Detailed Analysis/Modelling/Simulation/Design/Problem Solving/Experiment as needed;
5. Final development of product/process, testing, results, conclusions and future directions;
6. Preparing a Dissertation in the standard format for being evaluated by the Department.
7. Final Seminar Presentation before a Departmental Committee.

POWER SYSTEM ANALYSIS AND DESIGN LAB.

Subject Code: BELE1-835 **L T P C**
0 0 2 1

Learning Objectives:

1. To apply high level programming languages and software tools for power system studies.
2. To learn to develop computer programs for load flow analysis.
3. To understand the method to perform short circuit analysis.
4. Carry out stability studies of power system.
5. Simulate load frequency control of single area system.

Course Outcomes:

1. After studying this course, the students will acquire the skill of using power system related tools for power system analysis, such as;
2. Load flow studies, short circuit studies,

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3. Load frequency control, stability analysis etc.
4. To design transmission system, distribution system and underground cables etc.

EXPERIMENTS

1. Introduction to software tools for power system studies like MiPower, Etap etc. and/or some high level programming language such as MATLAB, C++ etc.
2. Design of transmission system for given power and distance.
3. Design of distribution systems.
4. Design of underground cables for a substation.
5. To develop a program for formation of Bus Admittance Matrix.
6. To develop a program for load flow analysis by Gauss Seidal method.
7. To develop a program for load flow analysis by Newton Raphson method.
8. To develop a program for formation of Bus Impedance Matrix using building algorithm.
9. To calculate short circuit currents and circuit breaker ratings for a power system network.
10. To develop a program for economic load dispatch of power systems.
11. Power system stability studies on a single machine system.
12. Optimal Capacitor placement on a system having variable reactive power and low voltage profile.
13. To develop a SIMULINK model for Load Frequency Control of single area system without and with PI Controller.

Note: At least ten experiments must be performed from the given list.

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ELECTRICAL MACHINE DESIGN

Subject Code: BELE1-872	**L T P C** **3 0 0 3**	**Duration: 38 Hrs.**

Learning Objectives:

1. To understand the various factors which influence the design: electrical, magnetic and thermal loading of electrical machines.
2. To design single and three phase transformer.
3. To design three phase induction motor and synchronous machine.

Course Outcomes:

At the end of this course, students will demonstrate the ability to

1. To analyze general considerations for design of electrical machines
2. To understand concepts of design of transformer.
3. To design three phase induction motor and synchronous machine.

UNIT-I

Introduction: Review of electrical properties of insulating materials and magnetic circuits, Major considerations in electrical machine design, space factor, choice of specific electrical and magnetic loadings, thermal considerations, heat flow, temperature rise, methods of ventilations, rating of machines, Limitations (assumptions) of traditional designs and need of Computer Aided Design.

UNIT-II

Transformers: General considerations, Sizing of a transformer, main dimensions, kVA output for single- and three-phase transformers, window space factor, overall dimensions, operating characteristics, regulation, no load current, temperature rise in transformers, design of cooling tank, methods for cooling of transformers.

UNIT-III

Three Phase Induction Motor: Standard specifications, Sizing of an induction motor, main dimensions, length of air gap, rules for selecting rotor slots of squirrel cage machines, design of rotor bars & slots, design of end rings, design of wound rotor, magnetic leakage calculations, leakage reactance of poly-phase machines, magnetizing current, short circuit current, circle diagram, operating characteristics.

UNIT-IV

Synchronous Machine: Sizing of a synchronous machine, main dimensions, design of salient pole machines, short circuit ratio, shape of pole face, armature design, armature parameters, estimation of air gap length, design of rotor, design of damper winding, determination of full load field mmf, design of field winding, design of turbo alternators, rotor design.

Recommended Books

1. A.K. Sawhney, 'A Course in Electrical Machine Design', Dhanpat Rai and Sons, **1970**.
2. M.G. Say, 'Theory & Performance & Design of A.C. Machines', ELBS London.
3. S.K. Sen, 'Principles of Electrical Machine Design with Computer Programmes', Oxford and IBH Publishing, **2006**.

HVDC TRANSMISSION

Subject Code: BELE1-873 | **L T P C 3 0 0 3** | **Duration: 40 Hrs.**

Learning Objectives:

1. To introduce to the advantages of HVDC transmission over HVAC transmission.
2. To understand the operation of Line Commutated Converters and Voltage Source Converters. and the control strategies used in HVDC transmission system.
3. To study HVDC related effects such as; corona, interference and harmonics.
4. To study the effect of HVDC control on power system stability.

Course Outcomes:

At the end of this course, students will demonstrate the ability

1. To know the importance of HVDC transmission.
2. To understand HVDC system control strategies.
3. To understand the enhancement of power system stability by HVDC system.

UNIT-I (5 Hrs.)

Overview: Comparison of EHV AC and DC transmission, description of DC transmission systems, modern trends in AC and DC transmission.

UNIT-II (15 Hrs.)

HVDC System: Configurations of DC transmission system, planning for High Voltage Direct Current (HVDC) transmission, Introduction to Device: Thyristor valve, valve tests, recent trends.

Converter and HVDC System Control: Converter configurations and their characteristics, Types of HVDC links, Pulse number, choice of converter configuration, simplified analysis of Graetz circuit, converter bridge characteristics, characteristics of a twelve-pulse converter, detailed analysis of converters with and without overlap.

UNIT-III (12 Hrs.)

Corona and Interference: 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.

Harmonic Filters: Generation of harmonics, Smoothing reactor, design of AC filters, DC filters, protection against over-currents, over-voltages in a converter station, surge arresters, Parallel operation of HVDC/AC systems, Multi terminal systems.

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UNIT- IV (8 Hrs.)

Stability Enhancement using HVDC Control: Basic Concepts: Power System Angular, Voltage and Frequency Stability. Power Modulation: basic principles – synchronous and asynchronous links. Voltage Stability Problem in AC/dc systems.

Recommended Books

1. K.R. Padiyar, 'HVDC Power Transmission Systems', New Age International Publishers, **2011**.
2. J. Arrillaga, 'High Voltage Direct Current Transmission', Peter Peregrinus Ltd., **1983**.
3. E.W. Kimbark, 'Direct Current Transmission', Vol.1, Wiley Interscience, **1971**.
4. S. Kamakshaiah and V. Kamaraju, 'HVDC Transmission', McGraw Hill Education, **2017**.

FUZZY LOGIC SYSTEMS

Subject Code: BELE1-874	**L T P C** **3 0 0 3**	**Duration: 40 Hrs.**

Learning Objectives:

1. To introduce to classical sets and fuzzy sets.
2. To study about classical relations and fuzzy relations.
3. To learn about membership functions and fuzzy arithmetic.

Course Outcomes:

1. Familiarity with classical sets and fuzzy sets.
2. Awareness about classical relations and fuzzy relations.
3. Knowledge about membership functions and fuzzy arithmetic.

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UNIT I (10 Hrs.)

Introduction, Classical Sets and Fuzzy Sets: Background, Uncertainty and Imprecision, Statistics and Random Processes, Uncertainty in Information, Fuzzy Sets and Membership, Chance versus Ambiguity. Classical Sets - Operations on Classical Sets, Properties of Classical (Crisp) Sets, Mapping of Classical Sets to Functions Fuzzy Sets - Fuzzy Set operations, Properties of Fuzzy Sets.

UNIT II (14 Hrs.)

Classical Relations and Fuzzy Relations: Cartesian Product, Crisp Relations, Cardinality of Crisp Relations, Operations on Crisp Relations, Properties of Crisp Relations, Composition. Fuzzy Relations, Cardinality of Fuzzy Relations, Operations on Fuzzy Relations, Properties of Fuzzy Relations, Fuzzy Cartesian Product and Composition, Non-interactive Fuzzy Sets. Tolerance and Equivalence Relations, Crisp Equivalence Relation, Crisp Tolerance Relation, Fuzzy Tolerance and Equivalence Relations. Value Assignments, Cosine Amplitude, Max-min Method.

UNIT-III (6 Hrs.)

Membership Functions: Features of the Membership Function, Standard Forms and Boundaries, Fuzzification, Membership Value Assignments, Intuition, Inference, Rank Ordering, Angular Fuzzy Sets.

UNIT-IV (10 Hrs.)

Fuzzy-to-Crisp Conversions, Fuzzy Arithmetic: Lambda-Cuts for Fuzzy Sets, Lambda-Cuts for Fuzzy Relations, Defuzzification Methods Extension Principle, Crisp Functions, Mapping and Relations, Functions of fuzzy Sets, Extension Principle, Fuzzy Transform (Mapping), Practical Considerations, Fuzzy Numbers, Interval Analysis in Arithmetic.

Recommended Books

1. G. Klir, B. Juan, 'Fuzzy Sets and Fuzzy Logic', Prentice Hall, New Jersey, **1995**.
2. V. Novák, Základy Fuzzy Modelování. Praha: BEN, 2000. 176 p. ISBN 80-7300-009-1.

3. P. Klement, 'Triangular Norms', Kluwer Academic Press, London, **2000**.
4. H.T. Nguyan, E A. Walker, 'Fuzzy Logic', Chapman and Hall, New York, **2000**.
5. S.N. Sivanandam, and S.N. Deepa, 'Principles of Soft Computing', Wiley Publications, **2007.**

NEURAL NETWORKS

Subject Code: BELE1-875 **L T P C** **Duration: 40 Hrs.**
3 0 0 3

Learning Objectives:
1. To introduce to artificial neural networks and their applications.
2. To introduce to learning processes involved in training of neural networks
3. To learn about single-layer and multi-layer perceptron and self-organization maps.

Course Outcomes:
1. Familiarity with artificial neural networks and their applications.
2. Learning about training of neural networks.
3. Knowledge about single-layer and multi-layer perceptron and self-organization maps.

UNIT-I (10 Hrs.)

Introduction: what is a neural network? Human Brain, Models of a Neuron, Neural networks viewed as Directed Graphs, Network Architectures, Knowledge Representation, Artificial Intelligence and Neural Networks.

Learning Process-1: Error Correction learning, Memory based learning, Hebbian learning.

UNIT-II (10 Hrs.)

Learning Process-2: Competitive, Boltzmann learning, Credit Assignment Problem, Memory, Adaption, Statistical nature of the learning process.

Single Layer Perceptrons: Adaptive filtering problem, Unconstrained Organization Techniques, Linear least square filters, least mean square algorithm, learning curves, Learning rate annealing techniques, perception, convergence theorem.

UNIT-III (10 Hrs.)

Multilayer Perceptron: Back propagation algorithm XOR problem, Heuristics, Output representation and decision rule, Computer experiment, feature detection, back propagation and differentiation, Hessian matrix, Generalization, Cross validation, Virtues and limitations of back propagation learning, Accelerated convergence, supervised learning.

UNIT-IV (10 Hrs.)

Self-Organization Maps: Two basic feature mapping models, Self-organization map, SOM algorithm, properties of feature map, computer simulations, learning vector quantization, Adaptive patter classification, Hierarchal Vector quantilizer, contexmel Maps. HOPFIELD MODELS – Hopfield models.

Recommended Books

1. B. Vegnanarayana, 'Artificial Neural Networks', Prentice Hall of India P. Ltd., **2005**.
2. Li Min Fu,' Neural networks in Computer Intelligence', TMH, **2003**.
3. James A. Freeman and David M.S. Kapura, 'Neural Networks', Pearson Education **2004**.
4. N.P. Padhy, 'Artificial Intelligence and Intelligent Systems', Oxford University Press, New Delhi, **2005**.
5. S.N. Sivanandam and S.N. Deepa, 'Principles of Soft Computing', Wiley Publications, **2007**.

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GROUP-A
1ST SEMESTER

Course		Contact Hrs.			Marks			Credits
Code	Name	L	T	P	Internal	External	Total	
BPHYS5-101	Physics (Optics, Electromagnetism & Quantum Mechanics)	3	1	0	40	60	100	4
BMATH5-101	Mathematics-I (Calculus, Linear Algebra)	3	1	0	40	60	100	4
BMECE0-101	Engineering Graphics & Design	2	0	0	40	60	100	2
BELEE0-101	Basics Electrical Engineering	3	1	0	40	60	100	4
BPHYS5-102	Physics (Optics, Electromagnetism & Quantum Mechanics) Lab.	0	0	2	60	40	100	1
BMECE0-102	Engineering Graphics & Design Lab.	0	0	6	60	40	100	3
BELEE0-102	Basics Electrical Engineering Lab.	0	0	2	60	40	100	1
BHUMA0-104	Drug Abuse: Problem, Management and Prevention	3	0	0	100	0	100	0
Total		13	3	8	440	360	800	19

Note:
1. **There will be Induction Programme of 3 weeks before start of normal classes.**
2. **Drug Abuse: Problem, Management and Prevention is a non-credit Course; however, it is necessary to secure at least E grade in it.**

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2ND SEMESTER

Course		Contact Hrs.			Marks			Credits
Code	Name	L	T	P	Internal	External	Total	
BCHEM0-101	Chemistry-I	3	1	0	40	60	100	4
BMATH5-201	Mathematics-II (Probability and Statistics)	3	1	0	40	60	100	4
BHUMA0-101	English	2	0	0	40	60	100	2
BCSCE0-101	Programming for Problem Solving	3	0	0	40	60	100	3
BCHEM0-102	Chemistry-I Lab.	0	0	2	60	40	100	1
BHUMA0-102	English Lab.	0	0	2	60	40	100	1
BCSCE0-102	Programming for Problem Solving Lab.	0	0	4	60	40	100	2
BMFPR0-101	Manufacturing Practices	1	0	4	60	40	100	3
BHUMA0-103	Human Values & Professional Ethics	3	0	0	100	0	100	0
Total		15	2	12	500	400	900	20

Note:
1. **Human Values & Professional Ethics is a non-credit Course; however, it is necessary to secure at least E grade in it.**
2. **Marks of 4 Week Manufacturing Practices Training during Summer Vacation will be included in 3rd Semester**

GROUP-B
1ST SEMESTER

Course		Contact Hrs.			Marks			Credits
Code	Name	L	T	P	Internal	External	Total	
BCHEM0-101	Chemistry-I	3	1	0	40	60	100	4
BMATH5-101	Mathematics-I (Calculus, Linear Algebra)	3	1	0	40	60	100	4
BHUMA0-101	English	2	0	0	40	60	100	2
BCSCE0-101	Programming for Problem Solving	3	0	0	40	60	100	3
BCHEM0-102	Chemistry-I Lab.	0	0	2	60	40	100	1
BHUMA0-102	English Lab.	0	0	2	60	40	100	1
BCSCE0-102	Programming for Problem Solving Lab.	0	0	4	60	40	100	2
BMFPR0-101	Manufacturing Practices	1	0	4	60	40	100	3
BHUMA0-103	Human Values & Professional Ethics	3	0	0	100	0	100	0
Total		15	2	12	500	400	900	20

Note:
1. There will be Induction Programme of 3 weeks before start of normal classes.
2. Human Values & Professional Ethics is a non-credit Course; however, it is necessary to secure at least E grade in it.

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2ND SEMESTER

Course		Contact Hrs.			Marks			Credits
Code	Name	L	T	P	Internal	External	Total	
BPHYS5-101	Physics (Optics, Electromagnetism & Quantum Mechanics)	3	1	0	40	60	100	4
BMATH5-201	Mathematics-II (Probability and Statistics)	3	1	0	40	60	100	4
BMECE0-101	Engineering Graphics & Design	2	0	0	40	60	100	2
BELEE0-101	Basics Electrical Engineering	3	1	0	40	60	100	4
BPHYS5-102	Physics (Optics, Electromagnetism & Quantum Mechanics) Lab.	0	0	2	60	40	100	1
BMECE0-102	Engineering Graphics & Design Lab.	0	0	6	60	40	100	3
BELEE0-102	Basics Electrical Engineering Lab.	0	0	2	60	40	100	1
BHUMA0-104	Drug Abuse: Problem, Management and Prevention	3	0	0	100	0	100	0
Total		13	3	8	440	360	800	19

Note:
1. Drug Abuse: Problem, Management and Prevention is a non-credit Course; however, it is necessary to secure at least E grade in it.
2. Marks of 4 Week Manufacturing Practices Training during Summer Vacation will be included in 3rd Semester

PHYSICS (OPTICS, ELECTROMAGNETISM & QUANTUM MECHANICS)

Subject Code: BPHYS5-101 **L T P C** **Duration: 38 Hrs.**
3 1 0 4

UNIT-I

Optics: (12 Hrs.)
Introduction to Interference and example; Concept of diffraction, Fraunhofer and Fresnel diffraction; Fraunhofer diffraction at a single slit (concept only), double slit and multiple slits; Diffraction grating, characteristics of the diffraction grating and its applications. Polarization by reflection, scattering of light, circular and elliptical polarization, optical activity.

UNIT-II

Fibre Optics and LASER: (8 Hrs.)
Optical fibre, Acceptance angle, Numerical aperture, Modes of propagation, losses associated with optical fibres, Sep and graded index fibres, Applications of optical fibres. Introduction to LASER, Principle and working of laser, population inversion, pumping, various modes, different types of lasers: gas lasers (He-Ne), solid-state lasers (Ruby), Properties of laser beams: mono-chromaticity, coherence, directionality and brightness, applications of lasers in science, engineering and medicine.

UNIT-III

Electromagnetism and Magnetic Properties of Materials: (8 Hrs.)
Laws of Electrostatics, Electric current and the continuity equation, Laws of Magnetism, Ampere's and Faraday's law, Maxwell's equations, Magnetisation, permeability and Susceptibility, Classifications of magnetic materials: Diamagnetic, Paramagnetic, Ferromagnetic & Ferrimagnetic, Magnetic domains and Hysteresis.

UNIT-IV

Quantum Mechanics (10 Hrs.)
Introduction to Quantum mechanics, Wave nature of particles, De Broglie's concept, Time-dependent and time-independent Schrodinger equation for wave-function, probability current, Free-particle wave-function and wave-packets, Uncertainty principle, application of uncertainty principle: non-existence of electron in the nucleus, expectation value. Schrodinger equation for one dimensional problems– particle in a box, linear harmonic oscillator.

Recommended Books:

1. David Griffiths, 'Introduction to Electrodynamics'.
2. Gupta & Gaur, 'Engineering Physics'.
3. Ian G. Main, 'Oscillations and Waves in Physics'.
4. H.J. Pain, 'The Physics of Vibrations and Waves'.
5. A. Ghatak, 'Optics'.
6. O. Svelto, 'Principles of Lasers'.
7. Satayaparkash, 'Quantum Mechanics'.
8. A. Ghatak and Lokanathan, 'Quantum Mechanics'.

MATHEMATICS-I (CALCULUS, LINEAR ALGEBRA)

Subject Code: BMATH5-101 **L T P C** **Duration: 46 Hrs.**
3 1 0 4

UNIT –I

Calculus: (12 Hrs.)
Rolle's Theorem, Mean value theorems, Taylor's and Maclaurin theorems with remainders; indeterminate forms and L' Hospital's rule; Maxima and minima. Evaluation of definite and

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improper integrals; Beta and Gamma functions and their properties; Applications of definite integrals to evaluate surface areas and volumes of revolutions.

UNIT –II

Sequences and Series: (10 Hrs.)

Convergence of sequence and series, tests for convergence (Comparison test, Ratio test, Raabe's test, Logarithmic test, Cauchy's root test, Cauchy's Integral test, series of positive and negative terms); Power series, Taylor's series, series for exponential, trigonometric and logarithm functions.

UNIT –III

Multivariable Calculus: (12 Hrs.)

Limit, continuity and partial derivatives, total derivative; Tangent plane and normal line; Maxima, minima and saddle points; Method of Lagrange multipliers; Gradient, curl and divergence: Geometrical interpretation and basic properties, Directional derivative.

UNIT –IV

Linear Algebra: (12 Hrs.)

Inverse and rank of a matrix, rank-nullity theorem; System of linear equations; Symmetric, skew-symmetric and orthogonal matrices; Determinants; Eigenvalues and eigenvectors; Diagonalization of matrices; Cayley-Hamilton Theorem, and Orthogonal transformation.

Recommended Books:

1. G.B. Thomas and R.L. Finney, 'Calculus and Analytic Geometry', 9th Edn., Pearson, Reprint, **2002**.
2. Erwin Kreyszig, 'Advanced Engineering Mathematics', 9th Edn, John Wiley & Sons, **2006**.
3. T. Veerarajan, 'Engineering Mathematics for First Year', Tata McGraw Hill, New Delhi, **2008.**
4. B.V. Ramana, 'Higher Engineering Mathematics', Tata McGraw Hill, New Delhi, 11th Reprint, **2010**.
5. D. Poole, 'Linear Algebra: A Modern Introduction', 2nd Edn., Brooks/Cole, **2005**.
6. B.S. Grewal, 'Higher Engineering Mathematics', Khanna Publishers, 36th Edn., **2010**.

Course Outcomes:

The objective of this course is to familiarize the prospective engineers with techniques in calculus, multivariate analysis and linear algebra. It aims to equip the students with standard concepts and tools at an intermediate to advanced level that will serve them well towards tackling more advanced level of mathematics and applications that they would find useful in their disciplines.

The students will learn:

1. To apply differential and integral calculus to notions of curvature and to improper integrals. Apart from some other applications they will have a basic understanding of Beta and Gamma functions.
2. The fallouts of Rolle's Theorem that is fundamental to application of analysis to Engineering problems.
3. The tool of power series and Fourier series for learning advanced Engineering Mathematics.
4. To deal with functions of several variables that are essential in most branches of engineering.
5. The essential tool of matrices and linear algebra in a comprehensive manner.

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ENGINEERING GRAPHICS & DESIGN

Subject Code: BMECE0-101 **L T P C** **Duration: 24 Hrs.**
2 0 0 2

1. **Traditional Engineering Graphics:**
   Principles of Engineering Graphics; Scales; Orthographic Projection- Points, lines, planes and solids; Descriptive Geometry; Drawing Principles; Isometric Projection; Surface Development; Reading a Drawing; Sectional Views; Dimensioning & Tolerances; True Length, Angle, Shortest Distance.
2. **Computer Graphics:**
   Co-ordinate system; Types of CAD software, draw commands; Modify commands; Dimensioning; setting of units & limits; Editing of Drawing; Printing.

Recommended Text/Reference Books:

1. N.D. Bhatt, V.M. Panchal & P.R. Ingle, 'Engineering Drawing', Charotar Publishing House, **2014**.
2. M.B. Shah & B.C. Rana, 'Engineering Drawing and Computer Graphics', Pearson Education, **2008**.
3. B. Agrawal & C.M. Agrawal, 'Engineering Graphics', TMH Publication, **2012**.
4. K.L. Narayana & P. Kannaiah, 'Text book on Engineering Drawing', Scitech Publishers, **2008**.
5. (Corresponding set of) CAD Software Theory and User Manuals.

Course Outcomes:

All phases of manufacturing or construction require the conversion of new ideas and design concepts into the basic line language of graphics. Therefore, there are many areas (civil, mechanical, electrical, architectural and industrial) in which the skills of the CAD technicians play major roles in the design and development of new products or construction. Students prepare for actual work situations through practical training in a new state-of-the-art computer designed CAD laboratory using engineering software. This course is designed to address:

1. To prepare you to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.
2. To prepare you to communicate effectively.
3. To prepare you to use the techniques, skills, and modern engineering tools necessary for engineering practice.

The student will learn:

1. Introduction to engineering design and its place in society
2. Exposure to the visual aspects of engineering design
3. Exposure to engineering graphics standards
4. Exposure to solid modelling
5. Exposure to computer-aided geometric design
6. Exposure to creating working drawings
7. Exposure to engineering communication

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BASIC ELECTRICAL ENGINEERING

Subject Code: BELEE0-101 **L T P C** **Duration: 42 Hrs.**
3 1 0 4

UNIT-1

DC Circuits: (8 Hrs.)
Electrical circuit elements (R, L and C), voltage and current sources, Ohm's law, Kirchhoff current and voltage laws, analysis of simple circuits with dc excitation Superposition, Thevenin and Norton Theorems. Step response of RL, RC circuits.

UNIT-2

AC Circuits: (12 Hrs.)
Representation of sinusoidal waveforms, average, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor. Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC series and parallel combinations, series and parallel resonance. Three phase voltage source, phase sequence, three phase balanced circuits, voltage and current relations in star and delta connections.

UNIT-3

Transformers: (10 Hrs.)
Magnetic materials, BH characteristics, Single-phase Transformer, no load and full load conditions, phasor diagrams, equivalent circuit, calculation of losses in transformers, regulation and efficiency, Auto-transformers, their applications and comparison with two winding transformers.

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UNIT-4

Electrical Machines: (8 Hrs.)
Generation of rotating magnetic fields, Construction and working of a three-phase induction motor, Direct-On-Line and Star-Delta starters. Construction and working of single-phase motors (Split phase, shaded pole, capacitor start, capacitor run, capacitor start and run motors).

Electrical Installations: (4 Hrs.)
Components of LT Switchgear: Switch Fuse Unit (SFU), Miniature Circuit Breaker (MCB), Earth Leakage Circuit Breaker (ELCB), Moulded Case Circuit Breaker (MCCB), Types of Wiring, Earthing.

Recommended Books:

1. D.P. Kothari and I.J. Nagrath, 'Basic Electrical Engineering', Tata McGraw Hill, **2010**.
2. D.C. Kulshreshtha, 'Basic Electrical Engineering', McGraw Hill, **2009**.
3. L.S. Bobrow, 'Fundamentals of Electrical Engineering', Oxford University Press, **2011**.
4. E. Hughes, 'Electrical and Electronics Technology', Pearson, **2010**.
5. V.D. Toro, 'Electrical Engineering Fundamentals', Prentice Hall, India, **1989**.
6. J.P.S. Dhillon. J.S. Dhillon and D. Singh, 'Principles of Electrical & Electronics Engineering', Kalyani Publishers, New Delhi, **2005**.

Course Outcomes:

1. To understand and analyze basic DC and AC circuits.
2. To study the use and working principle of single phase transformers.
3. To study the application and working principles of three phase and single phase induction motors.
4. To introduce to the components of low voltage electrical installations.

PHYSICS (OPTICS, ELECTROMAGNETISM & QUANTUM MECHANICS) LAB.

Subject Code: BPHYS5-102 **L T P C**
0 0 2 1

Note: Student's will have to perform at least 10 experiments from the given topic/list.

Experiments based on Optics, Electromagnetism & Quantum Mechanics:

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 fibre.
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.
14. To determine unknown capacitance by flashing and quenching method.
15. To study the Characteristics of a Series RC Circuit.
16. To determine the self-inductance of the coil (L) using Anderson's bridge.
17. To understand the phenomenon Photoelectric effect as a whole.

Physics Virtual Lab Experiments:

18. To calculate the beam divergence and spot size of the given laser beam.
19. To determine the wavelength of a laser using the Michelson interferometer.
20. To set up and observe Newton's rings.
21. To determine the wavelength of the given source.
22. To understand the phenomenon Photoelectric effect as a whole.
23. To draw kinetic energy of photoelectrons as a function of frequency of incident radiation.
24. To determine the Planck's constant from kinetic energy versus frequency graph.
25. To plot a graph connecting photocurrent and applied potential.
26. To determine the stopping potential from the photocurrent versus applied potential graph.

Note: Any other experiment based on the above topics may be included.

ENGINEERING GRAPHICS & DESIGN LAB.

Subject Code: BMECE0-102 **L T P C** **Duration: 60 Hrs.**
0 0 6 3

1. **Introduction to Engineering Drawing:**
   Principles of Engineering Graphics and their significance, usage of Drawing instruments, lettering, Dimensioning, Scales – Plain, Dimensioning-Types, System, Principles, Dimensions – Size & Location.
2. **Orthographic Projections:**
   Principles of Orthographic Projections-Conventions - Projections of Points and lines inclined to both planes; Projections of planes inclined Planes - Auxiliary Planes;
3. **Projections of Regular Solids:**
   Basic definitions of solid, types of solid, truncated and frustum of solid, Solids inclined to both the Planes; Draw simple annotation, dimensioning and scale.

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4. **Sections and Sectional Views of Right Angular Solids:**
   Prism, Cylinder, Pyramid, Cone – Section of views & true shape; Development of surfaces of Right Regular Solids - Prism, Pyramid, Cylinder and Cone; Development of paper tray, Funnel and Y piece.
5. **Isometric Projections:**
   Principles of Isometric projection – Isometric Scale, Isometric Views, Conventions; Isometric Views of lines, Planes, Simple and compound Solids; Conversion of Isometric Views to Orthographic Views and Vice-versa, Conventions;
6. **Overview of Computer Graphics:**
   Listing the computer technologies that impact on graphical communication, Demonstrating knowledge of the theory of CAD software [such as: The Menu System, Toolbars (Standard, Object Properties, Draw, Modify and Dimension), Drawing Area (Background, Crosshairs, Coordinate System), Dialog boxes and windows, Shortcut menus (Button Bars), The Command Line (where applicable), The Status Bar, Different methods of zoom as used in CAD, Select and erase objects.; Isometric Views of lines, Planes, Simple and compound Solids];
7. **Customization & CAD Drawing:**
   Consisting of set up of the drawing page and the printer, including scale settings, setting up of units and drawing limits; ISO and ANSI standards for coordinate dimensioning and tolerance; Orthographic constraints, Snap to objects manually and automatically; Producing drawings by using various coordinate input entry methods to draw straight lines, Applying various ways of drawing circles;
8. **Annotations, Layering & other Functions:**
   Applying dimensions to objects, applying annotations to drawings; Setting up and use of Layers, layers to create drawings, Create, edit and use customized layers; Changing line lengths through modifying existing lines (extend/lengthen); Printing documents to paper using the print command; orthographic projection techniques.

Note: Examiner shall test the knowledge of students by conducting viva voce from the drawing sheets and through use of Auto CAD.

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BASIC ELECTRICAL ENGINEERING LAB.

Subject Code: BELEE0-102 **L T P C**
0 0 2 1

EXPERIMENTS/DEMONSTRATIONS

1. To study basic safety precautions. Introduction and use of measuring instruments – voltmeter, ammeter, multi-meter, oscilloscope. real-life resistors, capacitors and inductors.
2. To verify Ohm's law.
3. To verify Kirchhoff's voltage and current laws.
4. To verify Superposition Theorem.
5. To verify Thevenin Theorem.
6. To obtain the sinusoidal steady state response of R-L circuit – impedance calculation and verification. Observation of phase differences between current and voltage.
7. To obtain the sinusoidal steady state response of R-C circuit – impedance calculation and verification. Observation of phase differences between current and voltage.
8. To study resonance phenomenon in R-L-C series circuits.
9. To perform open circuit and short circuit test on a single phase transformer and calculate the efficiency.

10. Demonstration of cut-out sections of machines: Induction machine (squirrel cage rotor and slip ring arrangement) and single-phase induction machines.
11. To connect, start and reverse the direction of rotation by change of phase-sequence of connections of three phase induction motor.
12. To connect, start and reverse the direction of rotation of single-phase induction motor.
13. To demonstrate working of DOL starter for three-phase induction motor.
14. To demonstrate working of star-delta starter for three-phase induction motor.
15. To demonstrate the components of LT switchgear.

Laboratory Outcomes:

1. Get an exposure to common electrical components and their ratings.
2. Make electrical connections by wires of appropriate ratings.
3. Understand the usage of common electrical measuring instruments.
4. Understand the basic characteristics of transformers and electrical induction motors.

DRUG ABUSE: PROBLEM, MANAGEMENT AND PREVENTION

Subject Code: BHUMA0-104 **L T P C** **Duration: 30 Hrs.**
3 0 0 0

UNIT-I

Meaning of Drug Abuse:
Meaning: Drug abuse, Drug dependence and Drug addiction. Nature and extent of drug abuse in India and Punjab.

UNIT-II

Consequences of Drug Abuse:
Individual: Education, Employment, Income.
Family: Violence.
Society: Crime.
Nation: Law and Order problem.

UNIT-III

Prevention of Drug Abuse:
Role of Family: Parent-child relationship, Family support, supervision, shipping values, active scrutiny.
School: Counselling, Teacher as role-model, Parent-teacher-health professional coordination, Random testing on students.

UNIT-IV

Treatment and Control of Drug Abuse:
Medical Management: Medication for treatment and to reduce withdrawal effects.
Psychological Management: Counselling, Behavioural and Cognitive therapy.
Social Management: Family, Group therapy and Environmental intervention.
Treatment: Medical, Psychological and Social Management.
Control: Role of Media and Legislation.

Recommended Books:

1. Ram Ahuja, 'Social Problems in India', Rawat Publications, Jaipur, **2003**.
2. 'Extent, Pattern and Trend of Drug Use in India', Ministry of Social Justice and Empowerment, Govt. of India, **2004.**
3. J.A. Inciardi, 'The Drug Crime Connection', Sage Publications, Beverly Hills, **1981**.
4. T. Kapoor, 'Drug Epidemic among Indian Youth', Mittal Publications, New Delhi, **1985**.
5. Kessel, Neil and Henry Walton, 'Alcoholism, Harmond Worth', Penguin Books, **1982**.

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6. Ishwar Modi and Shalini Modi, ‘Addiction and Prevention’, Rawat Publications, Jaipur, **1997.**
7. ‘National Household Survey of Alcohol and Drug Abuse’, Clinical Epidemiological Unit, All India Institute of Medical Sciences, New Delhi, **2003 & 2004**.
8. Ross Coomber and Others, ‘Key Concept in Drugs and Society’, Sage Publications, New Delhi, **2013**.
9. Bhim Sain, ‘Drug Addiction Alcoholism, Smoking Obscenity’, Mittal Publications, New Delhi, **1991**.
10. Ranvinder Singh Sandhu, ‘Drug Addiction in Punjab: A Sociological Study’, Guru Nanak Dev University, Amritsar, **2009**.
11. Chandra Paul Singh, ‘Alcohol and Dependence among Industrial Workers’, Shipra, Delhi, **2000**.
12. S. Sussman and S.L. Ames, ‘Drug Abuse: Concepts, Prevention and Cessation’, Cambridge University Press, **2008**.
13. P.S. Verma, ‘Punjab’s Drug Problem: Contours and Characteristics’, Vol. LII, No. 3, P.P. 40-43, Economic and Political Weekly, **2017**.
14. ‘World Drug Report’, United Nations Office of Drug and Crime, **2016**.
15. ‘World Drug Report’, United Nations Office of Drug and Crime, **2017**.

CHEMISTRY-I

Subject Code: BCHEM0-101 | **L T P C 3 1 0 4** | **Duration: 42 Hrs.**

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Course Objectives:
1. To understand the atomic and & molecular nature of various molecules
2. To understand the band structures
3. To elaborate the applications of spectroscopic techniques
4. To understand the thermodynamic functions and their applications
5. To rationalize periodic properties
6. To understand the concepts of stereochemistry and preparation of organic molecules

UNIT-I

1. Atomic and Molecular Structure: (12 Hrs.)

Bohr Theory of Hydrogen atom, Spectrum of H atom, Sommerfeld extension of Bohr Theory, Particle and wave nature of electron, De-Broglie equation, Aufbau principle, Compton effect, Schrodinger wave equation, Laplacian and Hamiltonian operator, Linear Combination of atomic orbitals. Molecular orbitals of diatomic molecules and Energy level diagrams of homonuclear and heteronuclear diatomics. Pi-molecular orbitals of butadiene and benzene and aromaticity. Crystal field theory and the energy level diagrams for transition metal ions and their magnetic properties. Band structure of solids and the role of doping on band structures.

UNIT-II

2. Spectroscopic Techniques and Applications: (8 Hrs.)

Principles and selection rules of Electronic spectroscopy and Fluorescence spectroscopy along with their applications. Principles and selection rules of Vibrational and rotational spectroscopy of diatomic molecules and their Applications. Nuclear magnetic resonance up to spin-spin coupling and magnetic resonance imaging.

3. Intermolecular Forces and Potential Energy Surfaces: (4 Hrs.)

Ideal gas equation, Ionic, dipolar and van Der Waals interactions. Real gas equation. Equations of state of real gases and critical phenomena. Potential energy surfaces of H_3, and HCN

UNIT-III

4. Use of Free Energy in Chemical Equilibria: (6 Hrs.)

Ideal Solution, Non Ideal Solutions, Thermodynamic functions: energy, entropy and free energy. Numerical problems based on entropy and free energies. Free energy and emf. Cell potentials, the Nernst equation and applications. Acid base, oxidation reduction and solubility equilibria. Thermodynamic properties of ideal solutions. Introduction to Electrochemical Corrosion and its mechanism. Use of free energy considerations in metallurgy through Ellingham diagrams.

5. Periodic Properties: (4 Hrs.)

Effective nuclear charge, penetration of orbitals, variations of s, p, d and f orbital energies of atoms in the periodic table, electronic configurations, atomic and ionic sizes, ionization energies, electron affinity and electronegativity, polarizability, oxidation states, coordination numbers and geometries, hard soft acids and bases principle

UNIT-IV

6. Stereochemistry: (4 Hrs.)

Representations of 3-dimensional structures, structural isomers and stereoisomers, configurations and symmetry and chirality, enantiomers, diastereomers, optical activity, absolute configurations and conformational analysis of butane. Isomerism in transitional metal compounds.

7. Organic Reactions and Synthesis of a Drug Molecule: (4 Hrs.)

Introduction to reactions involving substitution, addition, elimination, oxidation, reduction, cyclization and ring openings. Synthesis of a commonly used drug molecule – β lactum, Paracetamol, Chloroquine and Aspirin

Recommended Books:

1. B.H. Mahan, 'University Chemistry'.
2. M.J. Sienko and R.A. Plane 'Chemistry: Principles and Applications'.
3. C.N. Banwell, 'Fundamentals of Molecular Spectroscopy'.
4. B.L. Tembe, Kamaluddin and M.S. Krishnan, 'Engineering Chemistry (NPTEL Web-book).
5. P.W. Atkins, 'Physical Chemistry'.
6. K.P.C. Volhardt and N.E. Schore 'Organic Chemistry: Structure and Function', 5th Edn., http://bcs.whfreeman.com/vollhardtschore5e/default.asp

Course Outcomes:

The concepts developed in this course will aid in quantification of several concepts in chemistry that have been introduced at the 10+2 levels in schools. Technology is being increasingly based on the electronic, atomic and molecular level modifications.

Quantum theory is more than 100 years old and to understand phenomena at nanometer levels, one has to base the description of all chemical processes at molecular levels. The course will enable the student to:

1. Analyze microscopic chemistry in terms of atomic and molecular orbitals and intermolecular forces.
2. Rationalize bulk properties and processes using thermodynamic considerations.
3. Distinguish the ranges of the electromagnetic spectrum used for exciting different molecular energy levels in various spectroscopic techniques
4. Rationalize periodic properties such as ionization potential, electronegativity, oxidation states and electronegativity.
5. List major chemical reactions that are used in the synthesis of molecules.

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MATHEMATICS-II (PROBABILITY AND STATISTICS)

Subject Code: BMATH5-201 **L T P C** **Duration: 40 Hrs.**
3 1 0 4

UNIT –I

Basic Probability: (12 Hrs.)
Probability spaces, conditional probability, independence; Discrete random variables, Independent random variables, the multinomial distribution, Poisson approximation to the binomial distribution, infinite sequences of Bernoulli trials, sums of independent random variables; Expectation of Discrete Random Variables, Moments, Variance of a sum, Chebyshev's Inequality.

UNIT –II

Continuous Probability Distributions: (6 Hrs.)
Continuous random variables and their properties, distribution functions and densities, normal, exponential and gamma densities.

Bivariate Distributions: (6 Hrs.)
Bivariate distributions and their properties, distribution of sums and quotients, conditional densities, Bayes' rule.

UNIT –III

Basic Statistics: (10 Hrs.)
Measures of Central tendency: Moments, skewness and Kurtosis - Probability distributions: Binomial, Poisson and Normal - evaluation of statistical parameters for these three distributions, Correlation and regression – Rank correlation.

UNIT –IV

Applied Statistics: (8 Hrs.)
Curve fitting by the method of least squares- fitting of straight lines, second degree parabolas and more general curves. Test of significance: Large sample test for single proportion, difference of proportions, single mean, difference of means, and difference of standard deviations.

Small Samples: (4 Hrs.)
Test for single mean, difference of means and correlation coefficients, test for ratio of variances - Chi-square test for goodness of fit and independence of attributes.

Recommended Books:

1. E. Kreyszig, 'Advanced Engineering Mathematics', John Wiley & Sons, **2006**.
2. P.G. Hoel, S.C. Port and C.J. Stone, 'Introduction to Probability Theory', Universal Book Stall, **2003**.
3. S. Ross, 'A First Course in Probability', Pearson Education India, **2002**.
4. W. Feller, 'An Introduction to Probability Theory and its Applications', Vol. 1, Wiley, **1968**.
5. B.S. Grewal, 'Higher Engineering Mathematics', Khanna Publishers, **2000**.
6. T. Veerarajan, 'Engineering Mathematics', Tata McGraw Hill, New Delhi, **2010**.

Course Outcomes:
The objective of this course is to familiarize the prospective engineers with techniques in multivariate integration, ordinary and partial differential equations and complex variables. It aims to equip the students to deal with advanced level of mathematics and applications that would be essential for their disciplines.
The students will learn:

1. The mathematical tools needed in evaluating multiple integrals and their usage.
2. The effective mathematical tools for the solutions of differential equations that model physical processes.

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3. The tools of differentiation and integration of functions of a complex variable that are used in various techniques dealing engineering problems.

ENGLISH

Subject Code: BHUMA0-101 **L T P C** **Duration: 25 Hrs.**
2 0 0 2

UNIT-I

1. Vocabulary Building:
1.1 The concept of Word Formation
1.2 Root words from foreign languages and their use in English
1.3 Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives.
1.4 Synonyms, antonyms, and standard abbreviations.

UNIT-II

2. Basic Writing Skills:
2.1 Sentence Structures
2.2 Use of phrases and clauses in sentences
2.3 Importance of proper punctuation
2.4 Creating coherence
2.5 Organizing principles of paragraphs in documents
2.6 Techniques for writing precisely

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UNIT-III

3. Identifying Common Errors in Writing:
3.1 Subject-verb agreement
3.2 Noun-pronoun agreement
3.3 Misplaced modifiers
3.4 Articles
3.5 Prepositions
3.6 Redundancies
3.7 Clichés

UNIT-IV

4. Nature and Style of sensible Writing:
4.1 Describing
4.2 Defining
4.3 Classifying
4.4 Providing examples or evidence
4.5 Writing introduction and conclusion

5. Writing Practices:
5.1 Comprehension
5.2 Précis Writing
5.3 Essay Writing

Recommended Books:

1. Michael Swan, 'Practical English Usage', OUP, **1995**.
2. F.T. Wood, 'Remedial English Grammar', Macmillan, **2007.**
3. William Zinsser, 'On Writing Well', Harper Resource Book, **2001.**
4. Liz Hamp-Lyons and Ben Heasly, 'Study Writing', Cambridge University Press, **2006**.
5. Sanjay Kumar and Pushp Lata, 'Communication Skills', Oxford University Press, **2011**.
6. 'Exercises in Spoken English', Parts. I-III. CIEFL, Hyderabad. Oxford University Press.

Course Outcomes:
1. The student will acquire basic proficiency in English including reading and listening comprehension, writing and speaking skills.

PROGRAMMING FOR PROBLEM SOLVING

Subject Code: BCSCE0-101 **L T P C** **Duration: 41 Hrs.**
3 0 0 3

UNIT-I

1. Introduction to Programming: (6 Hrs.)
Introduction to components of a computer system (disks, memory, processor, where a program is stored and executed, operating system, compilers etc.). Idea of Algorithm: steps to solve logical and numerical problems. Representation of Algorithm: Flowchart/Pseudocode with examples. From algorithms to programs; source code, variables (with data types) variables and memory locations, Syntax and Logical Errors in compilation, object and executable code.

2. Arithmetic Expressions and Precedence: (12 Hrs.)
Conditional Branching and Loops. Writing and evaluation of conditionals and consequent branching. Iteration and loops.

UNIT-II

3. Arrays: (5 Hrs.)
Arrays (1-D, 2-D), Character arrays and Strings

4. Basic Algorithms: (5 Hrs.)
Searching, Basic Sorting Algorithms (Bubble, Insertion and Selection), Finding roots of equations, notion of order of complexity through example programs (no formal definition required)

UNIT-III

5. Function: (4 Hrs.)
Functions (including using built in libraries), Parameter passing in functions, call by value, Passing arrays to functions: idea of call by reference

6. Recursion: (4 Hrs.)
Recursion, as a different way of solving problems. Example programs, such as Finding Factorial, Fibonacci series, Ackerman function etc. Quick sort or Merge sort.

UNIT-IV

7. Structure: (3 Hrs.)
Structures, Defining structures and Array of Structures

8. Pointers: (2 Hrs.)
Idea of pointers, Defining pointers, Use of Pointers in self-referential structures, notion of linked list (no implementation)

9. File Handling: (only if time is available, otherwise should be done as part of the lab)

Recommended Text Books:
1. Byron Gottfried, 'Schaum's Outline of Programming with C', McGraw Hill.
2. E. Balaguruswamy, 'Programming in ANSI C', Tata McGraw Hill.

Recommended Reference Books:
1. Brian W. Kernighan and Dennis M. Ritchie, 'The C Programming Language', Prentice Hall of India.

Course Outcomes:
The student will learn
1. To formulate simple algorithms for arithmetic and logical problems.
2. To translate the algorithms to programs (in C language).

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3. To test and execute the programs and correct syntax and logical errors.
4. To implement conditional branching, iteration and recursion.
5. To decompose a problem into functions and synthesize a complete program using divide and conquer approach.
6. To use arrays, pointers and structures to formulate algorithms and programs.
7. To apply programming to solve matrix addition and multiplication problems and searching and sorting problems.
8. To apply programming to solve simple numerical method problems, namely rot finding of function, differentiation of function and simple integration.

CHEMISTRY-I LAB.

Subject Code: BCHEM0-101 **L T P C**
0 0 2 1

Course Objectives:
1. To learn the preparation and standardization of solutions
2. To learn the estimation of various physical properties of given liquid samples
3. To estimate various crucial parameters for water sample
4. To learn the preparation of various molecules and detection of functional groups.

Choice of 10-12 experiments from the following:
1. Preparation of a standard solution
2. Determination of surface tension and viscosity
3. Thin layer chromatography
4. Determination of total Alkalinity/ Acidity of a water sample.
5. Determination of residual chlorine in water sample
6. Estimation of total, temporary and permanent hardness of water
7. Determination of the rate constant of a reaction
8. Determination of strength of an acid conductometrically
9. Potentiometry - determination of redox potentials and emfs
10. Synthesis of a polymer
11. Saponification /acid value of an oil
12. Detection and confirmation of organic functional groups.
13. Models of spatial orientation
14. To test the validity of Lambert Beer law/ Determination of λ_{max} / Determination of unknown concentration of a solution.
15. Determination of the partition coefficient of a substance between two immiscible liquids
16. Adsorption of acetic acid by charcoal
17. Synthesis of a drug – Acetaminophen, Aspirin

Laboratory Outcomes:

The chemistry laboratory course will consist of experiments illustrating the principles of chemistry relevant to the study of science and engineering. The students will learn to:

1. Estimate rate constants of reactions from concentration of reactants/products as a function of time
2. Measure molecular/system properties such as surface tension, viscosity, conductance of solutions, redox potentials, chloride content of water, etc.
3. Synthesize a small drug molecule and analyze a salt sample

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ENGLISH LAB.

Subject Code: BHUMA0-102 **L T P C**
0 0 2 1

Oral Communication

(This unit involves interactive practice sessions in Language Lab.)

1. Listening Comprehension
2. Pronunciation, Intonation, Stress and Rhythm
3. Common Everyday Situations: Conversations and Dialogues
4. Communication at Workplace
5. Interviews
6. Formal Presentations

PROGRAMMING FOR PROBLEM SOLVING LAB.

Subject Code: BCSCE0-102 **L T P C**
0 0 4 2

NOTE: The laboratory should be preceded or followed by a tutorial to explain the approach or algorithm to be implemented for the problem given.

Tutorial 1: Problem solving using computers:
Lab1: Familiarization with programming environment
Tutorial 2: Variable types and type conversions:
Lab 2: Simple computational problems using arithmetic expressions
Tutorial 3: Branching and logical expressions:
Lab 3: Problems involving if-then-else structures
Tutorial 4: Loops, while and for loops:
Lab 4: Iterative problems e.g., sum of series
Tutorial 5: 1D Arrays: searching, sorting:
Lab 5: 1D Array manipulation
Tutorial 6: 2D arrays and Strings
Lab 6: Matrix problems, String operations
Tutorial 7: Functions, call by value:
Lab 7: Simple functions
Tutorial 8 &9: Numerical methods (Root finding, numerical differentiation, numerical integration):
Lab 8 and 9: Programming for solving Numerical methods problems
Tutorial 10: Recursion, structure of recursive calls
Lab 10: Recursive functions
Tutorial 11: Pointers, structures and dynamic memory allocation
Lab 11: Pointers and structures
Tutorial 12: File handling:
Lab 12: File operations

Laboratory Outcomes:

1. To formulate the algorithms for simple problems
2. To translate given algorithms to a working and correct program
3. To be able to correct syntax errors as reported by the compilers
4. To be able to identify and correct logical errors encountered at run time
5. To be able to write iterative as well as recursive programs
6. To be able to represent data in arrays, strings and structures and manipulate them through a program

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7. To be able to declare pointers of different types and use them in defining self-referential structures.
8. To be able to create, read and write to and from simple text files.

MANUFACTURING PRACTICES (THEORY & LAB.)

Subject Code: BMFPR0-101 **L T P C** **Duration: 80 Hrs.**
1 0 4 3

Lectures & Videos: (10 Hrs.)
1. Manufacturing Methods- casting, forming, machining, joining, advanced manufacturing Methods.
2. CNC machining, Additive manufacturing.
3. Fitting operations & power tools.
4. Sheet Metal Operations.
5. Electrical & Electronics.
6. Carpentry.
7. Plastic moulding (injection moulding, blow moulding, extrusion moulding), glass cutting.
8. Metal casting.
9. Welding (arc welding & gas welding), brazing.

Recommended Text/Reference Books:
1. S.K. Hajra Choudhury, A.K. Hajra Choudhury and S.K. Nirjhar Roy, 'Elements of Workshop Technology', Vol.-I, **2008** and Vol.-II **2010**, Media Promoters and Publishers Pvt. Ltd., Mumbai.
2. S. Kalpakjian, Steven S. Schmid, 'Manufacturing Engineering and Technology', 4th Edn., Pearson Education India Edn., **2002**.
3. Gowri P. Hariharan and A. Suresh Babu, 'Manufacturing Technology – I', Pearson, **2008**.
4. Roy A. Lindberg, 'Processes and Materials of Manufacture', 4th Edn., Prentice Hall India, **1998**.
5. P.N. Rao, 'Manufacturing Technology', Vol.-I and Vol.-II, Tata McGraw Hill House, **2017**.

Course Outcomes:
1. Upon completion of this course, the students will gain knowledge of the different manufacturing processes which are commonly employed in the industry, to fabricate components using different materials.

Workshop Practice: (70 Hrs.)
1. Machine shop **(10 Hrs.)**
2. Fitting shop **(8 Hrs.)**
3. Carpentry **(6 Hrs.)**
4. Electrical & Electronics **(8 Hrs.)**
5. Welding shop **(8 Hrs. (Arc welding 4 Hrs. + Gas welding 4 Hrs.)**
6. Casting **(8 Hrs.)**
7. Sheet Metal Operations **(10 Hrs.)**
8. Smithy **(6 Hrs.)**
9. Plastic moulding & Glass Cutting **(6 Hrs.)**
10. Examinations could involve the actual fabrication of simple components, utilizing one or more of the techniques covered above.

Laboratory Outcomes:
1. Upon completion of this laboratory course, students will be able to fabricate components with their own hands.
2. They will also get practical knowledge of the dimensional accuracies and dimensional

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tolerances possible with different manufacturing processes.
3. By assembling different components, they will be able to produce small devices of their interest.

HUMAN VALUES AND PROFESSIONAL ETHICS

Subject Code: BHUMA0-103 **L T P C** **Duration: 30 Hrs.**
3 0 0 0

UNIT-I (8 Hrs.)

Meaning of values, Values as social fact, Universal values – equality, justice, freedom/ liberty, inclusion. Distinction between social and culture values and values associated with crafts and occupations. Work and leisure as values – Marx and Veblen

UNIT-II (9 Hrs.)

Values, morality, ethics and their relation with Religion, values as mechanisms of control and coercion. Functional Theory of Values of Talcott Parsons, Theory of Basic Values of Shalom Schwartz, Theory of Protestant Ethic and Capitalism of Max Weber, Bhagwat Gita and Theory of Karma-Dharma, Sikhism and theory of work, dignity of labour, meditation and sharing.

UNIT-III (7 Hrs.)

Meaning and types of Professional Ethics, Goals of professional work and their problems, Normative and evaluative elements in professional work, Duties and obligations, Professional rights, Virtues in professional life (honesty, trustworthiness, transparency, competence, integrity and exemplary conduct), Engineering ethics and service ideals.

UNIT-IV (6 Hrs.)

Technology for and against mankind and environment- fulfilment of human needs, and industrial disasters: case studies – Bhopal Gas Tragedy, Chernobyl and Fukushima Disasters; Equality at work place: gender discrimination and caste/class-based exclusions.

Recommended Books:

1. Schwartz, H. Shalom, ‘An Overview of the Schwartz Theory of Basic Values’. Online Readings in Psychology and Culture. **2** (1). doi:10.9707/2307-0919.1116, **2012**.
2. John Berry, Janek, Pandey; Poortinga, Ype ‘Handbook of Cross-cultural Psychology’, 2nd Edn.. Boston, MA: Allyn and Bacon. p. 77. ISBN 9780205160747, **1997**.
3. Timo Airaksinen, ‘The Philosophy of Professional Ethics’, University of Helsinki, Finland.
4. Manju Jitendra Jain, ‘Yes, It’s Possible’, Kalpana Publications, Mumbai, **2011**.

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GROUP-A
1ST SEMESTER

Course		Contact Hrs.			Marks			Credits
Code	Name	L	T	P	Internal	External	Total	
BPHYS4-101	Physics (Mechanics and Mechanics of Solids)	3	1	0	40	60	100	4
BMATH4-101	Mathematics-I (Calculus, Multivariable Calculus & Linear Algebra)	3	1	0	40	60	100	4
BMECE0-101	Engineering Graphics & Design	2	0	0	40	60	100	2
BELEE0-101	Basics Electrical Engineering	3	1	0	40	60	100	4
BPHYS4-102	Physics (Mechanics & Mech. of Solids) Lab.	0	0	2	60	40	100	1
BMECE0-102	Engineering Graphics & Design Lab.	0	0	6	60	40	100	3
BELEE0-102	Basics Electrical Engineering Lab.	0	0	2	60	40	100	1
BHUMA0-104	Drug Abuse: Problem, Management and Prevention	3	0	0	100	0	100	0
Total		13	3	8	440	360	800	19

Note:
1. There will be Induction Programme of 3 weeks before start of normal classes.
2. Drug Abuse: Problem, Management and Prevention is a non-credit Course; however, it is necessary to secure at least E grade in it.

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2ND SEMESTER

Course		Contact Hrs.			Marks			Credits
Code	Name	L	T	P	Internal	External	Total	
BCHEM0-101	Chemistry-I	3	1	0	40	60	100	4
BMATH4-201	Mathematics-II (Differential Equations)	3	1	0	40	60	100	4
BHUMA0-101	English	2	0	0	40	60	100	2
BCSCE0-101	Programming for Problem Solving	3	0	0	40	60	100	3
BCHEM0-102	Chemistry-I Lab.	0	0	2	60	40	100	1
BHUMA0-102	English Lab.	0	0	2	60	40	100	1
BCSCE0-102	Programming for Problem Solving Lab.	0	0	4	60	40	100	2
BMFPR0-101	Manufacturing Practices	1	0	4	60	40	100	3
BHUMA0-103	Human Values & Professional Ethics	3	0	0	100	0	100	0
Total		15	2	12	500	400	900	20

Note:
1. Human Values & Professional Ethics is a non-credit Course; however, it is necessary to secure at least E grade in it.
2. Marks of 4 Week Manufacturing Practices Training during Summer Vacation will be included in 3rd Semester

GROUP-B
1ST SEMESTER

Course		Contact Hrs.			Marks			Credits
Code	Name	L	T	P	Internal	External	Total	
BCHEM0-101	Chemistry-I	3	1	0	40	60	100	4
BMATH4-101	Mathematics-I (Calculus, Multivariable Calculus & Linear Algebra)	3	1	0	40	60	100	4
BHUMA0-101	English	2	0	0	40	60	100	2
BCSCE0-101	Programming for Problem Solving	3	0	0	40	60	100	3
BCHEM0-102	Chemistry-I Lab.	0	0	2	60	40	100	1
BHUMA0-102	English Lab.	0	0	2	60	40	100	1
BCSCE0-102	Programming for Problem Solving Lab.	0	0	4	60	40	100	2
BMFPR0-101	Manufacturing Practices	1	0	4	60	40	100	3
BHUMA0-103	Human Values & Professional Ethics	3	0	0	100	0	100	0
Total		15	2	12	500	400	900	20

Note:
1. There will be Induction Programme of 3 weeks before start of normal classes.
2. Human Values & Professional Ethics is a non-credit Course; however, it is necessary to secure at least E grade in it.

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2ND SEMESTER

Course		Contact Hrs.			Marks			Credits
Code	Name	L	T	P	Internal	External	Total	
BPHYS4-101	Physics (Mechanics And Mechanics of Solids)	3	1	0	40	60	100	4
BMATH4-201	Mathematics-II (Differential Equations)	3	1	0	40	60	100	4
BMEE0-101	Engineering Graphics & Design	2	0	0	40	60	100	2
BELEE0-101	Basics Electrical Engineering	3	1	0	40	60	100	4
BPHYS4-102	Physics (Mechanics & Mech. of Solids) Lab.	0	0	2	60	40	100	1
BMECE0-102	Engineering Graphics & Design Lab.	0	0	6	60	40	100	3
BELEE0-102	Basics Electrical Engineering Lab.	0	0	2	60	40	100	1
BHUMA0-104	Drug Abuse: Problem, Management and Prevention	3	0	0	100	0	100	0
Total		13	3	8	440	360	800	19

Note:
1. Drug Abuse: Problem, Management and Prevention is a non-credit Course; however, it is necessary to secure at least E grade in it.
2. Marks of 4 Week Manufacturing Practices Training during Summer Vacation will be included in 3rd Semester

PHYSICS (MECHANICS AND MECHANICS OF SOLIDS)

Subject Code: BPHYS4-101 **L T P C** **Duration: 38 Hrs.**
3 1 0 4

UNIT-I

Friction and Mechanics of Solids: (10 Hrs.)

Brief introduction to friction, its laws, types, motion on horizontal and inclined plane, methods of changing friction and applications of friction. Concept of stress – strain, elasticity, plasticity, strain hardening, failure (fracture/yielding), Generalized Hooke's law, one dimensional stress-strain curve. Force analysis -- axial force, shear force, bending moment and twisting moment. Bending stress; Shear stress; Concept of strain energy; Yield criteria.

UNIT-II

Simple Harmonic Oscillator: (8 Hrs.)

Mechanical and electrical simple harmonic oscillators, damped harmonic oscillator- heavy, critical and light damping, energy decay in a damped harmonic oscillator, quality factor, forced oscillations and resonance (electrical and mechanical).

UNIT-III

Vector Mechanics: (**10 Hrs.**)

Transformation of scalar and vector under rotation transformation, Forces in Nature, Newton's laws and its completeness in describing particle motion; Form invariance of Newton's Second Law; Potential energy function; F = - Grad V, equipotential surfaces and meaning of gradient; Conservative and non-conservative forces, curl of a force field; Concept of Central forces; Conservation of Angular Momentum.

UNIT-IV

Frames of References and Rigid Body Dynamics: (10 Hrs.)

Inertial and Non-inertial frames of reference; Galilean and Lorentz transformations, Introduction to Cartesian, spherical and cylindrical coordinate system. Basic idea of Centripetal and Coriolis forces along with their applications. Definition and motion of a rigid body in the plane; Rotation in the plane, Angular momentum about a point of a rigid body in planar motion; introduction to three-dimension rigid body motion- only need to highlight the distinction from two-dimensional motion with examples.

Recommended Books:

1. M.K. Harbola, 'Engineering Mechanics', 2nd Edn.
2. M.K. Verma, 'Introduction to Mechanics'.
3. Mathur, 'Mechanics', S. Chand Publishing.
4. Upadhyaya, 'Classical Mechanics', Himalaya Publishing House.
5. J.L. Synge & B.A. Griffiths, 'Principles of Mechanics'.
6. J.L. Meriam, 'Engineering Mechanics – Dynamics', 7th Edn.
7. W.T. Thomson, 'Theory of Vibrations with Applications'.
8. N.C. Dahl & T.J. Lardner, 'An Introduction to the Mechanics of Solids', 2nd Edn. with SI Units-SH Crandall.
9. Malik and Singh, 'Engineering Physics', Tata McGraw Hill.

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MATHEMATICS-I (CALCULUS, MULTIVARIABLE CALCULUS & LINEAR ALGEBRA)

Subject Code: BMATH4-101	L T P C	Duration: 46 Hrs.
	3 1 0 4	

UNIT–I

Calculus: (14 Hrs.)

Rolle’s theorem, Mean value theorems, Taylor’s and Maclaurin theorems with remainders; Indeterminate forms and L'Hospital's rule; Maxima and minima. Evaluation of definite and improper integrals; Beta and Gamma functions and their properties; Applications of definite integrals to evaluate surface areas and volumes of revolutions. Convergence of sequence and series, tests for convergence, power series, Taylor's series. series for exponential, trigonometric and logarithmic functions.

UNIT–II

Multivariable Calculus: (10 Hrs.)

Limit, continuity and partial derivatives, Tangent plane and normal line; Maxima, minima and saddle points; Method of Lagrange multipliers; Gradient, curl and divergence: Geometrical interpretation and basic properties, Directional derivative.

UNIT–III

Multiple Integration: (12 Hrs.)

Double and triple integrals (Cartesian and polar), change of order of integration in double integrals, Change of variables (Cartesian to polar), Applications: areas and volumes by (double integration) Center of mass and Gravity (constant and variable densities). Theorems of Green, Gauss and Stokes (Statement only), simple applications involving cubes, sphere and rectangular parallelepipeds.

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UNIT–IV

Linear Algebra: (10 Hrs.)

Inverse and rank of a matrix, rank-nullity theorem; System of linear equations; Symmetric, skew-symmetric and orthogonal matrices; Determinants; Eigenvalues and eigenvectors; Diagonalization of matrices; Cayley-Hamilton Theorem, and Orthogonal transformation.

Recommended Books:

1. G.B. Thomas and R.L. Finney, ‘Calculus and Analytic Geometry’, 9th Edn., Pearson, Reprint, **2002**.
2. T. Veerarajan, ‘Engineering Mathematics for First Year’, 11th Reprint, Tata McGraw Hill, New Delhi, **2008**.
3. B.V. Ramana, ‘Higher Engineering Mathematics’, Tata McGraw Hill, New Delhi, **2010**.
4. B.S. Grewal, ‘Higher Engineering Mathematics’, Khanna Publishers, 35th Edn., **2000**.
5. D. Poole, ‘Linear Algebra: A Modern Introduction’, 2nd Edn., Brooks/Cole, **2005**.
6. V. Krishnamurthy, V.P. Mainra and J.L. Arora, ‘An Introduction to Linear Algebra’, Affiliated East–West Press, Reprint, **2005**.
7. Erwin Kreyszig, ‘Advanced Engineering Mathematics’, 9th Edn., John Wiley & Sons, **2006**.

Course Outcomes:

The objective of this course is to familiarize the prospective engineers with techniques in calculus, multivariate analysis and linear algebra. It aims to equip the students with standard concepts and tools at an intermediate to advanced level that will serve them well towards tackling more advanced level of mathematics and applications that they would find useful in their disciplines.

The students will learn:
1. To apply differential and integral calculus to notions of curvature and to improper integrals. Apart from some other applications they will have a basic understanding of Beta and Gamma functions.
2. The fallouts of Rolle's Theorem that is fundamental to application of analysis to Engineering problems.
3. The tool of power series and Fourier series for learning advanced Engineering Mathematics.
4. To deal with functions of several variables that are essential in most branches of engineering.
5. The essential tool of matrices and linear algebra in a comprehensive manner.

ENGINEERING GRAPHICS & DESIGN

Subject Code: BMECE0-101 **L T P C** **2 0 0 2** **Duration: 24 Hrs.**

1. **Traditional Engineering Graphics:**
   Principles of Engineering Graphics; Scales; Orthographic Projection- Points, lines, planes and solids; Descriptive Geometry; Drawing Principles; Isometric Projection; Surface Development; Reading a Drawing; Sectional Views; Dimensioning & Tolerances; True Length, Angle, Shortest Distance.
2. **Computer Graphics:**
   Co-ordinate system; Types of CAD software, draw commands; Modify commands; Dimensioning; setting of units & limits; Editing of Drawing; Printing.

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Recommended Text/Reference Books:

1. N.D. Bhatt, V.M. Panchal & P.R. Ingle, 'Engineering Drawing', Charotar Publishing House, **2014**.
2. M.B. Shah & B.C. Rana, 'Engineering Drawing and Computer Graphics', Pearson Education, **2008**.
3. B. Agrawal & C.M. Agrawal, 'Engineering Graphics', TMH Publication, **2012**.
4. K.L. Narayana & P. Kannaiah, 'Text book on Engineering Drawing', Scitech Publishers, **2008**.
5. (Corresponding set of) CAD Software Theory and User Manuals.

Course Outcomes:
All phases of manufacturing or construction require the conversion of new ideas and design concepts into the basic line language of graphics. Therefore, there are many areas (civil, mechanical, electrical, architectural and industrial) in which the skills of the CAD technicians play major roles in the design and development of new products or construction. Students prepare for actual work situations through practical training in a new state-of-the-art computer designed CAD laboratory using engineering software. This course is designed to address:
1. To prepare you to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.
2. To prepare you to communicate effectively.
3. To prepare you to use the techniques, skills, and modern engineering tools necessary for engineering practice.

The student will learn:
1. Introduction to engineering design and its place in society
2. Exposure to the visual aspects of engineering design
3. Exposure to engineering graphics standards

4. Exposure to solid modelling
5. Exposure to computer-aided geometric design
6. Exposure to creating working drawings
7. Exposure to engineering communication

BASIC ELECTRICAL ENGINEERING

Subject Code: BELEE0-101 **L T P C** **Duration: 42 Hrs.**
3 1 0 4

UNIT-1

DC Circuits: (8 Hrs.)
Electrical circuit elements (R, L and C), voltage and current sources, Ohm's law, Kirchhoff current and voltage laws, analysis of simple circuits with dc excitation Superposition, Thevenin and Norton Theorems. Step response of RL, RC circuits.

UNIT-2

AC Circuits: (12 Hrs.)
Representation of sinusoidal waveforms, average, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor. Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC series and parallel combinations, series and parallel resonance. Three phase voltage source, phase sequence, three phase balanced circuits, voltage and current relations in star and delta connections.

UNIT-3

Transformers: (10 Hrs.)
Magnetic materials, BH characteristics, Single-phase Transformer, no load and full load conditions, phasor diagrams, equivalent circuit, calculation of losses in transformers, regulation and efficiency, Auto-transformers, their applications and comparison with two winding transformers.

UNIT-4

Electrical Machines: (8 Hrs.)
Generation of rotating magnetic fields, Construction and working of a three-phase induction motor, Direct-On-Line and Star-Delta starters**.** Construction and working of single-phase motors (Split phase, shaded pole, capacitor start, capacitor run, capacitor start and run motors).

Electrical Installations: (4 Hrs.)
Components of LT Switchgear: Switch Fuse Unit (SFU), Miniature Circuit Breaker (MCB), Earth Leakage Circuit Breaker (ELCB), Moulded Case Circuit Breaker (MCCB), Types of Wiring, Earthing.

Recommended Books:

1. D.P. Kothari and I.J. Nagrath, 'Basic Electrical Engineering', Tata McGraw Hill, **2010**.
2. D.C. Kulshreshtha, 'Basic Electrical Engineering', McGraw Hill, **2009**.
3. L.S. Bobrow, 'Fundamentals of Electrical Engineering', Oxford University Press, **2011**.
4. E. Hughes, 'Electrical and Electronics Technology', Pearson, **2010**.
5. V.D. Toro, 'Electrical Engineering Fundamentals', Prentice Hall, India, **1989**.
6. J.P.S. Dhillon. J.S. Dhillon and D. Singh, 'Principles of Electrical & Electronics Engineering', Kalyani Publishers, New Delhi, **2005**.

Course Outcomes:
1. To understand and analyze basic DC and AC circuits.
2. To study the use and working principle of single phase transformers.
3. To study the application and working principles of three phase and single phase induction motors.
4. To introduce to the components of low voltage electrical installations.

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PHYSICS (MECHANICS & MECH. OF SOLIDS) LAB.

Subject Code: BPHYS4-102 **L T P C**
0 0 2 1

Note: Students will have to perform at least 10 experiments from the given topic/list.

Experiments based on Mechanics & Mech. of Solids (Broad Area):

Coupled Oscillators:

1. Experiments on an air-track;
2. Experiment on moment of inertia measurement,
3. Experiments with gyroscope;
4. Resonance phenomena in mechanical oscillators.

Experiments based on the above mentioned Topics:

1. To determine the Height of an object using a Sextant.
2. To determine the angular acceleration α and torque τ of flywheel.
3. To determine the Moment of Inertia of a Flywheel.
4. To determine **g** by Bar Pendulum.
5. To determine **g** by Kater's Pendulum.
6. To study the variation of time period with distance between centre of suspension and centre of gravity for a bar pendulum and to determine: (i)Radius of gyration of the bar about an axis through its C.G. and perpendicular to its length. (ii) The value of **g** in the laboratory.
7. To study the Motion of a Spring and calculate (a) Spring Constant (b) Value of **g** and (c) Modulus of rigidity.
8. To find the moment of inertia of an irregular body about an axis through its C.G with the torsional pendulum.
9. To compare the moment of inertia of a solid sphere and hollow sphere or solid disc of same mass with the torsional pendulum.
10. To study the variation of time period with distance between centre of suspension and centre of gravity for a bar pendulum and to determine: (i)Radius of gyration of the bar about an axis through its C.G. and perpendicular to its length. (ii) The value of **g** in the laboratory.
11. To determine the Elastic Constants/Young's Modulus of a Wire by Searle's method.
12. To determine the Modulus of Rigidity of a Wire by Maxwell's needle.
13. To determine the Modulus of Rigidity of brass.
14. To find the moment of inertia of an irregular body about an axis through its C.G with the torsional pendulum.
15. To compare the moment of inertia of a solid sphere and hollow sphere or solid disc of same mass with the torsional pendulum.

Virtual Lab Experiments:

16. To verify that energy conservation and momentum conservation can be used with a ballistic pendulum to determine the initial velocity of a projectile, its momentum and kinetic energy.
17. To verify the momentum and kinetic energy conservation using collision balls.
18. To understand the torsional oscillation of pendulum in different liquid. and determine the rigidity modulus of the suspension wire using torsion pendulum.
19. To find the Time of flight, Horizontal range and maximum height of a projectile for different velocity, angle of projection, cannon height and environment.
20. The Elastic and Inelastic collision simulation will help to analyse the collision variations for different situations.
21. Study of variation of Momentum, Kinetic energy, Velocity of collision of the objects and the Center of Mass with different velocity and mass.

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22. Demonstration of collision behaviour for elastic and inelastic type.
23. Variation of collision behavior in elastic and inelastic type.
24. Calculation of the Momentum, Kinetic energy, and Velocity after collision.

Note: Any other experiment based on the above mentioned broad topics may be included.

ENGINEERING GRAPHICS & DESIGN LAB.

Subject Code: BMECE0-102 **L T P C** **Duration: 60 Hrs.**
0 0 6 2

1. **Introduction to Engineering Drawing:**
   Principles of Engineering Graphics and their significance, usage of Drawing instruments, lettering, Dimensioning, Scales – Plain, Dimensioning-Types, System, Principles, Dimensions – Size & Location.
2. **Orthographic Projections:**
   Principles of Orthographic Projections-Conventions - Projections of Points and lines inclined to both planes; Projections of planes inclined Planes - Auxiliary Planes;
3. **Projections of Regular Solids:**
   Basic definitions of solid, types of solid, truncated and frustum of solid, Solids inclined to both the Planes; Draw simple annotation, dimensioning and scale.
4. **Sections and Sectional Views of Right Angular Solids:**
   Prism, Cylinder, Pyramid, Cone – Section of views & true shape; Development of surfaces of Right Regular Solids - Prism, Pyramid, Cylinder and Cone; Development of paper tray, Funnel and Y piece.
5. **Isometric Projections:**
   Principles of Isometric projection – Isometric Scale, Isometric Views, Conventions; Isometric Views of lines, Planes, Simple and compound Solids; Conversion of Isometric Views to Orthographic Views and Vice-versa, Conventions;
6. **Overview of Computer Graphics:**
   Listing the computer technologies that impact on graphical communication, Demonstrating knowledge of the theory of CAD software [such as: The Menu System, Toolbars (Standard, Object Properties, Draw, Modify and Dimension), Drawing Area (Background, Crosshairs, Coordinate System), Dialog boxes and windows, Shortcut menus (Button Bars), The Command Line (where applicable), The Status Bar, Different methods of zoom as used in CAD, Select and erase objects.; Isometric Views of lines, Planes, Simple and compound Solids];
7. **Customization & CAD Drawing:**
   Consisting of set up of the drawing page and the printer, including scale settings, setting up of units and drawing limits; ISO and ANSI standards for coordinate dimensioning and tolerance; Orthographic constraints, Snap to objects manually and automatically; Producing drawings by using various coordinate input entry methods to draw straight lines, Applying various ways of drawing circles;
8. **Annotations, Layering & other Functions:**
   Applying dimensions to objects, applying annotations to drawings; Setting up and use of Layers, layers to create drawings, Create, edit and use customized layers; Changing line lengths through modifying existing lines (extend/lengthen); Printing documents to paper using the print command; orthographic projection techniques.

Note: Examiner shall test the knowledge of students by conducting viva voce from the drawing sheets and through use of Auto CAD.

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BASIC ELECTRICAL ENGINEERING LAB.

Subject Code: BELEE0-102 **L T P C**
0 0 2 1

EXPERIMENTS/DEMONSTRATIONS

1. To study basic safety precautions. Introduction and use of measuring instruments – voltmeter, ammeter, multi-meter, oscilloscope. real-life resistors, capacitors and inductors.
2. To verify Ohm's law.
3. To verify Kirchhoff's voltage and current laws.
4. To verify Superposition Theorem.
5. To verify Thevenin Theorem.
6. To obtain the sinusoidal steady state response of R-L circuit – impedance calculation and verification. Observation of phase differences between current and voltage.
7. To obtain the sinusoidal steady state response of R-C circuit – impedance calculation and verification. Observation of phase differences between current and voltage.
8. To study resonance phenomenon in R-L-C series circuits.
9. To perform open circuit and short circuit test on a single phase transformer and calculate the efficiency.
10. Demonstration of cut-out sections of machines: Induction machine (squirrel cage rotor and slip ring arrangement) and single-phase induction machines.
11. To connect, start and reverse the direction of rotation by change of phase-sequence of connections of three phase induction motor.
12. To connect, start and reverse the direction of rotation of single-phase induction motor.
13. To demonstrate working of DOL starter for three-phase induction motor.
14. To demonstrate working of star-delta starter for three-phase induction motor.
15. To demonstrate the components of LT switchgear.

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Laboratory Outcomes:

1. Get an exposure to common electrical components and their ratings.
2. Make electrical connections by wires of appropriate ratings.
3. Understand the usage of common electrical measuring instruments.
4. Understand the basic characteristics of transformers and electrical induction motors.

DRUG ABUSE: PROBLEM, MANAGEMENT AND PREVENTION

Subject Code: BHUMA0-104 **L T P C** **Duration: 30 Hrs.**
3 0 0 0

UNIT-I

Meaning of Drug Abuse:
Meaning: Drug abuse, Drug dependence and Drug addiction. Nature and extent of drug abuse in India and Punjab.

UNIT-II

Consequences of Drug Abuse:
Individual: Education, Employment, Income.
Family: Violence.
Society: Crime.
Nation: Law and Order problem.

UNIT-III

Prevention of Drug Abuse:
Role of Family: Parent-child relationship, Family support, supervision, shipping values, active scrutiny.
School: Counselling, Teacher as role-model, Parent-teacher-health professional coordination, Random testing on students.

UNIT-IV

Treatment and Control of Drug Abuse:
Medical Management: Medication for treatment and to reduce withdrawal effects.
Psychological Management: Counselling, Behavioural and Cognitive therapy.
Social Management: Family, Group therapy and Environmental intervention.
Treatment: Medical, Psychological and Social Management.
Control: Role of Media and Legislation.

Recommended Books:

1. Ram Ahuja, 'Social Problems in India', Rawat Publications, Jaipur, **2003**.
2. 'Extent, Pattern and Trend of Drug Use in India', Ministry of Social Justice and Empowerment, Govt. of India, **2004.**
3. J.A. Inciardi, 'The Drug Crime Connection', Sage Publications, Beverly Hills, **1981**.
4. T. Kapoor, 'Drug Epidemic among Indian Youth', Mittal Publications, New Delhi, **1985**.
5. Kessel, Neil and Henry Walton, 'Alcoholism, Harmond Worth', Penguin Books, **1982**.
6. Ishwar Modi and Shalini Modi, 'Addiction and Prevention', Rawat Publications, Jaipur, **1997**.
7. 'National Household Survey of Alcohol and Drug Abuse', Clinical Epidemiological Unit, All India Institute of Medical Sciences, New Delhi, **2003 & 2004**.
8. Ross Coomber and Others, 'Key Concept in Drugs and Society', Sage Publications, New Delhi, **2013**.
9. Bhim Sain, 'Drug Addiction Alcoholism, Smoking Obscenity', Mittal Publications, New Delhi, **1991**.
10. Ranvinder Singh Sandhu, 'Drug Addiction in Punjab: A Sociological Study', Guru Nanak Dev University, Amritsar, **2009**.
11. Chandra Paul Singh, 'Alcohol and Dependence among Industrial Workers', Shipra, Delhi, **2000**.
12. S. Sussman and S.L. Ames, 'Drug Abuse: Concepts, Prevention and Cessation', Cambridge University Press, **2008**.
13. P.S. Verma, 'Punjab's Drug Problem: Contours and Characteristics', Vol. LII, No. 3, P.P. 40-43, Economic and Political Weekly, **2017**.
14. 'World Drug Report', United Nations Office of Drug and Crime, **2016**.
15. 'World Drug Report', United Nations Office of Drug and Crime, **2017**.

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CHEMISTRY-I

Subject Code: BCHEM0-101	**L T P C** **3 1 0 4**	**Duration: 42 Hrs.**

Course Objectives:
1. To understand the atomic and & molecular nature of various molecules
2. To understand the band structures
3. To elaborate the applications of spectroscopic techniques
4. To understand the thermodynamic functions and their applications
5. To rationalize periodic properties
6. To understand the concepts of stereochemistry and preparation of organic molecules

UNIT-I

1. Atomic and Molecular Structure: (12 Hrs.)

Bohr Theory of Hydrogen atom, Spectrum of H atom, Sommerfeld extension of Bohr Theory, Particle and wave nature of electron, De-Broglie equation, Aufbau principle, Compton effect, Schrodinger wave equation, Laplacian and Hamiltonian operator, Linear Combination of atomic orbitals. Molecular orbitals of diatomic molecules and Energy level diagrams of homonuclear and heteronuclear diatomics. Pi-molecular orbitals of butadiene and benzene and aromaticity. Crystal field theory and the energy level diagrams for transition metal ions and their magnetic properties. Band structure of solids and the role of doping on band structures.

UNIT-II

2. Spectroscopic Techniques and Applications: (8 Hrs.)

Principles and selection rules of Electronic spectroscopy and Fluorescence spectroscopy along with their applications. Principles and selection rules of Vibrational and rotational spectroscopy of diatomic molecules and their Applications. Nuclear magnetic resonance up to spin-spin coupling and magnetic resonance imaging.

3. Intermolecular Forces and Potential Energy Surfaces: (4 Hrs.)

Ideal gas equation, Ionic, dipolar and van Der Waals interactions. Real gas equation. Equations of state of real gases and critical phenomena. Potential energy surfaces of H_3, and HCN

UNIT-III

4. Use of Free Energy in Chemical Equilibria: (6 Hrs.)

Ideal Solution, Non Ideal Solutions, Thermodynamic functions: energy, entropy and free energy. Numerical problems based on entropy and free energies. Free energy and emf. Cell potentials, the Nernst equation and applications. Acid base, oxidation reduction and solubility equilibria. Thermodynamic properties of ideal solutions. Introduction to Electrochemical Corrosion and its mechanism. Use of free energy considerations in metallurgy through Ellingham diagrams.

5. Periodic Properties: (4 Hrs.)

Effective nuclear charge, penetration of orbitals, variations of s, p, d and f orbital energies of atoms in the periodic table, electronic configurations, atomic and ionic sizes, ionization energies, electron affinity and electronegativity, polarizability, oxidation states, coordination numbers and geometries, hard soft acids and bases principle

UNIT-IV

6. Stereochemistry: (4 Hrs.)

Representations of 3-dimensional structures, structural isomers and stereoisomers, configurations and symmetry and chirality, enantiomers, diastereomers, optical activity, absolute configurations and conformational analysis of butane. Isomerism in transitional metal compounds.

7. Organic Reactions and Synthesis of a Drug Molecule: (4 Hrs.)

Introduction to reactions involving substitution, addition, elimination, oxidation, reduction, cyclization and ring openings. Synthesis of a commonly used drug molecule – β lactum, Paracetamol, Chloroquine and Aspirin

Recommended Books:

1. B.H. Mahan, 'University Chemistry'.
2. M.J. Sienko and R.A. Plane 'Chemistry: Principles and Applications'.
3. C.N. Banwell, 'Fundamentals of Molecular Spectroscopy'.
4. B.L. Tembe, Kamaluddin and M.S. Krishnan, 'Engineering Chemistry (NPTEL Web-book).
5. P.W. Atkins, 'Physical Chemistry'.
6. K.P.C. Volhardt and N.E. Schore 'Organic Chemistry: Structure and Function', 5th Edn., http://bcs.whfreeman.com/vollhardtschore5e/default.asp.

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Course Outcomes:
The concepts developed in this course will aid in quantification of several concepts in chemistry that have been introduced at the 10+2 levels in schools. Technology is being increasingly based on the electronic, atomic and molecular level modifications.
Quantum theory is more than 100 years old and to understand phenomena at nanometer levels, one has to base the description of all chemical processes at molecular levels. The course will enable the student to:

1. Analyze microscopic chemistry in terms of atomic and molecular orbitals and intermolecular forces.
2. Rationalize bulk properties and processes using thermodynamic considerations.
3. Distinguish the ranges of the electromagnetic spectrum used for exciting different molecular energy levels in various spectroscopic techniques
4. Rationalize periodic properties such as ionization potential, electronegativity, oxidation states and electronegativity.
5. List major chemical reactions that are used in the synthesis of molecules.

MATHEMATICS-II (DIFFERENTIAL EQUATIONS)

Subject Code: BMATH4-201 **L T P C** **Duration: 44 Hrs.**
3 1 0 4

UNIT–I

First Order Ordinary Differential Equations: (6 Hrs.)
Linear and Bernoulli's equations, exact equation, Equations not of first degree: equations solvable for p, equations solvable for y, equations solvable for x and Clairaut's type.
Ordinary Differential Equations of higher Orders: (6 Hrs.):
Second order linear differential equations with variable coefficients, method of variation of parameters, Cauchy-Euler equation; Power series solutions; Frobenius method.

UNIT–II

Partial Differential Equations: (12 Hrs.)
First order partial differential equations, solutions of first order linear and non-linear PDEs. Solution to homogenous and non-homogenous linear partial differential equations second and higher order by complimentary function and particular integral method.

UNIT–III

Partial Differential Equations: (10 Hrs.)
The Laplacian in plane, cylindrical and spherical polar coordinates, solutions with Bessel functions and Legendre functions. one dimensional diffusion equation and its solution by separation of variables. Boundary-value problems: Solution of boundary-value problems for various linear PDEs in various geometries.

UNIT –IV

Partial Differential Equations: (10 Hrs.)
Flows, vibrations and diffusions, second-order linear equations and their classification, Initial and boundary conditions (with an informal description of well-posed problems), D'Alembert's solution of the wave equation; Separation of variables method to simple problems in Cartesian coordinates.

Recommended Books:

1. S.J. Farlow, 'Partial Differential Equations for Scientists and Engineers', Dover Publications, **1993**.
2. R. Haberman, 'Elementary Applied Partial Differential Equations with Fourier Series and Boundary Value Problem', 4th Edn., Prentice Hall, **1998**.
3. Ian Sneddon, 'Elements of Partial Differential Equations', McGraw Hill, **1964**.

4. Erwin Kreyszig, 'Advanced Engineering Mathematics', 9th Edn., John Wiley & Sons, **2006**.
5. W.E. Boyce and R.C. DiPrima, 'Elementary Differential Equations and Boundary Value Problems', 9th Edn., Wiley India, **2009**.
6. S.L. Ross, 'Differential Equations', 3rd Edn., Wiley India, **1984**.
7. E.A. Coddington, 'An Introduction to Ordinary Differential Equations', Prentice Hall India, **1995**.
8. E.L. Ince, 'Ordinary Differential Equations', Dover Publications, **1958**.
9. G.F. Simmons and S.G. Krantz, 'Differential Equations', Tata McGraw Hill, **2007**.

Course Outcomes:

The objective of this course is to familiarize the prospective engineers with techniques in multivariate integration, ordinary and partial differential equations and complex variables. It aims to equip the students to deal with advanced level of mathematics and applications that would be essential for their disciplines.

The students will learn:

1. The mathematical tools needed in evaluating multiple integrals and their usage.
2. The effective mathematical tools for the solutions of differential equations that model physical processes.
3. The tools of differentiation and integration of functions of a complex variable that are used in various techniques dealing engineering problems.

ENGLISH

Subject Code: BHUMA0-101 **L T P C** **Duration: 25 Hrs.**

2 0 0 2

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UNIT-I

1. Vocabulary Building:

1.1 The concept of Word Formation

1.2 Root words from foreign languages and their use in English

1.3 Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives.

1.4 Synonyms, antonyms, and standard abbreviations.

UNIT-II

2. Basic Writing Skills:

2.1 Sentence Structures

2.2 Use of phrases and clauses in sentences

2.3 Importance of proper punctuation

2.4 Creating coherence

2.5 Organizing principles of paragraphs in documents

2.6 Techniques for writing precisely

UNIT-III

3. Identifying Common Errors in Writing:

3.1 Subject-verb agreement

3.2 Noun-pronoun agreement

3.3 Misplaced modifiers

3.4 Articles

3.5 Prepositions

3.6 Redundancies

3.7 Clichés

UNIT-IV

4. Nature and Style of Sensible Writing:
4.1 Describing
4.2 Defining
4.3 Classifying
4.4 Providing examples or evidence
4.5 Writing introduction and conclusion

5. Writing Practices:
5.1 Comprehension
5.2 Précis Writing
5.3 Essay Writing

Recommended Books:

1. Michael Swan, 'Practical English Usage', OUP, **1995**.
2. F.T. Wood, 'Remedial English Grammar', Macmillan, **2007.**
3. William Zinsser, 'On Writing Well', Harper Resource Book, **2001.**
4. Liz Hamp-Lyons and Ben Heasly, 'Study Writing', Cambridge University Press, **2006**.
5. Sanjay Kumar and Pushp Lata, 'Communication Skills', Oxford University Press, **2011**.
6. 'Exercises in Spoken English', Parts. I-III. CIEFL, Hyderabad. Oxford University Press.

Course Outcomes:

1. The student will acquire basic proficiency in English including reading and listening comprehension, writing and speaking skills.

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PROGRAMMING FOR PROBLEM SOLVING

Subject Code: BCSCE0-101 | **L T P C 3 0 0 3** | **Duration: 41 Hrs.**

UNIT-I

1. Introduction to Programming: (6 Hrs.)

Introduction to components of a computer system (disks, memory, processor, where a program is stored and executed, operating system, compilers etc.). Idea of Algorithm: steps to solve logical and numerical problems. Representation of Algorithm: Flowchart/Pseudocode with examples. From algorithms to programs; source code, variables (with data types) variables and memory locations, Syntax and Logical Errors in compilation, object and executable code.

2. Arithmetic Expressions and Precedence: (12 Hrs.)

Conditional Branching and Loops. Writing and evaluation of conditionals and consequent branching. Iteration and loops.

UNIT-II

3. Arrays: (5 Hrs.)

Arrays (1-D, 2-D), Character arrays and Strings.

4. Basic Algorithms: (5 Hrs.)

Searching, Basic Sorting Algorithms (Bubble, Insertion and Selection), Finding roots of equations, notion of order of complexity through example programs (no formal definition required).

UNIT-III

5. Function: (4 Hrs.)

Functions (including using built in libraries), Parameter passing in functions, call by value, Passing arrays to functions: idea of call by reference.

6. Recursion: (4 Hrs.)

Recursion, as a different way of solving problems. Example programs, such as Finding

Factorial, Fibonacci series, Ackerman function etc. Quick sort or Merge sort.

UNIT-IV

7. Structure: (3 Hrs.)

Structures, Defining structures and Array of Structures

8. Pointers: (2 Hrs.)

Idea of pointers, Defining pointers, Use of Pointers in self-referential structures, notion of linked list (no implementation)

9. File Handling: (only if time is available, otherwise should be done as part of the lab)

Recommended Text Books:

1. Byron Gottfried, 'Schaum's Outline of Programming with C', McGraw Hill.
2. E. Balaguruswamy, 'Programming in ANSI C', Tata McGraw Hill.

Recommended Reference Books:

1. Brian W. Kernighan and Dennis M. Ritchie, 'The C Programming Language', Prentice Hall of India.

Course Outcomes:

The student will learn

1. To formulate simple algorithms for arithmetic and logical problems.
2. To translate the algorithms to programs (in C language).
3. To test and execute the programs and correct syntax and logical errors.
4. To implement conditional branching, iteration and recursion.
5. To decompose a problem into functions and synthesize a complete program using divide and conquer approach.
6. To use arrays, pointers and structures to formulate algorithms and programs.
7. To apply programming to solve matrix addition and multiplication problems and searching and sorting problems.
8. To apply programming to solve simple numerical method problems, namely rot finding of function, differentiation of function and simple integration.

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CHEMISTRY-I LAB.

Subject Code: BCHEM0-101 **L T P C**
0 0 2 1

Course Objectives:

1. To learn the preparation and standardization of solutions
2. To learn the estimation of various physical properties of given liquid samples
3. To estimate various crucial parameters for water sample
4. To learn the preparation of various molecules and detection of functional groups.

Choice of 10-12 experiments from the following:

1. Preparation of a standard solution
2. Determination of surface tension and viscosity
3. Thin layer chromatography
4. Determination of total Alkalinity/ Acidity of a water sample.
5. Determination of residual chlorine in water sample
6. Estimation of total, temporary and permanent hardness of water
7. Determination of the rate constant of a reaction
8. Determination of strength of an acid conductometrically
9. Potentiometry - determination of redox potentials and emfs
10. Synthesis of a polymer
11. Saponification /acid value of an oil
12. Detection and confirmation of organic functional groups.

13. Models of spatial orientation
14. To test the validity of Lambert Beer law/ Determination of λ_{max} / Determination of unknown concentration of a solution.
15. Determination of the partition coefficient of a substance between two immiscible liquids
16. Adsorption of acetic acid by charcoal
17. Synthesis of a drug – Acetaminophen, Aspirin

Laboratory Outcomes:

The chemistry laboratory course will consist of experiments illustrating the principles of chemistry relevant to the study of science and engineering. The students will learn to:

1. Estimate rate constants of reactions from concentration of reactants/products as a function of time
2. Measure molecular/system properties such as surface tension, viscosity, conductance of solutions, redox potentials, chloride content of water, etc.
3. Synthesize a small drug molecule and analyze a salt sample

ENGLISH LAB.

Subject Code: BHUMA0-102 **L T P C**
0 0 2 1

Oral Communication

(This unit involves interactive practice sessions in Language Lab.)

1. Listening Comprehension
2. Pronunciation, Intonation, Stress and Rhythm
3. Common Everyday Situations: Conversations and Dialogues
4. Communication at Workplace
5. Interviews
6. Formal Presentations

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PROGRAMMING FOR PROBLEM SOLVING LAB.

Subject Code: BCSCE0-102 **L T P C**
0 0 4 2

NOTE: The laboratory should be preceded or followed by a tutorial to explain the approach or algorithm to be implemented for the problem given.

Tutorial 1: Problem solving using computers:
Lab1: Familiarization with programming environment
Tutorial 2: Variable types and type conversions:
Lab 2: Simple computational problems using arithmetic expressions
Tutorial 3: Branching and logical expressions:
Lab 3: Problems involving if-then-else structures
Tutorial 4: Loops, while and for loops:
Lab 4: Iterative problems e.g., sum of series
Tutorial 5: 1D Arrays: searching, sorting:
Lab 5: 1D Array manipulation
Tutorial 6: 2D arrays and Strings
Lab 6: Matrix problems, String operations
Tutorial 7: Functions, call by value:
Lab 7: Simple functions

Tutorial 8 &9: Numerical methods (Root finding, numerical differentiation, numerical integration):
Lab 8 and 9: Programming for solving Numerical methods problems
Tutorial 10: Recursion, structure of recursive calls
Lab 10: Recursive functions
Tutorial 11: Pointers, structures and dynamic memory allocation
Lab 11: Pointers and structures
Tutorial 12: File handling:
Lab 12: File operations
Laboratory Outcomes:
1. To formulate the algorithms for simple problems
2. To translate given algorithms to a working and correct program
3. To be able to correct syntax errors as reported by the compilers
4. To be able to identify and correct logical errors encountered at run time
5. To be able to write iterative as well as recursive programs
6. To be able to represent data in arrays, strings and structures and manipulate them through a program
7. To be able to declare pointers of different types and use them in defining self referential structures.
8. To be able to create, read and write to and from simple text files.

MANUFACTURING PRACTICES (THEORY & LAB.)

Subject Code: BMFPR0-101	**L T P C** **1 0 4 3**	**Duration: 80 Hrs.**

Lectures & Videos: (10 Hrs.)
1. Manufacturing Methods- casting, forming, machining, joining, advanced manufacturing Methods.
2. CNC machining, Additive manufacturing.
3. Fitting operations & power tools.
4. Sheet Metal Operations.
5. Electrical & Electronics.
6. Carpentry.
7. Plastic moulding (injection moulding, blow moulding, extrusion moulding), glass cutting.
8. Metal casting.
9. Welding (arc welding & gas welding), brazing.

Recommended Text/Reference Books:
1. S.K. Hajra Choudhury, A.K. Hajra Choudhury and S.K. Nirjhar Roy, ‘Elements of Workshop Technology’, Vol.-I, **2008** and Vol.-II **2010**, Media Promoters and Publishers Pvt. Ltd., Mumbai.
2. S. Kalpakjian, Steven S. Schmid, ‘Manufacturing Engineering and Technology’, 4th Edn., Pearson Education India Edn., **2002**.
3. Gowri P. Hariharan and A. Suresh Babu, ‘Manufacturing Technology – I’, Pearson, **2008**.
4. Roy A. Lindberg, ‘Processes and Materials of Manufacture’, 4th Edn., Prentice Hall India, **1998**.
5. P.N. Rao, ‘Manufacturing Technology’, Vol.-I and Vol.-II, Tata McGraw Hill House, **2017**.

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Course Outcomes:

1. Upon completion of this course, the students will gain knowledge of the different manufacturing processes which are commonly employed in the industry, to fabricate components using different materials.

Workshop Practice: (70 Hrs.)

1. Machine shop **(10 Hrs.)**
2. Fitting shop **(8 Hrs.)**
3. Carpentry **(6 Hrs.)**
4. Electrical & Electronics **(8 Hrs.)**
5. Welding shop **(8 Hrs. (Arc welding 4 Hrs. + Gas welding 4 Hrs.)**
6. Casting **(8 Hrs.)**
7. Sheet Metal Operations **(10 Hrs.)**
8. Smithy **(6 Hrs.)**
9. Plastic moulding & Glass Cutting **(6 Hrs.)**
10. Examinations could involve the actual fabrication of simple components, utilizing one or more of the techniques covered above.

Laboratory Outcomes:

1. Upon completion of this laboratory course, students will be able to fabricate components with their own hands.
2. They will also get practical knowledge of the dimensional accuracies and dimensional tolerances possible with different manufacturing processes.
3. By assembling different components, they will be able to produce small devices of their interest.

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HUMAN VALUES AND PROFESSIONAL ETHICS

Subject Code: BHUMA0-103 **L T P C** **Duration: 30 Hrs.**
3 0 0 0

UNIT-I (8 Hrs.)

Meaning of values, Values as social fact, Universal values – equality, justice, freedom/ liberty, inclusion. Distinction between social and culture values and values associated with crafts and occupations. Work and leisure as values – Marx and Veblen

UNIT-II (9 Hrs.)

Values, morality, ethics and their relation with Religion, values as mechanisms of control and coercion. Functional Theory of Values of Talcott Parsons, Theory of Basic Values of Shalom Schwartz, Theory of Protestant Ethic and Capitalism of Max Weber, Bhagwat Gita and Theory of Karma-Dharma, Sikhism and theory of work, dignity of labour, meditation and sharing.

UNIT-III (7 Hrs.)

Meaning and types of Professional Ethics, Goals of professional work and their problems, Normative and evaluative elements in professional work, Duties and obligations, Professional rights, Virtues in professional life (honesty, trustworthiness, transparency, competence, integrity and exemplary conduct), Engineering ethics and service ideals.

UNIT-IV (6 Hrs.)

Technology for and against mankind and environment- fulfilment of human needs, and industrial disasters: case studies – Bhopal Gas Tragedy, Chernobyl and Fukushima Disasters; Equality at work place: gender discrimination and caste/class-based exclusions.

Recommended Books:

1. Schwartz, H. Shalom, 'An Overview of the Schwartz Theory of Basic Values'. Online Readings in Psychology and Culture. **2** (1). doi:10.9707/2307-0919.1116, **2012**.

2. John Berry, Janek, Pandey; Poortinga, Ype 'Handbook of Cross-cultural Psychology', 2nd Edn.. Boston, MA: Allyn and Bacon. p. 77. ISBN 9780205160747, **1997**.
3. Timo Airaksinen, 'The Philosophy of Professional Ethics', University of Helsinki, Finland.
4. Manju Jitendra Jain, 'Yes, It's Possible', Kalpana Publications, Mumbai, **2011**.

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GROUP-A
1ST SEMESTER

Course		Contact Hrs.			Marks			Credits
Code	Name	L	T	P	Internal	External	Total	
BPHYS1-101	Physics (Semiconductor Physics)	3	1	0	40	60	100	4
BMATH1-101	Mathematics-I (Calculus, Linear Algebra)	3	1	0	40	60	100	4
BMECE0-101	Engineering Graphics & Design	2	0	0	40	60	100	2
BELEE0-101	Basics Electrical Engineering	3	1	0	40	60	100	4
BPHYS1-102	Physics (Semiconductor Physics) Lab.	0	0	2	60	40	100	1
BMECE0-102	Engineering Graphics & Design Lab.	0	0	6	60	40	100	3
BELEE0-102	Basics Electrical Engineering Lab.	0	0	2	60	40	100	1
BHUMA0-104	Drug Abuse: Problem, Management and Prevention	3	0	0	100	0	100	0
Total		13	3	8	440	360	800	19

Note:
1. There will be Induction Programme of 3 weeks before start of normal classes.
2. Drug Abuse: Problem, Management and Prevention is a non-credit Course; however, it is necessary to secure at least E grade in it.

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2ND SEMESTER

Course		Contact Hrs.			Marks			Credits
Code	Name	L	T	P	Internal	External	Total	
BCHEM0-101	Chemistry-I	3	1	0	40	60	100	4
BMATH1-201	Mathematics-II (Probability and Statistics)	3	1	0	40	60	100	4
BHUMA0-101	English	2	0	0	40	60	100	2
BCSCE0-101	Programming for Problem Solving	3	0	0	40	60	100	3
BCHEM0-102	Chemistry-I Lab.	0	0	2	60	40	100	1
BHUMA0-102	English Lab.	0	0	2	60	40	100	1
BCSCE0-102	Programming for Problem Solving Lab.	0	0	4	60	40	100	2
BMFPR0-101	Manufacturing Practices	1	0	4	60	40	100	3
BHUMA0-103	Human Values & Professional Ethics	3	0	0	100	0	100	0
Total		15	2	12	500	400	900	20

Note:
1. Human Values & Professional Ethics is a non-credit Course; however, it is necessary to secure at least E grade in it.
2. Marks of 4 Week Manufacturing Practices Training during Summer Vacation will be included in 3rd Semester

GROUP-B
1ST SEMESTER

Course		Contact Hrs.			Marks			Credits
Code	Name	L	T	P	Internal	External	Total	
BCHEM0-101	Chemistry-I	3	1	0	40	60	100	4
BMATH1-101	Mathematics-I (Calculus, Linear Algebra)	3	1	0	40	60	100	4
BHUMA0-101	English	2	0	0	40	60	100	2
BCSCE0-101	Programming for Problem Solving	3	0	0	40	60	100	3
BCHEM0-102	Chemistry-I Lab.	0	0	2	60	40	100	1
BHUMA0-102	English Lab.	0	0	2	60	40	100	1
BCSCE0-102	Programming for Problem Solving Lab.	0	0	4	60	40	100	2
BMFPR0-101	Manufacturing Practices	1	0	4	60	40	100	3
BHUMA0-103	Human Values & Professional Ethics	3	0	0	100	0	100	0
Total		15	2	12	500	400	900	20

Note:
1. There will be Induction Programme of 3 weeks before start of normal classes.
2. Human Values & Professional Ethics is a non-credit Course; however, it is necessary to secure at least E grade in it.

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2ND SEMESTER

Course		Contact Hrs.			Marks			Credits
Code	Name	L	T	P	Internal	External	Total	
BPHYS1-101	Physics (Semiconductor Physics)	3	1	0	40	60	100	4
BMATH1-201	Mathematics-II (Probability and Statistics)	3	1	0	40	60	100	4
BMECE0-101	Engineering Graphics & Design	2	0	0	40	60	100	2
BELEE0-101	Basics Electrical Engineering	3	1	0	40	60	100	4
BPHYS1-102	Physics (Semiconductor Physics) Lab.	0	0	2	60	40	100	1
BMECE0-102	Engineering Graphics & Design Lab.	0	0	6	60	40	100	3
BELEE0-102	Basics Electrical Engineering Lab.	0	0	2	60	40	100	1
BHUMA0-104	Drug Abuse: Problem, Management and Prevention	3	0	0	100	0	100	0
Total		13	3	8	440	360	800	19

Note:
1. Drug Abuse: Problem, Management and Prevention is a non-credit Course; however, it is necessary to secure at least E grade in it.
2. Marks of 4 Week Manufacturing Practices Training during Summer Vacation will be included in 3rd Semester

PHYSICS (SEMICONDUCTOR PHYSICS)

Subject Code: BPHYS1-101 **L T P C** **Duration: 38 Hrs.**
3 1 0 4

UNIT-I

Quantum Theory: (10 Hrs.)
Need and origin of Quantum Concept, Wave-particle duality, Matter waves, Group and Phase velocities, Concept of Uncertainty Principle and its application: nonexistence of electron in the nucleus, 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. Concept of scattering from a potential barrier and tunneling.

UNIT-II

Electronic Materials: (8 Hrs.)
Free electron theory, Density of states and energy band diagrams, Introduction to band gap theory, Direct and indirect band gaps. Types of electronic materials: metals, semiconductors and insulators, Occupation probability, Fermi level, Effective mass, phonons.

UNIT-III

Semiconductors and Light- Semiconductor Interactions: (12 Hrs.)
Intrinsic and extrinsic semiconductors, Dependence of Fermi level on carrier-concentration and temperature (equilibrium carrier statistics), Carrier generation and recombination, Carrier transport: diffusion and drift, p-n junction, Metal-semiconductor junction (Ohmic and Schottky), Semiconductor materials of interest for optoelectronic devices. Optical transitions in bulk semiconductors: absorption, spontaneous emission, and stimulated emission; Lasers: principles and working of laser: population inversion, pumping, types of lasers with emphasis on the semi-conductor Lasers.

UNIT-IV

Fibre Optics Communication: (8 Hrs.)
Introduction and importance of use of optical fibres in data transmission, optical fibre as a dielectric wave guide: total internal reflection, numerical aperture and various fibre parameters, losses associated with optical fibres, step and graded index fibres, applications of optical fibres.

Recommended Books:

1. Satayaparkash, 'Quantum Mechanics'.
2. A. Ghatak and Lokanathan, 'Quantum Mechanics'.
3. J. Singh, 'Semiconductor Optoelectronics: Physics and Technology', McGraw Hill Inc., **1995.**
4. S.M. Sze, 'Semiconductor Devices: Physics and Technology', Wiley, **2008**.
5. A. Yariv and P. Yeh, 'Photonics: Optical Electronics in Modern Communications', Oxford University Press, New York, **2007**.
6. P. Bhattacharya, 'Semiconductor Optoelectronic Devices', Prentice Hall of India, **1997**.
7. M R Shenoy, 'Online Course: Semiconductor Optoelectronics', NPTEL.
8. Monica Katiyar and Deepak Gupta, 'Online Course: Optoelectronic Materials and Devices', NPTEL.
9. Ben. G. Streetman, 'Solid State Electronics Devices', Pearson Prentice Hall.

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MATHEMATICS-I (CALCULUS, LINEAR ALGEBRA)

Subject Code: BMATH1-101 **L T P C** **Duration: 46 Hrs.**
3 1 0 4

UNIT –I

Calculus: (12 Hrs.)
Rolle's Theorem, Mean value theorems, Taylor's and Maclaurin theorems with remainders; indeterminate forms and L' Hospital's rule; Maxima and minima. Evaluation of definite and improper integrals; Beta and Gamma functions and their properties; Applications of definite integrals to evaluate surface areas and volumes of revolutions.

UNIT –II

Sequences and Series: (10 Hrs.)
Convergence of sequence and series, tests for convergence (Comparison test, Ratio test, Raabe's test, Logarithmic test, Cauchy's root test, Cauchy's Integral test, series of positive and negative terms); Power series, Taylor's series, series for exponential, trigonometric and logarithm functions.

UNIT –III

Multivariable Calculus: (12 Hrs.)
Limit, continuity and partial derivatives, total derivative; Tangent plane and normal line; Maxima, minima and saddle points; Method of Lagrange multipliers; Gradient, curl and divergence: Geometrical interpretation and basic properties, Directional derivative.

UNIT –IV

Linear Algebra: (12 Hrs.)
Inverse and rank of a matrix, rank-nullity theorem; System of linear equations; Symmetric, skew-symmetric and orthogonal matrices; Determinants; Eigenvalues and eigenvectors; Diagonalization of matrices; Cayley-Hamilton Theorem, and Orthogonal transformation.

Recommended Books:

1. G.B. Thomas and R.L. Finney, 'Calculus and Analytic Geometry', 9th Edn., Pearson, Reprint, **2002**.
2. Erwin Kreyszig, 'Advanced Engineering Mathematics', 9th Edn, John Wiley & Sons, **2006**.
3. T. Veerarajan, 'Engineering Mathematics for First Year', Tata McGraw Hill, New Delhi, **2008.**
4. B.V. Ramana, 'Higher Engineering Mathematics', 11th Reprint, Tata McGraw Hill, New Delhi, **2010**.
5. D. Poole, 'Linear Algebra: A Modern Introduction', 2nd Edn., Brooks/Cole, **2005**.
6. B.S. Grewal, 'Higher Engineering Mathematics', 36th Edn., Khanna Publishers, **2010**.

Course Outcomes:
The objective of this course is to familiarize the prospective engineers with techniques in calculus, multivariate analysis and linear algebra. It aims to equip the students with standard concepts and tools at an intermediate to advanced level that will serve them well towards tackling more advanced level of mathematics and applications that they would find useful in their disciplines.
The students will learn:

1. To apply differential and integral calculus to notions of curvature and to improper integrals. Apart from some other applications they will have a basic understanding of Beta and Gamma functions.
2. The fallouts of Rolle's Theorem that is fundamental to application of analysis to Engineering problems.
3. The tool of power series and Fourier series for learning advanced Engineering Mathematics.

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4. To deal with functions of several variables that are essential in most branches of engineering.
5. The essential tool of matrices and linear algebra in a comprehensive manner.

ENGINEERING GRAPHICS & DESIGN

Subject Code: BMECE0-101 **L T P C** **Duration: 24 Hrs.**
2 0 0 2

1. **Traditional Engineering Graphics:**
   Principles of Engineering Graphics; Scales; Orthographic Projection- Points, lines, planes and solids; Descriptive Geometry; Drawing Principles; Isometric Projection; Surface Development; Reading a Drawing; Sectional Views; Dimensioning & Tolerances; True Length, Angle, Shortest Distance.
2. **Computer Graphics:**
   Co-ordinate system; Types of CAD software, draw commands; Modify commands; Dimensioning; setting of units & limits; Editing of Drawing; Printing.

Recommended Text/Reference Books:

1. N.D. Bhatt, V.M. Panchal & P.R. Ingle, ‘Engineering Drawing’, Charotar Publishing House, **2014**.
2. M.B. Shah & B.C. Rana, ‘Engineering Drawing and Computer Graphics’, Pearson Education, **2008**.
3. B. Agrawal & C.M. Agrawal, ‘Engineering Graphics’, TMH Publication, **2012**.
4. K.L. Narayana & P. Kannaiah, ‘Text book on Engineering Drawing’, Scitech Publishers, **2008**.
5. (Corresponding set of) CAD Software Theory and User Manuals.

Course Outcomes:

All phases of manufacturing or construction require the conversion of new ideas and design concepts into the basic line language of graphics. Therefore, there are many areas (civil, mechanical, electrical, architectural and industrial) in which the skills of the CAD technicians play major roles in the design and development of new products or construction. Students prepare for actual work situations through practical training in a new state-of-the-art computer designed CAD laboratory using engineering software. This course is designed to address:

1. To prepare you to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.
2. To prepare you to communicate effectively.
3. To prepare you to use the techniques, skills, and modern engineering tools necessary for engineering practice.

The student will learn:

1. Introduction to engineering design and its place in society
2. Exposure to the visual aspects of engineering design
3. Exposure to engineering graphics standards
4. Exposure to solid modelling
5. Exposure to computer-aided geometric design
6. Exposure to creating working drawings
7. Exposure to engineering communication

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BASIC ELECTRICAL ENGINEERING

Subject Code: BELEE0-101 **L T P C** **Duration: 42 Hrs.**
3 1 0 4

UNIT-1

DC Circuits: (8 Hrs.)
Electrical circuit elements (R, L and C), voltage and current sources, Ohm's law, Kirchhoff current and voltage laws, analysis of simple circuits with dc excitation Superposition, Thevenin and Norton Theorems. Step response of RL, RC circuits.

UNIT-2

AC Circuits: (12 Hrs.)
Representation of sinusoidal waveforms, average, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor. Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC series and parallel combinations, series and parallel resonance. Three phase voltage source, phase sequence, three phase balanced circuits, voltage and current relations in star and delta connections.

UNIT-3

Transformers: (10 Hrs.)
Magnetic materials, BH characteristics, Single-phase Transformer, no load and full load conditions, phasor diagrams, equivalent circuit, calculation of losses in transformers, regulation and efficiency, Auto-transformers, their applications and comparison with two winding transformers.

UNIT-4

Electrical Machines: (8 Hrs.)
Generation of rotating magnetic fields, Construction and working of a three-phase induction motor, Direct-On-Line and Star-Delta starters. Construction and working of single-phase motors (Split phase, shaded pole, capacitor start, capacitor run, capacitor start and run motors).

Electrical Installations: (4 Hrs.)
Components of LT Switchgear: Switch Fuse Unit (SFU), Miniature Circuit Breaker (MCB), Earth Leakage Circuit Breaker (ELCB), Moulded Case Circuit Breaker (MCCB), Types of Wiring, Earthing.

Recommended Books:
1. D.P. Kothari and I.J. Nagrath, 'Basic Electrical Engineering', Tata McGraw Hill, **2010**.
2. D.C. Kulshreshtha, 'Basic Electrical Engineering', McGraw Hill, **2009**.
3. L.S. Bobrow, 'Fundamentals of Electrical Engineering', Oxford University Press, **2011**.
4. E. Hughes, 'Electrical and Electronics Technology', Pearson, **2010**.
5. V.D. Toro, 'Electrical Engineering Fundamentals', Prentice Hall, India, **1989**.
6. J.P.S. Dhillon. J.S. Dhillon and D. Singh, 'Principles of Electrical & Electronics Engineering', Kalyani Publishers, New Delhi, **2005**.

Course Outcomes:
1. To understand and analyze basic DC and AC circuits.
2. To study the use and working principle of single phase transformers.
3. To study the application and working principles of three phase and single phase induction motors.
4. To introduce to the components of low voltage electrical installations.

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PHYSICS (SEMICONDUCTOR PHYSICS) LAB.

Subject Code: BPHYS1-102 **L T P C**
0 0 2 1

Note: Students will have to perform at least 10 experiments from the given topic/list.

<u>Experiments based on Semiconductor Physics:</u>

1. To study the V-I characteristic of different PN junction diode-Ge and Si.
2. To study the V-I characteristic of Zener diode.
3. To study the V-I characteristic of LED.
4. To analyze the suitability of a given Zener diode as a power regulator.
5. To find out the intensity response of a solar cell/Photo diode.
6. To find out the intensity response of a LED.
7. To determine the band gap of a semiconductor.
8. To determine the resistivity of a semiconductor by four probe method.
9. To confirm the de Broglie equation for electrons.
10. To study voltage regulation and ripple factor for a half-wave and a full-wave rectifier without and with different filters.
11. To study the magnetic field of a circular coil carrying current.
12. To find out polarizability of a dielectric substance.
13. To study B-H curve of a ferromagnetic material using CRO.
14. To find out the frequency of AC mains using electric-vibrator.
15. To find the velocity of ultrasound in liquid.
16. To study the Hall effect for the determination of charge current densities.
17. Distinguish between Diamagnetic material, Paramagnetic and ferromagnetic material.
18. Measurement of susceptibility of a liquid or a solution by Quincke’s method:
19. AFM experiment to study the sample with the nano-scale objects and measure surface topography with different scales, width and height of nano objects, and force-distance curves.
20. To study the temperature coefficient of Resistance of copper.

Physics Virtual Lab. Experiments:

21. To plot the characteristics of thermistor and hence find the temperature coefficient of resistance.
22. To determine the resistivity of semiconductors by Four Probe Method.
23. To study the forward and reverse biased characteristics of PNP and NPN transistors.
24. To study the B-H Curve.
25. To study the Hall effect experiment to determine the charge carrier density.
26. To determine the magnetic susceptibilities of paramagnetic liquids by Quincke's Method.
27. To study the phenomena of magnetic hysteresis and calculate the retentivity, coercivity and saturation magnetization of a material using a hysteresis loop tracer.
28. Verification and design of combinational logic using AND, OR, NOT, NAND and XOR gates.

Note: Any other experiment based on the above mentioned topics may be included.

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ENGINEERING GRAPHICS & DESIGN LAB.

Subject Code: BMECE0-102 **L T P C** **Duration: 60 Hrs.**
0 0 6 3

1. **Introduction to Engineering Drawing:**
   Principles of Engineering Graphics and their significance, usage of Drawing instruments, lettering, Dimensioning, Scales – Plain, Dimensioning-Types, System, Principles, Dimensions – Size & Location.
2. **Orthographic Projections:**
   Principles of Orthographic Projections-Conventions - Projections of Points and lines inclined to both planes; Projections of planes inclined Planes - Auxiliary Planes;
3. **Projections of Regular Solids:**
   Basic definitions of solid, types of solid, truncated and frustum of solid, Solids inclined to both the Planes; Draw simple annotation, dimensioning and scale.
4. **Sections and Sectional Views of Right Angular Solids:**
   Prism, Cylinder, Pyramid, Cone – Section of views & true shape; Development of surfaces of Right Regular Solids - Prism, Pyramid, Cylinder and Cone; Development of paper tray, Funnel and Y piece.
5. **Isometric Projections:**
   Principles of Isometric projection – Isometric Scale, Isometric Views, Conventions; Isometric Views of lines, Planes, Simple and compound Solids; Conversion of Isometric Views to Orthographic Views and Vice-versa, Conventions;
6. **Overview of Computer Graphics:**
   Listing the computer technologies that impact on graphical communication, Demonstrating knowledge of the theory of CAD software [such as: The Menu System, Toolbars (Standard, Object Properties, Draw, Modify and Dimension), Drawing Area (Background, Crosshairs, Coordinate System), Dialog boxes and windows, Shortcut menus (Button Bars), The Command Line (where applicable), The Status Bar, Different methods of zoom as used in CAD, Select and erase objects.; Isometric Views of lines, Planes, Simple and compound Solids];
7. **Customization & CAD Drawing:**
   Consisting of set up of the drawing page and the printer, including scale settings, setting up of units and drawing limits; ISO and ANSI standards for coordinate dimensioning and tolerance; Orthographic constraints, Snap to objects manually and automatically; Producing drawings by using various coordinate input entry methods to draw straight lines, Applying various ways of drawing circles;
8. **Annotations, Layering & other Functions:**
   Applying dimensions to objects, applying annotations to drawings; Setting up and use of Layers, layers to create drawings, Create, edit and use customized layers; Changing line lengths through modifying existing lines (extend/lengthen); Printing documents to paper using the print command; orthographic projection techniques.

Note: Examiner shall test the knowledge of students by conducting viva voce from the drawing sheets and through use of Auto CAD.

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BASIC ELECTRICAL ENGINEERING LAB.

Subject Code: BELEE0-102 **L T P C**
0 0 2 1

EXPERIMENTS/DEMONSTRATIONS

1. To study basic safety precautions. Introduction and use of measuring instruments – voltmeter, ammeter, multi-meter, oscilloscope. real-life resistors, capacitors and inductors.
2. To verify Ohm's law.
3. To verify Kirchhoff's voltage and current laws.
4. To verify Superposition Theorem.
5. To verify Thevenin Theorem.
6. To obtain the sinusoidal steady state response of R-L circuit – impedance calculation and verification. Observation of phase differences between current and voltage.
7. To obtain the sinusoidal steady state response of R-C circuit – impedance calculation and verification. Observation of phase differences between current and voltage.
8. To study resonance phenomenon in R-L-C series circuits.
9. To perform open circuit and short circuit test on a single phase transformer and calculate the efficiency.
10. Demonstration of cut-out sections of machines: Induction machine (squirrel cage rotor and slip ring arrangement) and single-phase induction machines.
11. To connect, start and reverse the direction of rotation by change of phase-sequence of connections of three phase induction motor.
12. To connect, start and reverse the direction of rotation of single-phase induction motor.
13. To demonstrate working of DOL starter for three-phase induction motor.
14. To demonstrate working of star-delta starter for three-phase induction motor.
15. To demonstrate the components of LT switchgear.

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Laboratory Outcomes:

1. Get an exposure to common electrical components and their ratings.
2. Make electrical connections by wires of appropriate ratings.
3. Understand the usage of common electrical measuring instruments.
4. Understand the basic characteristics of transformers and electrical induction motors.

DRUG ABUSE: PROBLEM, MANAGEMENT AND PREVENTION

Subject Code: BHUMA0-104 **L T P C** **Duration: 30 Hrs.**
3 0 0 0

UNIT-I

Meaning of Drug Abuse:
Meaning: Drug abuse, Drug dependence and Drug addiction. Nature and extent of drug abuse in India and Punjab.

UNIT-II

Consequences of Drug Abuse:
Individual: Education, Employment, Income.
Family: Violence.
Society: Crime.
Nation: Law and Order problem.

UNIT-III

Prevention of Drug Abuse:

Role of Family: Parent-child relationship, Family support, supervision, shipping values, active scrutiny.

School: Counselling, Teacher as role-model, Parent-teacher-health professional coordination, Random testing on students.

UNIT-IV

Treatment and Control of Drug Abuse:

Medical Management: Medication for treatment and to reduce withdrawal effects.
Psychological Management: Counselling, Behavioural and Cognitive therapy.
Social Management: Family, Group therapy and Environmental intervention.
Treatment: Medical, Psychological and Social Management.
Control: Role of Media and Legislation.

Recommended Books:

1. Ram Ahuja, 'Social Problems in India', Rawat Publications, Jaipur, **2003**.
2. 'Extent, Pattern and Trend of Drug Use in India', Ministry of Social Justice and Empowerment, Govt. of India, **2004.**
3. J.A. Inciardi, 'The Drug Crime Connection', Sage Publications, Beverly Hills, **1981**.
4. T. Kapoor, 'Drug Epidemic among Indian Youth', Mittal Publications, New Delhi, **1985**.
5. Kessel, Neil and Henry Walton, 'Alcoholism, Harmond Worth', Penguin Books, **1982**.
6. Ishwar Modi and Shalini Modi, 'Addiction and Prevention', Rawat Publications, Jaipur, **1997**.
7. 'National Household Survey of Alcohol and Drug Abuse', Clinical Epidemiological Unit, All India Institute of Medical Sciences, New Delhi, **2003 & 2004**.
8. Ross Coomber and Others, 'Key Concept in Drugs and Society', Sage Publications, New Delhi, **2013**.
9. Bhim Sain, 'Drug Addiction Alcoholism, Smoking Obscenity', Mittal Publications, New Delhi, **1991**.
10. Ranvinder Singh Sandhu, 'Drug Addiction in Punjab: A Sociological Study', Guru Nanak Dev University, Amritsar, **2009**.
11. Chandra Paul Singh, 'Alcohol and Dependence among Industrial Workers', Shipra, Delhi, **2000**.
12. S. Sussman and S.L. Ames, 'Drug Abuse: Concepts, Prevention and Cessation', Cambridge University Press, **2008**.
13. P.S. Verma, 'Punjab's Drug Problem: Contours and Characteristics', Vol. LII, No. 3, P.P. 40-43, Economic and Political Weekly, **2017**.
14. 'World Drug Report', United Nations Office of Drug and Crime, **2016**.
15. 'World Drug Report', United Nations Office of Drug and Crime, **2017**.

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CHEMISTRY-I

Subject Code: BCHEM0-101	**L T P C**	**Duration: 42 Hrs.**
	3 1 0 4	

Course Objectives:

1. To understand the atomic and & molecular nature of various molecules
2. To understand the band structures
3. To elaborate the applications of spectroscopic techniques
4. To understand the thermodynamic functions and their applications
5. To rationalize periodic properties
6. To understand the concepts of stereochemistry and preparation of organic molecules

UNIT-I

1. Atomic and Molecular Structure: (12 Hrs.)

Bohr Theory of Hydrogen atom, Spectrum of H atom, Sommerfeld extension of Bohr Theory, Particle and wave nature of electron, De-Broglie equation, Aufbau principle, Compton effect, Schrodinger wave equation, Laplacian and Hamiltonian operator, Linear Combination of atomic orbitals. Molecular orbitals of diatomic molecules and Energy level diagrams of homonuclear and heteronuclear diatomics. Pi-molecular orbitals of butadiene and benzene and aromaticity. Crystal field theory and the energy level diagrams for transition metal ions and their magnetic properties. Band structure of solids and the role of doping on band structures.

UNIT-II

2. Spectroscopic Techniques and Applications: (8 Hrs.)

Principles and selection rules of Electronic spectroscopy and Fluorescence spectroscopy along with their applications. Principles and selection rules of Vibrational and rotational spectroscopy of diatomic molecules and their Applications. Nuclear magnetic resonance up to spin-spin coupling and magnetic resonance imaging.

3. Intermolecular Forces and Potential Energy Surfaces: (4 Hrs.)

Ideal gas equation, Ionic, dipolar and van Der Waals interactions. Real gas equation. Equations of state of real gases and critical phenomena. Potential energy surfaces of H_3, and HCN

UNIT-III

4. Use of Free Energy in Chemical Equilibria: (6 Hrs.)

Ideal Solution, Non Ideal Solutions, Thermodynamic functions: energy, entropy and free energy. Numerical problems based on entropy and free energies. Free energy and emf. Cell potentials, the Nernst equation and applications. Acid base, oxidation reduction and solubility equilibria. Thermodynamic properties of ideal solutions. Introduction to Electrochemical Corrosion and its mechanism. Use of free energy considerations in metallurgy through Ellingham diagrams.

5. Periodic Properties: (4 Hrs.)

Effective nuclear charge, penetration of orbitals, variations of s, p, d and f orbital energies of atoms in the periodic table, electronic configurations, atomic and ionic sizes, ionization energies, electron affinity and electronegativity, polarizability, oxidation states, coordination numbers and geometries, hard soft acids and bases principle

UNIT-IV

6. Stereochemistry: (4 Hrs.)

Representations of 3-dimensional structures, structural isomers and stereoisomers, configurations and symmetry and chirality, enantiomers, diastereomers, optical activity, absolute configurations and conformational analysis of butane. Isomerism in transitional metal compounds.

7. Organic Reactions and Synthesis of a Drug Molecule: (4 Hrs.)

Introduction to reactions involving substitution, addition, elimination, oxidation, reduction, cyclization and ring openings. Synthesis of a commonly used drug molecule – β lactum, Paracetamol, Chloroquine and Aspirin

Recommended Books:

1. B.H. Mahan, 'University Chemistry'.
2. M.J. Sienko and R.A. Plane 'Chemistry: Principles and Applications'.
3. C.N. Banwell, 'Fundamentals of Molecular Spectroscopy'.
4. B.L. Tembe, Kamaluddin and M.S. Krishnan, 'Engineering Chemistry (NPTEL Web-book).
5. P.W. Atkins, 'Physical Chemistry'.
6. K.P.C. Volhardt and N.E. Schore 'Organic Chemistry: Structure and Function', 5th Edn., http://bcs.whfreeman.com/vollhardtschore5e/default.asp

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Course Outcomes:
The concepts developed in this course will aid in quantification of several concepts in chemistry that have been introduced at the 10+2 levels in schools. Technology is being increasingly based on the electronic, atomic and molecular level modifications.
Quantum theory is more than 100 years old and to understand phenomena at nanometer levels, one has to base the description of all chemical processes at molecular levels. The course will enable the student to:

1. Analyze microscopic chemistry in terms of atomic and molecular orbitals and intermolecular forces.
2. Rationalize bulk properties and processes using thermodynamic considerations.
3. Distinguish the ranges of the electromagnetic spectrum used for exciting different molecular energy levels in various spectroscopic techniques
4. Rationalize periodic properties such as ionization potential, electronegativity, oxidation states and electronegativity.
5. List major chemical reactions that are used in the synthesis of molecules.

MATHEMATICS-II (PROBABILITY AND STATISTICS)

Subject Code: BMATH1-201 **L T P C** **Duration: 40 Hrs.**
3 1 0 4

UNIT –I

Basic Probability: (12 Hrs.)
Probability spaces, conditional probability, independence; Discrete random variables, Independent random variables, the multinomial distribution, Poisson approximation to the binomial distribution, infinite sequences of Bernoulli trials, sums of independent random variables; Expectation of Discrete Random Variables, Moments, Variance of a sum, Chebyshev's Inequality.

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UNIT –II

Continuous Probability Distributions: (6 Hrs.)
Continuous random variables and their properties, distribution functions and densities, normal, exponential and gamma densities.
Bivariate Distributions: (6 Hrs.) Bivariate distributions and their properties, distribution of sums and quotients, conditional densities, Bayes' rule.

UNIT –III

Basic Statistics: (10 Hrs.)
Measures of Central tendency: Moments, skewness and Kurtosis - Probability distributions: Binomial, Poisson and Normal - evaluation of statistical parameters for these three distributions, Correlation and regression – Rank correlation.

UNIT –IV

Applied Statistics: (8 Hrs.)
Curve fitting by the method of least squares- fitting of straight lines, second degree parabolas and more general curves. Test of significance: Large sample test for single proportion, difference of proportions, single mean, difference of means, and difference of standard deviations.
Small Samples: (4 Hrs.)
Test for single mean, difference of means and correlation coefficients, test for ratio of variances - Chi-square test for goodness of fit and independence of attributes.

Recommended Books:

1. E. Kreyszig, ‘Advanced Engineering Mathematics’, John Wiley & Sons, **2006**.

2. P.G. Hoel, S.C. Port and C.J. Stone, 'Introduction to Probability Theory', Universal Book Stall, **2003**.
3. S. Ross, 'A First Course in Probability', Pearson Education India, **2002**.
4. W. Feller, 'An Introduction to Probability Theory and its Applications', Vol.-1, Wiley, **1968**.
5. B.S. Grewal, 'Higher Engineering Mathematics', Khanna Publishers, **2000**.
6. T. Veerarajan, 'Engineering Mathematics', Tata McGraw Hill, New Delhi, **2010**.

Course Outcomes:

The objective of this course is to familiarize the prospective engineers with techniques in multivariate integration, ordinary and partial differential equations and complex variables. It aims to equip the students to deal with advanced level of mathematics and applications that would be essential for their disciplines.

The students will learn:

1. The mathematical tools needed in evaluating multiple integrals and their usage.
2. The effective mathematical tools for the solutions of differential equations that model physical processes.
3. The tools of differentiation and integration of functions of a complex variable that are used in various techniques dealing engineering problems.

ENGLISH

Subject Code: BHUMA0-101 **L T P C** **Duration: 25 Hrs.**

2 0 0 2

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UNIT-I

1. Vocabulary Building:

1.1 The concept of Word Formation
1.2 Root words from foreign languages and their use in English
1.3 Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives.
1.4 Synonyms, antonyms, and standard abbreviations.

UNIT-II

2. Basic Writing Skills:

2.1 Sentence Structures
2.2 Use of phrases and clauses in sentences
2.3 Importance of proper punctuation
2.4 Creating coherence
2.5 Organizing principles of paragraphs in documents
2.6 Techniques for writing precisely

UNIT-III

3. Identifying Common Errors in Writing:

3.1 Subject-verb agreement
3.2 Noun-pronoun agreement
3.3 Misplaced modifiers
3.4 Articles
3.5 Prepositions
3.6 Redundancies
3.7 Clichés

UNIT-IV

4. Nature and Style of sensible Writing:

4.1 Describing
4.2 Defining

4.3 Classifying
4.4 Providing examples or evidence
4.5 Writing introduction and conclusion

5. Writing Practices:

5.1 Comprehension
5.2 Précis Writing
5.3 Essay Writing

Recommended Books:

1. Michael Swan, 'Practical English Usage', OUP, **1995**.
2. F.T. Wood, 'Remedial English Grammar', Macmillan, **2007.**
3. William Zinsser, 'On Writing Well', Harper Resource Book, **2001.**
4. Liz Hamp-Lyons and Ben Heasly, 'Study Writing', Cambridge University Press, **2006**.
5. Sanjay Kumar and Pushp Lata, 'Communication Skills', Oxford University Press, **2011**.
6. 'Exercises in Spoken English', Parts. I-III. CIEFL, Hyderabad. Oxford University Press.

Course Outcomes:

1. The student will acquire basic proficiency in English including reading and listening comprehension, writing and speaking skills.

PROGRAMMING FOR PROBLEM SOLVING

Subject Code: BCSCE0-101	**L T P C**	**Duration: 41 Hrs.**
	3 0 0 3	

MRSPTU

UNIT-I

1. Introduction to Programming: (6 Hrs.)

Introduction to components of a computer system (disks, memory, processor, where a program is stored and executed, operating system, compilers etc.). Idea of Algorithm: steps to solve logical and numerical problems. Representation of Algorithm: Flowchart/Pseudocode with examples. From algorithms to programs; source code, variables (with data types) variables and memory locations, Syntax and Logical Errors in compilation, object and executable code.

2. Arithmetic Expressions and Precedence: (12 Hrs.)

Conditional Branching and Loops. Writing and evaluation of conditionals and consequent branching. Iteration and loops.

UNIT-II

3. Arrays: (5 Hrs.)

Arrays (1-D, 2-D), Character arrays and Strings

4. Basic Algorithms: (5 Hrs.)

Searching, Basic Sorting Algorithms (Bubble, Insertion and Selection), Finding roots of equations, notion of order of complexity through example programs (no formal definition required)

UNIT-III

5. Function: (4 Hrs.)

Functions (including using built in libraries), Parameter passing in functions, call by value, Passing arrays to functions: idea of call by reference

6. Recursion: (4 Hrs.)

Recursion, as a different way of solving problems. Example programs, such as Finding Factorial, Fibonacci series, Ackerman function etc. Quick sort or Merge sort.

UNIT-IV

7. Structure: (3 Hrs.)

Structures, Defining structures and Array of Structures

8. Pointers: (2 Hrs.)
Idea of pointers, Defining pointers, Use of Pointers in self-referential structures, notion of linked list (no implementation)
9. File Handling: (only if time is available, otherwise should be done as part of the lab)
Recommended Text Books:
1. Byron Gottfried, 'Schaum's Outline of Programming with C', McGraw Hill.
2. E. Balaguruswamy, 'Programming in ANSI C', Tata McGraw Hill.

Recommended Reference Books:
1. Brian W. Kernighan and Dennis M. Ritchie, 'The C Programming Language', Prentice Hall of India.

Course Outcomes:
The student will learn
1. To formulate simple algorithms for arithmetic and logical problems.
2. To translate the algorithms to programs (in C language).
3. To test and execute the programs and correct syntax and logical errors.
4. To implement conditional branching, iteration and recursion.
5. To decompose a problem into functions and synthesize a complete program using divide and conquer approach.
6. To use arrays, pointers and structures to formulate algorithms and programs.
7. To apply programming to solve matrix addition and multiplication problems and searching and sorting problems.
8. To apply programming to solve simple numerical method problems, namely rot finding of function, differentiation of function and simple integration.

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CHEMISTRY-I LAB.

Subject Code: BCHEM0-101 **L T P C**
0 0 2 1

Course Objectives:
1. To learn the preparation and standardization of solutions
2. To learn the estimation of various physical properties of given liquid samples
3. To estimate various crucial parameters for water sample
4. To learn the preparation of various molecules and detection of functional groups.

Choice of 10-12 experiments from the following:
1. Preparation of a standard solution
2. Determination of surface tension and viscosity
3. Thin layer chromatography
4. Determination of total Alkalinity/ Acidity of a water sample.
5. Determination of residual chlorine in water sample
6. Estimation of total, temporary and permanent hardness of water
7. Determination of the rate constant of a reaction
8. Determination of strength of an acid conductometrically
9. Potentiometry - determination of redox potentials and emfs
10. Synthesis of a polymer
11. Saponification /acid value of an oil
12. Detection and confirmation of organic functional groups.
13. Models of spatial orientation
14. To test the validity of Lambert Beer law/ Determination of λ_{max} / Determination of unknown concentration of a solution.
15. Determination of the partition coefficient of a substance between two immiscible

liquids
16. Adsorption of acetic acid by charcoal
17. Synthesis of a drug – Acetaminophen, Aspirin

Laboratory Outcomes:

The chemistry laboratory course will consist of experiments illustrating the principles of chemistry relevant to the study of science and engineering. The students will learn to:

1. Estimate rate constants of reactions from concentration of reactants/products as a function of time
2. Measure molecular/system properties such as surface tension, viscosity, conductance of solutions, redox potentials, chloride content of water, etc.
3. Synthesize a small drug molecule and analyze a salt sample

ENGLISH LAB.

Subject Code: BHUMA0-102 **L T P C**
0 0 2 1

Oral Communication

(This unit involves interactive practice sessions in Language Lab.)

1. Listening Comprehension
2. Pronunciation, Intonation, Stress and Rhythm
3. Common Everyday Situations: Conversations and Dialogues
4. Communication at Workplace
5. Interviews
6. Formal Presentations

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PROGRAMMING FOR PROBLEM SOLVING LAB.

Subject Code: BCSCE0-102 **L T P C**
0 0 4 2

NOTE: The laboratory should be preceded or followed by a tutorial to explain the approach or algorithm to be implemented for the problem given.

Tutorial 1: Problem solving using computers:
Lab1: Familiarization with programming environment
Tutorial 2: Variable types and type conversions:
Lab 2: Simple computational problems using arithmetic expressions
Tutorial 3: Branching and logical expressions:
Lab 3: Problems involving if-then-else structures
Tutorial 4: Loops, while and for loops:
Lab 4: Iterative problems e.g., sum of series
Tutorial 5: 1D Arrays: searching, sorting:
Lab 5: 1D Array manipulation
Tutorial 6: 2D arrays and Strings
Lab 6: Matrix problems, String operations
Tutorial 7: Functions, call by value:
Lab 7: Simple functions
Tutorial 8 &9: Numerical methods (Root finding, numerical differentiation, numerical integration):
Lab 8 and 9: Programming for solving Numerical methods problems
Tutorial 10: Recursion, structure of recursive calls

Lab 10: Recursive functions
Tutorial 11: Pointers, structures and dynamic memory allocation
Lab 11: Pointers and structures
Tutorial 12: File handling:
Lab 12: File operations

Laboratory Outcomes:

1. To formulate the algorithms for simple problems
2. To translate given algorithms to a working and correct program
3. To be able to correct syntax errors as reported by the compilers
4. To be able to identify and correct logical errors encountered at run time
5. To be able to write iterative as well as recursive programs
6. To be able to represent data in arrays, strings and structures and manipulate them through a program
7. To be able to declare pointers of different types and use them in defining self-referential structures.
8. To be able to create, read and write to and from simple text files.

MANUFACTURING PRACTICES (THEORY & LAB.)

Subject Code: BMFPR0-101 **L T P C** **Duration: 80 Hrs.**
1 0 4 3

Lectures & Videos: (10 Hrs.)

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1. Manufacturing Methods- casting, forming, machining, joining, advanced manufacturing Methods.
2. CNC machining, Additive manufacturing.
3. Fitting operations & power tools.
4. Sheet Metal Operations.
5. Electrical & Electronics.
6. Carpentry.
7. Plastic moulding (injection moulding, blow moulding, extrusion moulding), glass cutting.
8. Metal casting.
9. Welding (arc welding & gas welding), brazing.

Recommended Text/Reference Books:

1. S.K. Hajra Choudhury, A.K. Hajra Choudhury and S.K. Nirjhar Roy, ‘Elements of Workshop Technology’, Vol.-I, **2008** and Vol.-II **2010**, Media Promoters and Publishers Pvt. Ltd., Mumbai.
2. S. Kalpakjian, Steven S. Schmid, ‘Manufacturing Engineering and Technology’, 4th Edn., Pearson Education India Edn., **2002**.
3. Gowri P. Hariharan and A. Suresh Babu, ‘Manufacturing Technology – I’, Pearson, **2008**.
4. Roy A. Lindberg, ‘Processes and Materials of Manufacture’, 4th Edn., Prentice Hall India, **1998**.
5. P.N. Rao, ‘Manufacturing Technology’, Vol.-I and Vol.-II, Tata McGraw Hill House, **2017**.

Course Outcomes:

1. Upon completion of this course, the students will gain knowledge of the different manufacturing processes which are commonly employed in the industry, to fabricate components using different materials.

Workshop Practice: (70 Hrs.)

1. Machine shop **(10 Hrs.)**
2. Fitting shop **(8 Hrs.)**

3. Carpentry **(6 Hrs.)**
4. Electrical & Electronics **(8 Hrs.)**
5. Welding shop **(8 Hrs. (Arc welding 4 Hrs. + Gas welding 4 Hrs.)**
6. Casting **(8 Hrs.)**
7. Sheet Metal Operations **(10 Hrs.)**
8. Smithy **(6 Hrs.)**
9. Plastic moulding & Glass Cutting **(6 Hrs.)**
10. Examinations could involve the actual fabrication of simple components, utilizing one or more of the techniques covered above.

Laboratory Outcomes:

1. Upon completion of this laboratory course, students will be able to fabricate components with their own hands.
2. They will also get practical knowledge of the dimensional accuracies and dimensional tolerances possible with different manufacturing processes.
3. By assembling different components, they will be able to produce small devices of their interest.

HUMAN VALUES AND PROFESSIONAL ETHICS

Subject Code: BHUMA0-103 **L T P C** **Duration: 30 Hrs.**
3 0 0 0

UNIT-I (8 Hrs.)

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Meaning of values, Values as social fact, Universal values – equality, justice, freedom/ liberty, inclusion. Distinction between social and culture values and values associated with crafts and occupations. Work and leisure as values – Marx and Veblen

UNIT-II (9 Hrs.)

Values, morality, ethics and their relation with Religion, values as mechanisms of control and coercion. Functional Theory of Values of Talcott Parsons, Theory of Basic Values of Shalom Schwartz, Theory of Protestant Ethic and Capitalism of Max Weber, Bhagwat Gita and Theory of Karma-Dharma, Sikhism and theory of work, dignity of labour, meditation and sharing.

UNIT-III (7 Hrs.)

Meaning and types of Professional Ethics, Goals of professional work and their problems, Normative and evaluative elements in professional work, Duties and obligations, Professional rights, Virtues in professional life (honesty, trustworthiness, transparency, competence, integrity and exemplary conduct), Engineering ethics and service ideals.

UNIT-IV (6 Hrs.)

Technology for and against mankind and environment- fulfilment of human needs, and industrial disasters: case studies – Bhopal Gas Tragedy, Chernobyl and Fukushima Disasters; Equality at work place: gender discrimination and caste/class-based exclusions.

Recommended Books:

1. Schwartz, H. Shalom, 'An Overview of the Schwartz Theory of Basic Values'. Online Readings in Psychology and Culture. **2** (1). doi:10.9707/2307-0919.1116, **2012**.
2. John Berry, Janek, Pandey; Poortinga, Ype 'Handbook of Cross-cultural Psychology', 2nd Edn.. Boston, MA: Allyn and Bacon. p. 77. ISBN 9780205160747, **1997**.
3. Timo Airaksinen, 'The Philosophy of Professional Ethics', University of Helsinki, Finland.
4. Manju Jitendra Jain, 'Yes, It's Possible', Kalpana Publications, Mumbai, **2011**.

GROUP-A
1ST SEMESTER

Course		Contact Hrs.			Marks			Credits
Code	**Name**	**L**	**T**	**P**	**Internal**	**External**	**Total**	
BPHYS3-101	Physics (Waves and Optics and Introduction to Quantum Mechanics)	3	1	0	40	60	100	4
BMATH3-101	Mathematics-I (Calculus and Differential Equations)	3	1	0	40	60	100	4
BMECE0-101	Engineering Graphics & Design	2	0	0	40	60	100	2
BELEE0-101	Basics Electrical Engineering	3	1	0	40	60	100	4
BPHYS3-102	Physics (Wave, Optics & Quantum Mechanics) Lab.	0	0	2	60	40	100	1
BMECE0-102	Engineering Graphics & Design Lab.	0	0	6	60	40	100	3
BELEE0-102	Basics Electrical Engineering Lab.	0	0	2	60	40	100	1
BHUMA0-104	Drug Abuse: Problem, Management and Prevention	3	0	0	100	0	100	0
Total		13	3	8	440	360	800	19

Note:
1. There will be Induction Programme of 3 weeks before start of normal classes.
2. Drug Abuse: Problem, Management and Prevention is a non-credit Course; however, it is necessary to secure at least E grade in it.

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2ND SEMESTER

Course		Contact Hrs.			Marks			Credits
Code	**Name**	**L**	**T**	**P**	**Internal**	**External**	**Total**	
BCHEM0-101	Chemistry-I	3	1	0	40	60	100	4
BMATH3-201	Mathematics-II (Linear Algebra, Transform Calculus and Numerical Methods)	3	1	0	40	60	100	4
BHUMA0-101	English	2	0	0	40	60	100	2
BCSCE0-101	Programming for Problem Solving	3	0	0	40	60	100	3
BCHEM0-102	Chemistry-I Lab.	0	0	2	60	40	100	1
BHUMA0-102	English Lab.	0	0	2	60	40	100	1
BCSCE0-102	Programming for Problem Solving Lab.	0	0	4	60	40	100	2
BMFPR0-101	Manufacturing Practices	1	0	4	60	40	100	3
BHUMA0-103	Human Values & Professional Ethics	3	0	0	100	0	100	0
Total		15	2	12	500	400	900	20

Note:
1. Human Values & Professional Ethics is a non-credit Course; however, it is necessary to secure at least E grade in it.
2. Marks of 4 Week Manufacturing Practices Training during Summer Vacation will be included in 3rd Semester

GROUP-B
1ST SEMESTER

Course		Contact Hrs.			Marks			Credits
Code	Name	L	T	P	Internal	External	Total	
BCHEM0-101	Chemistry-I	3	1	0	40	60	100	4
BMATH3-101	Mathematics-I (Calculus and Differential Equations)	3	1	0	40	60	100	4
BHUMA0-101	English	2	0	0	40	60	100	2
BCSCE0-101	Programming for Problem Solving	3	0	0	40	60	100	3
BCHEM0-102	Chemistry-I Lab.	0	0	2	60	40	100	1
BHUMA0-102	English Lab.	0	0	2	60	40	100	1
BCSCE0-102	Programming for Problem Solving Lab.	0	0	4	60	40	100	2
BMFPR0-101	Manufacturing Practices	1	0	4	60	40	100	3
BHUMA0-103	Human Values & Professional Ethics	3	0	0	100	0	100	0
Total		15	2	12	500	400	900	20

Note:
1. There will be Induction Programme of 3 weeks before start of normal classes.
2. Human Values & Professional Ethics is a non-credit Course; however, it is necessary to secure at least E grade in it.

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2ND SEMESTER

Course		Contact Hrs.			Marks			Credits
Code	Name	L	T	P	Internal	External	Total	
BPHYS3-101	Physics (Waves and Optics and Introduction to Quantum Mechanics)	3	1	0	40	60	100	4
BMATH3-201	Mathematics-II (Linear Algebra, Transform Calculus and Numerical Methods)	3	1	0	40	60	100	4
BMECE0-101	Engineering Graphics & Design	2	0	0	40	60	100	2
BELEE0-101	Basics Electrical Engineering	3	1	0	40	60	100	4
BPHYS3-102	Physics (Wave, Optics & Quantum Mechanics) Lab.	0	0	2	60	40	100	1
BMECE0-102	Engineering Graphics & Design Lab.	0	0	6	60	40	100	3
BELEE0-102	Basics Electrical Engineering Lab.	0	0	2	60	40	100	1
BHUMA0-104	Drug Abuse: Problem, Management and Prevention	3	0	0	100	0	100	0
Total		13	3	8	440	360	800	19

Note:
1. Drug Abuse: Problem, Management and Prevention is a non-credit Course; however, it is necessary to secure at least E grade in it.
2. Marks of 4 Week Manufacturing Practices Training during Summer Vacation will be included in 3rd Semester

PHYSICS (WAVES AND OPTICS AND INTRODUCTION TO QUANTUM MECHANICS)

Subject Code: BPHYS3-101 **L T P C** **Duration: 38 Hrs.**
3 1 0 4

UNIT-I

Electromagnetic Waves and Dielectrics: (10 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 vector, Electromagnetic Spectrum (Basic ideas of different region).

Propagation of Light and Geometric Optics: (10 Hrs.)
Fermat's principle of stationary time and its applications e.g. in explaining mirage effect, laws of reflection and refraction. Brewster's angle, total internal reflection. Huygens' principle, superposition of waves and interference of light by wave-front splitting and amplitude splitting; Young's double slit experiment, Newton's ring experiment. Farunhofer diffraction from a single slit and a circular aperture, the Rayleigh criterion for limit of resolution and its application to vision; Diffraction gratings and their resolving power.

UNIT-III

Lasers and Applications: (8 Hrs.)
Spontaneous and stimulated emission, stimulated absorption, pumping and population inversion, Einstein's theory of matter radiation interaction and A and B coefficients; amplification of light by population inversion, different types of lasers: gas lasers (He-Ne, CO_2), solid-state lasers (ruby), Properties of laser beams: mono-chromaticity, coherence, directionality and brightness, applications of lasers in science, engineering and medicine.

UNIT-IV

Quantum Mechanics: (10 Hrs.)
Introduction to Quantum mechanics, Wave nature of particles, De Broglie's concept, Time-dependent and time-independent Schrodinger equation for wave-function, probability current, Free-particle wave-function and wave-packets, Uncertainty principle, application of uncertainty principle: nonexistence of electron in the nucleus, expectation value. Schrodinger equation for one dimensional problems– particle in a box, linear harmonic oscillator, Concept of scattering from a potential barrier and tunneling.

Recommended Books:

1. David Griffiths, 'Introduction to Electrodynamics'.
2. Gupta & Gaur, 'Engineering Physics', Dhanpat Rai.
3. Malik and Singh, 'Engineering Physics', Tata McGraw Hill.
4. Ian G. Main, 'Oscillations and Waves in Physics'.
5. H.J. Pain, 'The Physics of Vibrations and Waves'.
6. E. Hecht, 'Optics'.
7. Ghatak, 'Optics'.
8. O. Svelto, 'Principles of Lasers'.

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MATHEMATICS-I (CALCULUS AND DIFFERENTIAL EQUATIONS)

Subject Code: BMATH3-101 **L T P C** **Duration: 47 Hrs.**
3 1 0 4

UNIT –I

Calculus: (7 Hrs.)
Rolle's theorem, Mean value theorems, Taylor's and Maclaurin theorems with remainders; Indeterminate forms and L'Hospital's rule; Maxima and minima. Evaluation of definite and improper integrals; Beta and Gamma functions and their properties; Applications of definite integrals to evaluate surface areas and volumes of revolutions.

Sequences and Series: (7 Hrs.)
Convergence of sequence and series, tests for convergence, power series, Taylor's series. Series for exponential, trigonometric and logarithmic functions.

UNIT –II

Multivariable Calculus: Differentiation: (10 Hrs.)
Limit, continuity and partial derivatives, total derivative; Tangent plane and normal line; Maxima, minima and saddle points; Method of Lagrange multipliers; Gradient, curl and divergence: Geometrical interpretation and basic properties, Directional derivative.

UNIT –III

Multivariable Calculus-Integration: (12 Hrs.)
Multiple Integration: double and triple integrals (Cartesian and polar), change of order of integration in double integrals, Change of variables (Cartesian to polar), Applications: areas and volumes by (double integration) Center of mass and Gravity (constant and variable densities). Theorems of Green, Gauss and Stokes (statement only), Simple applications involving cubes, sphere and rectangular parallelepipeds.

UNIT –IV

First Order Ordinary Differential Equations: (5 Hrs.)
Linear and Bernoulli's equations, exact equations, Equations not of first degree: equations solvable for p, equations solvable for y, equations solvable for x and Clairaut's type.

Ordinary Differential Equations of Higher Order: (6 Hrs.)
Second order linear differential equations with variable coefficients, method of variation of parameters, Cauchy-Euler equation; Power series solutions; Frobenius method.

Recommended Books:

1. G.B. Thomas and R.L. Finney, 'Calculus and Analytic Geometry', Pearson, **2002**.
2. T. Veerarajan, 'Engineering Mathematics', McGraw Hill, New Delhi, **2008**.
3. B.V. Ramana, 'Higher Engineering Mathematics', McGraw Hill, New Delhi, **2010**.
4. B.S. Grewal, 'Higher Engineering Mathematics', Khanna Publishers, **2000**.
5. E. Kreyszig, 'Advanced Engineering Mathematics', John Wiley & Sons, **2006**.
6. W.E. Boyce and R.C. DiPrima, 'Elementary Differential Equations and Boundary Value Problems', Wiley India, **2009**.
7. S.L. Ross, 'Differential Equations', Wiley India, **1984**.
8. E.A. Coddington, 'An Introduction to Ordinary Differential Equations', Prentice Hall India, **1995**.
9. E.L. Ince, 'Ordinary Differential Equations', Dover Publications, **1958**.
10. G.F. Simmons and S.G. Krantz, 'Differential Equations', McGraw Hill, **2007.**

Course Outcomes:
The objective of this course is to familiarize the prospective engineers with techniques in calculus, multivariate analysis and linear algebra. It aims to equip the students with standard concepts and tools at an intermediate to advanced level that will serve them well towards tackling more advanced level of mathematics and applications that they would find useful

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in their disciplines.
The students will learn:
1. To apply differential and integral calculus to notions of curvature and to improper integrals. Apart from some other applications they will have a basic understanding of Beta and Gamma functions.
2. The fallouts of Rolle's Theorem that is fundamental to application of analysis to Engineering problems.
3. The tool of power series and Fourier series for learning advanced Engineering Mathematics.
4. To deal with functions of several variables that are essential in most branches of engineering.
5. The essential tool of matrices and linear algebra in a comprehensive manner.

ENGINEERING GRAPHICS & DESIGN

Subject Code: BMECE0-101 **L T P C** **Duration: 24 Hrs.**
2 0 0 2

1. **Traditional Engineering Graphics:**
   Principles of Engineering Graphics; Scales; Orthographic Projection- Points, lines, planes and solids; Descriptive Geometry; Drawing Principles; Isometric Projection; Surface Development; Reading a Drawing; Sectional Views; Dimensioning & Tolerances; True Length, Angle, Shortest Distance.
2. **Computer Graphics:**
   Co-ordinate system; Types of CAD software, draw commands; Modify commands; Dimensioning; setting of units & limits; Editing of Drawing; Printing.

Recommended Text/Reference Books:
1. N.D. Bhatt, V.M. Panchal & P.R. Ingle, 'Engineering Drawing', Charotar Publishing House, **2014**.
2. M.B. Shah & B.C. Rana, 'Engineering Drawing and Computer Graphics', Pearson Education, **2008**.
3. B. Agrawal & C.M. Agrawal, 'Engineering Graphics', TMH Publication, **2012**.
4. K.L. Narayana & P. Kannaiah, 'Text book on Engineering Drawing', Scitech Publishers, **2008**.
5. (Corresponding set of) CAD Software Theory and User Manuals.

Course Outcomes:
All phases of manufacturing or construction require the conversion of new ideas and design concepts into the basic line language of graphics. Therefore, there are many areas (civil, mechanical, electrical, architectural and industrial) in which the skills of the CAD technicians play major roles in the design and development of new products or construction. Students prepare for actual work situations through practical training in a new state-of-the-art computer designed CAD laboratory using engineering software. This course is designed to address:
1. To prepare you to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.
2. To prepare you to communicate effectively.
3. To prepare you to use the techniques, skills, and modern engineering tools necessary for engineering practice.

The student will learn:
1. Introduction to engineering design and its place in society
2. Exposure to the visual aspects of engineering design

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3. Exposure to engineering graphics standards
4. Exposure to solid modelling
5. Exposure to computer-aided geometric design
6. Exposure to creating working drawings
7. Exposure to engineering communication.

BASIC ELECTRICAL ENGINEERING

Subject Code: BELEE0-101 **L T P C** **Duration: 42 Hrs.**
3 1 0 4

UNIT-1

DC Circuits: (8 Hrs.)

Electrical circuit elements (R, L and C), voltage and current sources, Ohm's law, Kirchhoff current and voltage laws, analysis of simple circuits with dc excitation Superposition, Thevenin and Norton Theorems. Step response of RL, RC circuits.

UNIT-2

AC Circuits: (12 Hrs.)

Representation of sinusoidal waveforms, average, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor. Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC series and parallel combinations, series and parallel resonance. Three phase voltage source, phase sequence, three phase balanced circuits, voltage and current relations in star and delta connections.

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UNIT-3

Transformers: (10 Hrs.)

Magnetic materials, BH characteristics, Single-phase Transformer, no load and full load conditions, phasor diagrams, equivalent circuit, calculation of losses in transformers, regulation and efficiency, Auto-transformers, their applications and comparison with two winding transformers.

UNIT-4

Electrical Machines: (8 Hrs.)

Generation of rotating magnetic fields, Construction and working of a three-phase induction motor, Direct-On-Line and Star-Delta starters**.** Construction and working of single-phase motors (Split phase, shaded pole, capacitor start, capacitor run, capacitor start and run motors).

Electrical Installations: (4 Hrs.)

Components of LT Switchgear: Switch Fuse Unit (SFU), Miniature Circuit Breaker (MCB), Earth Leakage Circuit Breaker (ELCB), Moulded Case Circuit Breaker (MCCB), Types of Wiring, Earthing.

Recommended Books:

1. D.P. Kothari and I.J. Nagrath, 'Basic Electrical Engineering', Tata McGraw Hill, **2010**.
2. D.C. Kulshreshtha, 'Basic Electrical Engineering', McGraw Hill, **2009**.
3. L.S. Bobrow, 'Fundamentals of Electrical Engineering', Oxford University Press, **2011**.
4. E. Hughes, 'Electrical and Electronics Technology', Pearson, **2010**.
5. V.D. Toro, 'Electrical Engineering Fundamentals', Prentice Hall, India, **1989**.
6. J.P.S. Dhillon. J.S. Dhillon and D. Singh, 'Principles of Electrical & Electronics Engineering', Kalyani Publishers, New Delhi, **2005**.

Course Outcomes:

1. To understand and analyze basic DC and AC circuits.
2. To study the use and working principle of single phase transformers.
3. To study the application and working principles of three phase and single phase induction motors.

4. To introduce to the components of low voltage electrical installations.

PHYSICS (WAVE, OPTICS & QUANTUM MECHANICS) LAB.

Subject Code: BPHYS3-102 **L T P C**
0 0 2 1

Note: Students will have to perform at least 10 experiments from the given topic/list.

Experiments based on Wave, Optics & Quantum Mechanics (Broad Area):

Photoelectric effect experiment.

1. Frank Hertz Experiment.
2. Recording Hydrogen atom spectrum.
3. Diffraction and interference experiments (From ordinary light/laser pointers).
4. Measurements of speed of light on table top using modulation.
5. Minimum deviation from a prism.

Experiments based on the above mentioned topics:

1. To determine the numerical aperture of a given optic fibre and hence to find its acceptance angle.
2. To determine attenuation & propagation losses in optical fibres.
3. To study the laser beam characteristics like; wave length using diffraction grating aperture & divergence.
4. Study of diffraction using laser beam and thus to determine the grating element.
5. To study laser interference using Michelson's Interferometer.
6. To determine the grain size of a material using optical microscope.
7. To find the refractive index of a material/glass using spectrometer.
8. To find the refractive index of a liquid using spectrometer.
9. To find the velocity of ultrasound in liquid.
10. To determine the specific rotation of sugar using Laurent's half-shade polarimeter.
11. To study the characteristic of different p-n junction diode - Ge and Si.
12. To analyze the suitability of a given Zener diode as voltage regulator.
13. To find out the intensity response of a solar cell/Photo diode.
14. To find out the intensity response of a LED.
15. To understand the phenomenon Photoelectric effect as a whole.

Physics Virtual Lab. Experiments:

16. To find the resolving power of the prism.
17. To determine the angle of the given prism.
18. To determine the refractive index of the material of a prism
19. To determine the numerical aperture of a given optic fibre and hence to find its acceptance angle.
20. To calculate the beam divergence and spot size of the given laser beam.
21. To determine the wavelength of a laser using the Michelson interferometer.
22. To set up and observe Newton's rings.
23. To determine the wavelength of the given source.
24. To understand the phenomenon Photoelectric effect as a whole.
25. To draw kinetic energy of photoelectrons as a function of frequency of incident radiation.
26. To determine the Planck's constant from kinetic energy versus frequency graph.
27. To plot a graph connecting photocurrent and applied potential.
28. To determine the stopping potential from the photocurrent versus applied potential graph.

Note: Any other experiment based on the above mentioned broad topics may be included.

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ENGINEERING GRAPHICS & DESIGN LAB.

Subject Code: BMECE0-102 **L T P C** **Duration: 60 Hrs.**
0 0 6 3

1. **Introduction to Engineering Drawing:**
   Principles of Engineering Graphics and their significance, usage of Drawing instruments, lettering, Dimensioning, Scales – Plain, Dimensioning-Types, System, Principles, Dimensions – Size & Location.
2. **Orthographic Projections:**
   Principles of Orthographic Projections-Conventions - Projections of Points and lines inclined to both planes; Projections of planes inclined Planes - Auxiliary Planes;
3. **Projections of Regular Solids:**
   Basic definitions of solid, types of solid, truncated and frustum of solid, Solids inclined to both the Planes; Draw simple annotation, dimensioning and scale.
4. **Sections and Sectional Views of Right Angular Solids:**
   Prism, Cylinder, Pyramid, Cone – Section of views & true shape; Development of surfaces of Right Regular Solids - Prism, Pyramid, Cylinder and Cone; Development of paper tray, Funnel and Y piece.
5. **Isometric Projections:**
   Principles of Isometric projection – Isometric Scale, Isometric Views, Conventions; Isometric Views of lines, Planes, Simple and compound Solids; Conversion of Isometric Views to Orthographic Views and Vice-versa, Conventions;
6. **Overview of Computer Graphics:**
   Listing the computer technologies that impact on graphical communication, Demonstrating knowledge of the theory of CAD software [such as: The Menu System, Toolbars (Standard, Object Properties, Draw, Modify and Dimension), Drawing Area (Background, Crosshairs, Coordinate System), Dialog boxes and windows, Shortcut menus (Button Bars), The Command Line (where applicable), The Status Bar, Different methods of zoom as used in CAD, Select and erase objects.; Isometric Views of lines, Planes, Simple and compound Solids];
7. **Customization & CAD Drawing:**
   Consisting of set up of the drawing page and the printer, including scale settings, setting up of units and drawing limits; ISO and ANSI standards for coordinate dimensioning and tolerance; Orthographic constraints, Snap to objects manually and automatically; Producing drawings by using various coordinate input entry methods to draw straight lines, Applying various ways of drawing circles;
8. **Annotations, Layering & other Functions:**
   Applying dimensions to objects, applying annotations to drawings; Setting up and use of Layers, layers to create drawings, Create, edit and use customized layers; Changing line lengths through modifying existing lines (extend/lengthen); Printing documents to paper using the print command; orthographic projection techniques.

Note: Examiner shall test the knowledge of students by conducting viva voce from the drawing sheets and through use of Auto CAD.

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BASIC ELECTRICAL ENGINEERING LAB.

Subject Code: BELEE0-102 **L T P C**
0 0 2 1

EXPERIMENTS/DEMONSTRATIONS

1. To study basic safety precautions. Introduction and use of measuring instruments – voltmeter, ammeter, multi-meter, oscilloscope. real-life resistors, capacitors and inductors.
2. To verify Ohm's law.
3. To verify Kirchhoff's voltage and current laws.
4. To verify Superposition Theorem.
5. To verify Thevenin Theorem.
6. To obtain the sinusoidal steady state response of R-L circuit – impedance calculation and verification. Observation of phase differences between current and voltage.
7. To obtain the sinusoidal steady state response of R-C circuit – impedance calculation and verification. Observation of phase differences between current and voltage.
8. To study resonance phenomenon in R-L-C series circuits.
9. To perform open circuit and short circuit test on a single phase transformer and calculate the efficiency.
10. Demonstration of cut-out sections of machines: Induction machine (squirrel cage rotor and slip ring arrangement) and single-phase induction machines.
11. To connect, start and reverse the direction of rotation by change of phase-sequence of connections of three phase induction motor.
12. To connect, start and reverse the direction of rotation of single-phase induction motor.
13. To demonstrate working of DOL starter for three-phase induction motor.
14. To demonstrate working of star-delta starter for three-phase induction motor.
15. To demonstrate the components of LT switchgear.

Laboratory Outcomes:

1. Get an exposure to common electrical components and their ratings.
2. Make electrical connections by wires of appropriate ratings.
3. Understand the usage of common electrical measuring instruments.
4. Understand the basic characteristics of transformers and electrical induction motors.

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DRUG ABUSE: PROBLEM, MANAGEMENT AND PREVENTION

Subject Code: BHUMA0-104 **L T P C** **Duration: 30 Hrs.**
3 0 0 0

UNIT-I

Meaning of Drug Abuse:

Meaning: Drug abuse, Drug dependence and Drug addiction. Nature and extent of drug abuse in India and Punjab.

UNIT-II

Consequences of Drug Abuse:

Individual: Education, Employment, Income.
Family: Violence.
Society: Crime.
Nation: Law and Order problem.

UNIT-III

Prevention of Drug Abuse:

Role of Family: Parent-child relationship, Family support, supervision, shipping values, active scrutiny.

School: Counselling, Teacher as role-model, Parent-teacher-health professional coordination, Random testing on students.

UNIT-IV

Treatment and Control of Drug Abuse:

Medical Management: Medication for treatment and to reduce withdrawal effects.
Psychological Management: Counselling, Behavioural and Cognitive therapy.
Social Management: Family, Group therapy and Environmental intervention.
Treatment: Medical, Psychological and Social Management.
Control: Role of Media and Legislation.

Recommended Books:

1. Ram Ahuja, 'Social Problems in India', Rawat Publications, Jaipur, **2003**.
2. 'Extent, Pattern and Trend of Drug Use in India', Ministry of Social Justice and Empowerment, Govt. of India, **2004.**
3. J.A. Inciardi, 'The Drug Crime Connection', Sage Publications, Beverly Hills, **1981**.
4. T. Kapoor, 'Drug Epidemic among Indian Youth', Mittal Publications, New Delhi, **1985**.
5. Kessel, Neil and Henry Walton, 'Alcoholism, Harmond Worth', Penguin Books, **1982**.
6. Ishwar Modi and Shalini Modi, 'Addiction and Prevention', Rawat Publications, Jaipur, **1997**.
7. 'National Household Survey of Alcohol and Drug Abuse', Clinical Epidemiological Unit, All India Institute of Medical Sciences, New Delhi, **2003 & 2004**.
8. Ross Coomber and Others, 'Key Concept in Drugs and Society', Sage Publications, New Delhi, **2013**.
9. Bhim Sain, 'Drug Addiction Alcoholism, Smoking Obscenity', Mittal Publications, New Delhi, **1991**.
10. Ranvinder Singh Sandhu, 'Drug Addiction in Punjab: A Sociological Study', Guru Nanak Dev University, Amritsar, **2009**.
11. Chandra Paul Singh, 'Alcohol and Dependence among Industrial Workers', Shipra, Delhi, **2000**.
12. S. Sussman and S.L. Ames, 'Drug Abuse: Concepts, Prevention and Cessation', Cambridge University Press, **2008**.
13. P.S. Verma, 'Punjab's Drug Problem: Contours and Characteristics', Vol. LII, No. 3, P.P. 40-43, Economic and Political Weekly, **2017**.
14. 'World Drug Report', United Nations Office of Drug and Crime, **2016**.
15. 'World Drug Report', United Nations Office of Drug and Crime, **2017**.

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CHEMISTRY-I

Subject Code: BCHEM0-101 **L T P C** **Duration: 42 Hrs.**
3 1 0 4

Course Objectives

1. To understand the atomic and & molecular nature of various molecules
2. To understand the band structures
3. To elaborate the applications of spectroscopic techniques
4. To understand the thermodynamic functions and their applications
5. To rationalize periodic properties
6. To understand the concepts of stereochemistry and preparation of organic molecules

UNIT-I

1. Atomic and Molecular Structure: (12 Hrs.)

Bohr Theory of Hydrogen atom, Spectrum of H atom, Sommerfeld extension of Bohr Theory, Particle and wave nature of electron, De-Broglie equation, Aufbau principle, Compton effect, Schrodinger wave equation, Laplacian and Hamiltonian operator, Linear Combination of atomic orbitals. Molecular orbitals of diatomic molecules and Energy level diagrams of homonuclear and heteronuclear diatomics. Pi-molecular orbitals of butadiene and benzene and aromaticity. Crystal field theory and the energy level diagrams for transition metal ions and their magnetic properties. Band structure of solids and the role of doping on band structures.

UNIT-II

2. Spectroscopic Techniques and Applications: (8 Hrs.)

Principles and selection rules of Electronic spectroscopy and Fluorescence spectroscopy along with their applications. Principles and selection rules of Vibrational and rotational spectroscopy of diatomic molecules and their Applications. Nuclear magnetic resonance up to spin-spin coupling and magnetic resonance imaging.

3. Intermolecular Forces and Potential Energy Surfaces: (4 Hrs.)

Ideal gas equation, Ionic, dipolar and van Der Waals interactions. Real gas equation. Equations of state of real gases and critical phenomena. Potential energy surfaces of H_3, and HCN

UNIT-III

4. Use of Free Energy in Chemical Equilibria: (6 Hrs.)

Ideal Solution, Non Ideal Solutions, Thermodynamic functions: energy, entropy and free energy. Numerical problems based on entropy and free energies. Free energy and emf. Cell potentials, the Nernst equation and applications. Acid base, oxidation reduction and solubility equilibria. Thermodynamic properties of ideal solutions. Introduction to Electrochemical Corrosion and its mechanism. Use of free energy considerations in metallurgy through Ellingham diagrams.

5. Periodic Properties: (4 Hrs.)

Effective nuclear charge, penetration of orbitals, variations of s, p, d and f orbital energies of atoms in the periodic table, electronic configurations, atomic and ionic sizes, ionization energies, electron affinity and electronegativity, polarizability, oxidation states, coordination numbers and geometries, hard soft acids and bases principle

UNIT-IV

6. Stereochemistry: (4 Hrs.)

Representations of 3-dimensional structures, structural isomers and stereoisomers, configurations and symmetry and chirality, enantiomers, diastereomers, optical activity, absolute configurations and conformational analysis of butane. Isomerism in transitional metal compounds.

7. Organic Reactions and Synthesis of a Drug Molecule: (4 Hrs.)

Introduction to reactions involving substitution, addition, elimination, oxidation, reduction, cyclization and ring openings. Synthesis of a commonly used drug molecule – β lactum, Paracetamol, Chloroquine and Aspirin

Recommended Books:

1. B.H. Mahan, 'University Chemistry'.
2. M.J. Sienko and R.A. Plane 'Chemistry: Principles and Applications'.
3. C.N. Banwell, 'Fundamentals of Molecular Spectroscopy'.
4. B.L. Tembe, Kamaluddin and M.S. Krishnan, 'Engineering Chemistry (NPTEL Web-book).
5. P.W. Atkins, 'Physical Chemistry'.
6. K.P.C. Volhardt and N.E. Schore 'Organic Chemistry: Structure and Function', 5th Edn., http://bcs.whfreeman.com/vollhardtschore5e/default.asp

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Course Outcomes:

The concepts developed in this course will aid in quantification of several concepts in chemistry that have been introduced at the 10+2 levels in schools. Technology is being increasingly based on the electronic, atomic and molecular level modifications.

Quantum theory is more than 100 years old and to understand phenomena at nanometer levels, one has to base the description of all chemical processes at molecular levels. The course will enable the student to:

1. Analyze microscopic chemistry in terms of atomic and molecular orbitals and intermolecular forces.
2. Rationalize bulk properties and processes using thermodynamic considerations.
3. Distinguish the ranges of the electromagnetic spectrum used for exciting different molecular energy levels in various spectroscopic techniques
4. Rationalize periodic properties such as ionization potential, electronegativity, oxidation states and electronegativity.
5. List major chemical reactions that are used in the synthesis of molecules.

MATHEMATICS-II

Subject Code: BMATH3-201	L T P C 3 1 0 4	Duration: 46 Hrs.

UNIT–I

Linear Algebra: (10 Hrs.)

Algebra of matrices, Inverse and rank of a matrix, rank-nullity theorem; System of linear equations; Symmetric, skew-symmetric and orthogonal matrices; Determinants; Eigenvalues and eigenvectors; Diagonalization of matrices; Cayley-Hamilton Theorem, Orthogonal transformation and quadratic to canonical forms.

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UNIT–II

Numerical Methods-I: (12 Hrs.)

Solution of polynomial and transcendental equations – Bisection method, Newton-Raphson method and Regula-Falsi method. Finite differences, Interpolation using Newton's forward and backward difference formulae. Central difference interpolation: Gauss's forward and backward formulae. Numerical integration: Trapezoidal rule and Simpson's 1/3rd and 3/8 rules.

UNIT–III

Numerical Methods-II: (12 Hrs.)

Ordinary differential equations: Taylor's series, Euler and modified Euler's methods. Runge Kutta method of fourth order for solving first and second order equations. Milne's and Adam's predicator-corrector methods. Partial differential equations: Finite difference solution two dimensional Laplace equation and Poisson equation, Implicit and explicit methods for one dimensional heat equation (Bender-Schmidt and Crank-Nicholson methods), Finite difference explicit method for wave equation.

UNIT–IV

Transform Calculus: (12 Hrs.)

Laplace Transform, Properties of Laplace Transform, Laplace transform of periodic functions. Finding inverse Laplace transform by different methods, convolution theorem. Evaluation of integrals by Laplace transform, solving ODEs and PDEs by Laplace Transform method.

Recommended Books:

1. D. Poole, 'Linear Algebra: A Modern Introduction', Brooks/Cole, **2005**.
2. B.S. Grewal, 'Higher Engineering Mathematics', Khanna Publishers, **2010**.
3. V. Krishnamurthy, V.P. Mainra and J.L. Arora, 'An Introduction to Linear Algebra', Affiliated East-West Press, **2005**.

Course Outcomes:
The objective of this course is to familiarize the prospective engineers with techniques in multivariate integration, ordinary and partial differential equations and complex variables. It aims to equip the students to deal with advanced level of mathematics and applications that would be essential for their disciplines.
The students will learn:
1. The mathematical tools needed in evaluating multiple integrals and their usage.
2. The effective mathematical tools for the solutions of differential equations that model physical processes.
3. The tools of differentiation and integration of functions of a complex variable that are used in various techniques dealing engineering problems.

ENGLISH

Subject Code: BHUMA0-101 **L T P C** **Duration: 25 Hrs.**
2 0 0 2

UNIT-I

1. Vocabulary Building:
1.1 The concept of Word Formation
1.2 Root words from foreign languages and their use in English
1.3 Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives.
1.4 Synonyms, antonyms, and standard abbreviations.

UNIT-II

2. Basic Writing Skills:
2.1 Sentence Structures
2.2 Use of phrases and clauses in sentences
2.3 Importance of proper punctuation
2.4 Creating coherence
2.5 Organizing principles of paragraphs in documents
2.6 Techniques for writing precisely

UNIT-III

3. Identifying Common Errors in Writing:
3.1 Subject-verb agreement
3.2 Noun-pronoun agreement
3.3 Misplaced modifiers
3.4 Articles
3.5 Prepositions
3.6 Redundancies
3.7 Clichés

UNIT-IV

4. Nature and Style of Sensible Writing:
4.1 Describing
4.2 Defining
4.3 Classifying
4.4 Providing examples or evidence
4.5 Writing introduction and conclusion
5. Writing Practices:
5.1 Comprehension
5.2 Précis Writing

MRSPTU

5.3 Essay Writing

Recommended Books:

1. Michael Swan, 'Practical English Usage', OUP, **1995**.
2. F.T. Wood, 'Remedial English Grammar', Macmillan, **2007.**
3. William Zinsser, 'On Writing Well', Harper Resource Book, **2001.**
4. Liz Hamp-Lyons and Ben Heasly, 'Study Writing', Cambridge University Press, **2006**.
5. Sanjay Kumar and Pushp Lata, 'Communication Skills', Oxford University Press, **2011**.
6. 'Exercises in Spoken English', Parts. I-III. CIEFL, Hyderabad. Oxford University Press.

Course Outcomes:

1. The student will acquire basic proficiency in English including reading and listening comprehension, writing and speaking skills.

PROGRAMMING FOR PROBLEM SOLVING

Subject Code: BCSCE0-101	L T P C 3 0 0 3	Duration: 41 Hrs.

UNIT-I

1. Introduction to Programming: (6 Hrs.)

Introduction to components of a computer system (disks, memory, processor, where a program is stored and executed, operating system, compilers etc.). Idea of Algorithm: steps to solve logical and numerical problems. Representation of Algorithm: Flowchart/Pseudocode with examples. From algorithms to programs; source code, variables (with data types) variables and memory locations, Syntax and Logical Errors in compilation, object and executable code.

2. Arithmetic Expressions and Precedence: (12 Hrs.)

Conditional Branching and Loops. Writing and evaluation of conditionals and consequent branching. Iteration and loops.

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UNIT-II

3. Arrays: (5 Hrs.)

Arrays (1-D, 2-D), Character arrays and Strings

4. Basic Algorithms: (5 Hrs.)

Searching, Basic Sorting Algorithms (Bubble, Insertion and Selection), Finding roots of equations, notion of order of complexity through example programs (no formal definition required)

UNIT-III

5. Function: (4 Hrs.)

Functions (including using built in libraries), Parameter passing in functions, call by value, Passing arrays to functions: idea of call by reference

6. Recursion: (4 Hrs.)

Recursion, as a different way of solving problems. Example programs, such as Finding Factorial, Fibonacci series, Ackerman function etc. Quick sort or Merge sort.

UNIT-IV

7. Structure: (3 Hrs.)

Structures, Defining structures and Array of Structures

8. Pointers: (2 Hrs.)

Idea of pointers, Defining pointers, Use of Pointers in self-referential structures, notion of linked list (no implementation)

9. File Handling: (only if time is available, otherwise should be done as part of the lab)

Recommended Text Books:

1. Byron Gottfried, 'Schaum's Outline of Programming with C', McGraw Hill.

2. E. Balaguruswamy, 'Programming in ANSI C', Tata McGraw Hill.

Recommended Reference Books:

1. Brian W. Kernighan and Dennis M. Ritchie, 'The C Programming Language', Prentice Hall of India.

Course Outcomes:

The student will learn

1. To formulate simple algorithms for arithmetic and logical problems.
2. To translate the algorithms to programs (in C language).
3. To test and execute the programs and correct syntax and logical errors.
4. To implement conditional branching, iteration and recursion.
5. To decompose a problem into functions and synthesize a complete program using divide and conquer approach.
6. To use arrays, pointers and structures to formulate algorithms and programs.
7. To apply programming to solve matrix addition and multiplication problems and searching and sorting problems.
8. To apply programming to solve simple numerical method problems, namely rot finding of function, differentiation of function and simple integration.

CHEMISTRY-I LAB.

Subject Code: BCHEM0-101 **L T P C**
0 0 2 1

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Course Objectives:

1. To learn the preparation and standardization of solutions
2. To learn the estimation of various physical properties of given liquid samples
3. To estimate various crucial parameters for water sample
4. To learn the preparation of various molecules and detection of functional groups.

Choice of 10-12 experiments from the following:

1. Preparation of a standard solution
2. Determination of surface tension and viscosity
3. Thin layer chromatography
4. Determination of total Alkalinity/ Acidity of a water sample.
5. Determination of residual chlorine in water sample
6. Estimation of total, temporary and permanent hardness of water
7. Determination of the rate constant of a reaction
8. Determination of strength of an acid conductometrically
9. Potentiometry - determination of redox potentials and emfs
10. Synthesis of a polymer
11. Saponification /acid value of an oil
12. Detection and confirmation of organic functional groups.
13. Models of spatial orientation
14. To test the validity of Lambert Beer law/ Determination of λ_{max} / Determination of unknown concentration of a solution.
15. Determination of the partition coefficient of a substance between two immiscible liquids
16. Adsorption of acetic acid by charcoal
17. Synthesis of a drug – Acetaminophen, Aspirin

Laboratory Outcomes:

The chemistry laboratory course will consist of experiments illustrating the principles of chemistry relevant to the study of science and engineering. The students will learn to:

1. Estimate rate constants of reactions from concentration of reactants/products as a function of time
2. Measure molecular/system properties such as surface tension, viscosity, conductance of solutions, redox potentials, chloride content of water, etc.
3. Synthesize a small drug molecule and analyze a salt sample

ENGLISH LAB.

Subject Code: BHUMA0-102 **L T P C**
0 0 2 1

Oral Communication

(This unit involves interactive practice sessions in Language Lab.)

1. Listening Comprehension
2. Pronunciation, Intonation, Stress and Rhythm
3. Common Everyday Situations: Conversations and Dialogues
4. Communication at Workplace
5. Interviews
6. Formal Presentations

PROGRAMMING FOR PROBLEM SOLVING LAB.

Subject Code: BCSCE0-102 **L T P C**
0 0 4 2

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NOTE: The laboratory should be preceded or followed by a tutorial to explain the approach or algorithm to be implemented for the problem given.
Tutorial 1: Problem solving using computers:
Lab1: Familiarization with programming environment
Tutorial 2: Variable types and type conversions:
Lab 2: Simple computational problems using arithmetic expressions
Tutorial 3: Branching and logical expressions:
Lab 3: Problems involving if-then-else structures
Tutorial 4: Loops, while and for loops:
Lab 4: Iterative problems e.g., sum of series
Tutorial 5: 1D Arrays: searching, sorting:
Lab 5: 1D Array manipulation
Tutorial 6: 2D arrays and Strings
Lab 6: Matrix problems, String operations
Tutorial 7: Functions, call by value:
Lab 7: Simple functions
Tutorial 8 &9: Numerical methods (Root finding, numerical differentiation, numerical integration):
Lab 8 and 9: Programming for solving Numerical methods problems
Tutorial 10: Recursion, structure of recursive calls
Lab 10: Recursive functions
Tutorial 11: Pointers, structures and dynamic memory allocation
Lab 11: Pointers and structures
Tutorial 12: File handling:
Lab 12: File operations
Laboratory Outcomes:

1. To formulate the algorithms for simple problems
2. To translate given algorithms to a working and correct program
3. To be able to correct syntax errors as reported by the compilers
4. To be able to identify and correct logical errors encountered at run time
5. To be able to write iterative as well as recursive programs
6. To be able to represent data in arrays, strings and structures and manipulate them through a program
7. To be able to declare pointers of different types and use them in defining self-referential structures.
8. To be able to create, read and write to and from simple text files.

MANUFACTURING PRACTICES (THEORY & LAB.)

Subject Code: BMFPR0-101 **L T P C** **Duration: 80 Hrs.**
1 0 4 3

Lectures & Videos: (10 Hrs.)

1. Manufacturing Methods- casting, forming, machining, joining, advanced manufacturing Methods.
2. CNC machining, Additive manufacturing.
3. Fitting operations & power tools.
4. Sheet Metal Operations.
5. Electrical & Electronics.
6. Carpentry.
7. Plastic moulding (injection moulding, blow moulding, extrusion moulding), glass cutting.
8. Metal casting.
9. Welding (arc welding & gas welding), brazing.

Recommended Books:

1. S.K. Hajra Choudhury, A.K. Hajra Choudhury and S.K. Nirjhar Roy, ‘Elements of Workshop Technology’, Vol.-I, **2008** and Vol.-II **2010**, Media Promoters and Publishers Pvt. Ltd., Mumbai.
2. S. Kalpakjian, Steven S. Schmid, ‘Manufacturing Engineering and Technology’, 4th Edn., Pearson Education India Edn., **2002**.
3. Gowri P. Hariharan and A. Suresh Babu, ‘Manufacturing Technology – I’, Pearson, **2008**.
4. Roy A. Lindberg, ‘Processes and Materials of Manufacture’, 4th Edn., Prentice Hall India, **1998**.
5. P.N. Rao, ‘Manufacturing Technology’, Vol.-I and Vol.-II, Tata McGraw Hill House, **2017**.

Course Outcomes:

1. Upon completion of this course, the students will gain knowledge of the different manufacturing processes which are commonly employed in the industry, to fabricate components using different materials.

Workshop Practice: (70 Hrs.)

1. Machine shop **(10 Hrs.)**
2. Fitting shop **(8 Hrs.)**
3. Carpentry **(6 Hrs.)**
4. Electrical & Electronics **(8 Hrs.)**
5. Welding shop **(8 Hrs. (Arc welding 4 Hrs. + Gas welding 4 Hrs.)**
6. Casting **(8 Hrs.)**
7. Sheet Metal Operations **(10 Hrs.)**
8. Smithy **(6 Hrs.)**

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9. Plastic moulding & Glass Cutting **(6 Hrs.)**
10. Examinations could involve the actual fabrication of simple components, utilizing one or more of the techniques covered above.

Laboratory Outcomes:

1. Upon completion of this laboratory course, students will be able to fabricate components with their own hands.
2. They will also get practical knowledge of the dimensional accuracies and dimensional tolerances possible with different manufacturing processes.
3. By assembling different components, they will be able to produce small devices of their interest.

HUMAN VALUES AND PROFESSIONAL ETHICS

Subject Code: BHUMA0-103 **L T P C** **Duration: 30 Hrs.**

3 0 0 0

UNIT-I (8 Hrs.)

Meaning of values, Values as social fact, Universal values – equality, justice, freedom/ liberty, inclusion. Distinction between social and culture values and values associated with crafts and occupations. Work and leisure as values – Marx and Veblen

UNIT-II (9 Hrs.)

Values, morality, ethics and their relation with Religion, values as mechanisms of control and coercion. Functional Theory of Values of Talcott Parsons, Theory of Basic Values of Shalom Schwartz, Theory of Protestant Ethic and Capitalism of Max Weber, Bhagwat Gita and Theory of Karma-Dharma, Sikhism and theory of work, dignity of labour, meditation and sharing.

UNIT-III (7 Hrs.)

Meaning and types of Professional Ethics, Goals of professional work and their problems, Normative and evaluative elements in professional work, Duties and obligations, Professional rights, Virtues in professional life (honesty, trustworthiness, transparency, competence, integrity and exemplary conduct), Engineering ethics and service ideals.

UNIT-IV (6 Hrs.)

Technology for and against mankind and environment- fulfilment of human needs, and industrial disasters: case studies – Bhopal Gas Tragedy, Chernobyl and Fukushima Disasters; Equality at work place: gender discrimination and caste/class-based exclusions.

Recommended Books:

1. Schwartz, H. Shalom, 'An Overview of the Schwartz Theory of Basic Values'. Online Readings in Psychology and Culture. **2** (1). doi:10.9707/2307-0919.1116, **2012**.
2. John Berry, Janek, Pandey; Poortinga, Ype 'Handbook of Cross-cultural Psychology', 2nd Edn.. Boston, MA: Allyn and Bacon. p. 77. ISBN 9780205160747, **1997**.
3. Timo Airaksinen, 'The Philosophy of Professional Ethics', University of Helsinki, Finland.
4. Manju Jitendra Jain, 'Yes, It's Possible', Kalpana Publications, Mumbai, **2011**.

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GROUP-A
1ST SEMESTER

Course		Contact Hrs.			Marks			Credits
Code	Name	L	T	P	Internal	External	Total	
BPHYS2-101	Physics (Electromagnetism)	3	1	0	40	60	100	4
BMATH2-101	Mathematics-I (Calculus and Linear Algebra)	3	1	0	40	60	100	4
BMECE0-101	Engineering Graphics & Design	2	0	0	40	60	100	2
BELEE0-101	Basics Electrical Engineering	3	1	0	40	60	100	4
BPHYS2-102	Physics (Electromagnetism) Lab.	0	0	2	60	40	100	1
BMECE0-102	Engineering Graphics & Design Lab.	0	0	6	60	40	100	3
BELEE0-102	Basics Electrical Engineering Lab.	0	0	2	60	40	100	1
BHUMA0-104	Drug Abuse: Problem, Management and Prevention	3	0	0	100	0	100	0
Total		13	3	8	440	360	800	19

Note:

1. **There will be Induction Programme of 3 weeks before start of normal classes.**
2. **Drug Abuse: Problem, Management and Prevention is a non-credit Course; however, it is necessary to secure at least E grade in it.**

2ND SEMESTER

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Course		Contact Hrs.			Marks			Credits
Code	Name	L	T	P	Internal	External	Total	
BCHEM0-101	Chemistry-I	3	1	0	40	60	100	4
BMATH2-201	Mathematics-II (Calculus, Ordinary Differential Equations and Complex Variable)	3	1	0	40	60	100	4
BHUMA0-101	English	2	0	0	40	60	100	2
BCSCE0-101	Programming for Problem Solving	3	0	0	40	60	100	3
BCHEM0-102	Chemistry-I Lab.	0	0	2	60	40	100	1
BHUMA0-102	English Lab.	0	0	2	60	40	100	1
BCSCE0-102	Programming for Problem Solving Lab.	0	0	4	60	40	100	2
BMFPR0-101	Manufacturing Practices	1	0	4	60	40	100	3
BHUMA0-103	Human Values & Professional Ethics	3	0	0	100	0	100	0
Total		15	2	12	500	400	900	20

Note:

1. **Human Values & Professional Ethics is a non-credit Course; however, it is necessary to secure at least E grade in it.**
2. **Marks of 4 Week Manufacturing Practices Training during Summer Vacation will be included in 3rd Semester**

GROUP-B
1ST SEMESTER

Course		Contact Hrs.			Marks			Credits
Code	Name	L	T	P	Internal	External	Total	
BCHEM0-101	Chemistry-I	3	1	0	40	60	100	4
BMATH2-101	Mathematics-I (Calculus and Linear Algebra)	3	1	0	40	60	100	4
BHUMA0-101	English	2	0	0	40	60	100	2
BCSCE0-101	Programming for Problem Solving	3	0	0	40	60	100	3
BCHEM0-102	Chemistry-I Lab.	0	0	2	60	40	100	1
BHUMA0-102	English Lab.	0	0	2	60	40	100	1
BCSCE0-102	Programming for Problem Solving Lab.	0	0	4	60	40	100	2
BMFPR0-101	Manufacturing Practices	1	0	4	60	40	100	3
BHUMA0-103	Human Values & Professional Ethics	3	0	0	100	0	100	0
Total		15	2	12	500	400	900	20

Note:
1. There will be Induction Programme of 3 weeks before start of normal classes.
2. Human Values & Professional Ethics is a non-credit Course; however, it is necessary to secure at least E grade in it.

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2ND SEMESTER

Course		Contact Hrs.			Marks			Credits
Code	Name	L	T	P	Internal	External	Total	
BPHYS2-101	Physics (Electromagnetism)	3	1	0	40	60	100	4
BMATH2-201	Mathematics-II (Calculus, Ordinary Differential Equations and Complex Variable)	3	1	0	40	60	100	4
BMECE0-101	Engineering Graphics & Design	2	0	0	40	60	100	2
BELEE0-101	Basics Electrical Engineering	3	1	0	40	60	100	4
BPHYS2-102	Physics (Electromagnetism) Lab.	0	0	2	60	40	100	1
BMECE0-102	Engineering Graphics & Design Lab.	0	0	6	60	40	100	3
BELEE0-102	Basics Electrical Engineering Lab.	0	0	2	60	40	100	1
BHUMA0-104	Drug Abuse: Problem, Management and Prevention	3	0	0	100	0	100	0
Total		13	3	8	440	360	800	19

Note:
1. Drug Abuse: Problem, Management and Prevention is a non-credit Course; however, it is necessary to secure at least E grade in it.
2. Marks of 4 Week Manufacturing Practices Training during Summer Vacation will be included in 3rd Semester

PHYSICS (ELECTROMAGNETISM)

Subject Code: BPHYS2-101 **L T P C** **Duration: 38 Hrs.**
3 1 0 4

UNIT-I

1. Electrostatics in Vacuum and in Linear Dielectric Medium: (10 Hrs.)
Calculation of electric field and electrostatic potential for a charge distribution; Divergence and curl of electrostatic field; Laplace's and Poisson's equations for electrostatic potential. Basic idea of uniqueness theorem and method of images (plane conducting surface). Introduction to boundary conditions of electric field and electrostatic potential. Electrostatic field and potential of a dipole. Bound charges due to electric polarization; Electric displacement; boundary conditions on displacement.

UNIT-II

2. Magnetostatics and Magnetostatics in Linear Magnetic Medium: (10 Hrs.)
Bio-Savart law, Divergence and curl of static magnetic field; vector potential and calculating it for a given magnetic field. Concept of magnetization and associated bound currents; auxiliary magnetic field H, Boundary conditions on B and H. Magnetic susceptibility and ferromagnetic, paramagnetic and diamagnetic materials. Qualitative discussion of magnetic field in presence of magnetic materials.

UNIT-III

3. Faraday's Laws and Maxwell's Equations: (10 Hrs.)
Introduction to Faraday's law, Differential form of Faraday's law expressing curl of electric field in terms of time-derivative of magnetic field and calculating electric field due to changing magnetic fields. Continuity equation for current densities; Modifying equation for the curl of magnetic field to satisfy continuity equation; displacement current and magnetic field arising from time dependent electric field; Maxwell's equation in vacuum and non-conducting medium. Poynting vector (concept only).

UNIT-IV

4. Electromagnetic Waves: (8 Hrs.)
The wave equation; Plane electromagnetic waves in vacuum, their transverse nature and polarization; relation between electric and magnetic fields of an electromagnetic wave; energy carried by electromagnetic waves.

Recommended Books:

1. David Griffiths, 'Introduction to Electrodynamics'.
2. Prabir K. Basu & Hrishikesh Dhasmana, 'Electromagnetic Theory'.
3. Khunita, 'Fundamentals of Electromagnetic Theory'.
4. S.P. Puri, 'Classical Electrodynamics', Tata McGraw Hill
5. Gupta & Gaur, 'Engineering Physics', Dhanpat Rai.
6. Malik and Singh, 'Engineering Physics', Tata McGraw Hill.
7. Naidu, 'Engineering Physics', Pearson.

MATHEMATICS-I

Subject Code: BMATH2-101 **L T P C** **Duration: 40 Hrs.**
3 1 0 4

UNIT-I

Calculus: (12 Hrs.)
Rolle's Theorem, Mean value theorems, Taylor's and Maclaurin theorems with remainders; indeterminate forms and L'Hospital's rule; Maxima and minima. Evaluation of definite and

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improper integrals; Beta and Gamma functions and their properties; Applications of definite integrals to evaluate surface areas and volumes of revolutions.

UNIT-II

Sequences and Series: (11 Hrs.)

Convergence of sequence and series, tests for convergence (Comparison test, Ratio test, Raabe's test, Logarithmic test, Cauchy's root test, Cauchy's Integral test, series of positive and negative terms); Power series, Taylor's series, series for exponential, trigonometric and logarithm functions.

UNIT-III

Multivariable Calculus (Differentiation): (11 Hrs.)

Limit, continuity and partial derivatives, total derivative; Tangent plane and normal line; Maxima, minima and saddle points; Method of Lagrange multipliers; Gradient, curl and divergence: Geometrical interpretation and basic properties, Directional derivative.

UNIT-IV

Linear Algebra: (12 Hrs.)

Inverse and rank of a matrix, rank-nullity theorem; System of linear equations; Symmetric, skew-symmetric and orthogonal matrices; Determinants; Eigenvalues and eigenvectors; Diagonalization of matrices; Cayley-Hamilton Theorem, and Orthogonal transformation.

Recommended Books:

1. G.B. Thomas and R.L. Finney, 'Calculus and Analytic Geometry', 9th Edn., Pearson, Reprint, **2002**.
2. Erwin Kreyszig, 'Advanced Engineering Mathematics', 9th Edn., John Wiley & Sons, **2006**.
3. T. Veerarajan, 'Engineering Mathematics for First Year', Tata McGraw Hill, New Delhi, **2008**.
4. B.V. Ramana, 'Higher Engineering Mathematics', 11th Reprint, Tata McGraw Hill, New Delhi, **2010**.
5. D. Poole, 'Linear Algebra: A Modern Introduction', 2nd Edn., Brooks/Cole, **2005**.
6. B.S. Grewal, 'Higher Engineering Mathematics', 36th Edn., Khanna Publishers, **2010**.

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Course Outcomes:

The objective of this course is to familiarize the prospective engineers with techniques in calculus, multivariate analysis and linear algebra. It aims to equip the students with standard concepts and tools at an intermediate to advanced level that will serve them well towards tackling more advanced level of mathematics and applications that they would find useful in their disciplines.

The students will learn:

1. To apply differential and integral calculus to notions of curvature and to improper integrals. Apart from some other applications they will have a basic understanding of Beta and Gamma functions.
2. The fallouts of Rolle's Theorem that is fundamental to application of analysis to Engineering problems.
3. The tool of power series and Fourier series for learning advanced Engineering Mathematics.
4. To deal with functions of several variables that are essential in most branches of engineering.
5. The essential tool of matrices and linear algebra in a comprehensive manner.

ENGINEERING GRAPHICS & DESIGN

Subject Code: BMECE0-101 **L T P C** **Duration: 24 Hrs.**
2 0 0 2

1. **Traditional Engineering Graphics:**
   Principles of Engineering Graphics; Scales; Orthographic Projection- Points, lines, planes and solids; Descriptive Geometry; Drawing Principles; Isometric Projection; Surface Development; Reading a Drawing; Sectional Views; Dimensioning & Tolerances; True Length, Angle, Shortest Distance.
2. **Computer Graphics:**
   Co-ordinate system; Types of CAD software, draw commands; Modify commands; Dimensioning; setting of units & limits; Editing of Drawing; Printing.

Recommended Text/Reference Books:

1. N.D. Bhatt, V.M. Panchal & P.R. Ingle, 'Engineering Drawing', Charotar Publishing House, **2014**.
2. M.B. Shah & B.C. Rana, 'Engineering Drawing and Computer Graphics', Pearson Education, **2008**.
3. B. Agrawal & C.M. Agrawal, 'Engineering Graphics', TMH Publication, **2012**.
4. K.L. Narayana & P. Kannaiah, 'Text book on Engineering Drawing', Scitech Publishers, **2008**.
5. (Corresponding set of) CAD Software Theory and User Manuals.

Course Outcomes:

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All phases of manufacturing or construction require the conversion of new ideas and design concepts into the basic line language of graphics. Therefore, there are many areas (civil, mechanical, electrical, architectural and industrial) in which the skills of the CAD technicians play major roles in the design and development of new products or construction. Students prepare for actual work situations through practical training in a new state-of-the-art computer designed CAD laboratory using engineering software. This course is designed to address:

1. To prepare you to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.
2. To prepare you to communicate effectively.
3. To prepare you to use the techniques, skills, and modern engineering tools necessary for engineering practice.

The student will learn:

1. Introduction to engineering design and its place in society
2. Exposure to the visual aspects of engineering design
3. Exposure to engineering graphics standards
4. Exposure to solid modelling
5. Exposure to computer-aided geometric design
6. Exposure to creating working drawings
7. Exposure to engineering communication

BASIC ELECTRICAL ENGINEERING

Subject Code: BELEE0-101 **L T P C** **Duration: 42 Hrs.**
3 1 0 4

UNIT-1

DC Circuits: (8 Hrs.)
Electrical circuit elements (R, L and C), voltage and current sources, Ohm's law, Kirchhoff current and voltage laws, analysis of simple circuits with dc excitation Superposition, Thevenin and Norton Theorems. Step response of RL, RC circuits.

UNIT-2

AC Circuits: (12 Hrs.)
Representation of sinusoidal waveforms, average, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor. Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC series and parallel combinations, series and parallel resonance. Three phase voltage source, phase sequence, three phase balanced circuits, voltage and current relations in star and delta connections.

UNIT-3

Transformers: (10 Hrs.)
Magnetic materials, BH characteristics, Single-phase Transformer, no load and full load conditions, phasor diagrams, equivalent circuit, calculation of losses in transformers, regulation and efficiency, Auto-transformers, their applications and comparison with two winding transformers.

UNIT-4

Electrical Machines: (8 Hrs.)
Generation of rotating magnetic fields, Construction and working of a three-phase induction motor, Direct-On-Line and Star-Delta starters. Construction and working of single-phase motors (Split phase, shaded pole, capacitor start, capacitor run, capacitor start and run motors).
Electrical Installations: (4 Hrs.)
Components of LT Switchgear: Switch Fuse Unit (SFU), Miniature Circuit Breaker (MCB), Earth Leakage Circuit Breaker (ELCB), Moulded Case Circuit Breaker (MCCB), Types of Wiring, Earthing.

Recommended Books:

1. D.P. Kothari and I.J. Nagrath, 'Basic Electrical Engineering', Tata McGraw Hill, **2010**.
2. D.C. Kulshreshtha, 'Basic Electrical Engineering', McGraw Hill, **2009**.
3. L.S. Bobrow, 'Fundamentals of Electrical Engineering', Oxford University Press, **2011**.
4. E. Hughes, 'Electrical and Electronics Technology', Pearson, **2010**.
5. V.D. Toro, 'Electrical Engineering Fundamentals', Prentice Hall, India, **1989**.
6. J.P.S. Dhillon. J.S. Dhillon and D. Singh, 'Principles of Electrical & Electronics Engineering', Kalyani Publishers, New Delhi, **2005**.

Course Outcomes:
1. To understand and analyze basic DC and AC circuits.
2. To study the use and working principle of single phase transformers.
3. To study the application and working principles of three phase and single phase induction motors.
4. To introduce to the components of low voltage electrical installations.

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PHYSICS (ELECTROMAGNETISM) LAB.

Subject Code: BPHYS2-102 **L T P C**
0 0 2 1

Note: Students will have to perform at least 10 experiments from the given topic/list.

<u>Experiments based on Electromagnetism (Broad Area):</u>

1. Experiments on electromagnetic induction and electromagnetic breaking;
2. LC circuit and LCR circuit;
3. Resonance phenomena in LCR circuits;
4. Magnetic field from Helmholtz coil;
5. Measurement of Lorentz force in a vacuum tube.

Experiments based on the above mentioned topics:

1. To determine unknown capacitance by flashing and quenching method.
2. To study the Characteristics of a Series RC Circuit.
3. To determine the self-inductance of the coil (L) using Anderson's bridge.
4. To study the series LCR circuit and determine its (a) Resonant Frequency, (b) Quality factor.
5. To study a parallel LCR circuit and determine its (a) Anti-resonant frequency (b) Quality factor Q.
6. To determine self-inductance of a coil by Rayleigh's method.
7. To determine the mutual inductance of two coils by Absolute method.
8. To study the magnetic field of a circular coil carrying current.
9. To study B-H curve using CRO.
10. To find out the frequency of AC mains using electric-vibrator.
11. To find out polarizability of a dielectric substance.
12. Measurement of field strength B and its variation in a Solenoid (Determine dB/dx).
13. To study the variation of magnetic field with distance along axis of a circular coil-realization of Helmholtz's coils.
14. To study the induced emf as a function of the velocity of magnet and to study the phenomenon of electromagnetic damping.
15. To study the field pattern of various modes inside a rectangular waveguide.
16. To study the field pattern of various modes inside a rectangular waveguide.

Virtual Lab Experiments:

17. To find out the horizontal component of earth's magnetic field (Bh).
18. An experiment to study the variation of magnetic field with distance along the axis of a circular coil carrying current.
19. Aim is to find the horizontal intensity of earth's magnetic field at a place and moment of the bar magnet.
20. To determine the self-inductance of the coil (L) using Anderson's bridge.
21. To calculate the value of inductive reactance (XL) of the coil at a particular frequency.
22. The temperature coefficient of resistor simulation will help the user to easily identify the change in resistivity of the resistor according to the change in temperature.

Note: Any other experiment based on the above mentioned broad topics may be included.

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ENGINEERING GRAPHICS & DESIGN LAB.

Subject Code: BMECE0-102 **L T P C** **Duration: 60 Hrs.**

0 0 6 3

1. **Introduction to Engineering Drawing:**
   Principles of Engineering Graphics and their significance, usage of Drawing instruments, lettering, Dimensioning, Scales – Plain, Dimensioning-Types, System, Principles, Dimensions – Size & Location.
2. **Orthographic Projections:**
   Principles of Orthographic Projections-Conventions - Projections of Points and lines inclined to both planes; Projections of planes inclined Planes - Auxiliary Planes;
3. **Projections of Regular Solids:**
   Basic definitions of solid, types of solid, truncated and frustum of solid, Solids inclined to both the Planes; Draw simple annotation, dimensioning and scale.

4. **Sections and Sectional Views of Right Angular Solids:**
   Prism, Cylinder, Pyramid, Cone – Section of views & true shape; Development of surfaces of Right Regular Solids - Prism, Pyramid, Cylinder and Cone; Development of paper tray, Funnel and Y piece.
5. **Isometric Projections:**
   Principles of Isometric projection – Isometric Scale, Isometric Views, Conventions; Isometric Views of lines, Planes, Simple and compound Solids; Conversion of Isometric Views to Orthographic Views and Vice-versa, Conventions;
6. **Overview of Computer Graphics:**
   Listing the computer technologies that impact on graphical communication, Demonstrating knowledge of the theory of CAD software [such as: The Menu System, Toolbars (Standard, Object Properties, Draw, Modify and Dimension), Drawing Area (Background, Crosshairs, Coordinate System), Dialog boxes and windows, Shortcut menus (Button Bars), The Command Line (where applicable), The Status Bar, Different methods of zoom as used in CAD, Select and erase objects.; Isometric Views of lines, Planes, Simple and compound Solids];
7. **Customization & CAD Drawing:**
   Consisting of set up of the drawing page and the printer, including scale settings, setting up of units and drawing limits; ISO and ANSI standards for coordinate dimensioning and tolerance; Orthographic constraints, Snap to objects manually and automatically; Producing drawings by using various coordinate input entry methods to draw straight lines, Applying various ways of drawing circles;
8. **Annotations, Layering & other Functions:**
   Applying dimensions to objects, applying annotations to drawings; Setting up and use of Layers, layers to create drawings, Create, edit and use customized layers; Changing line lengths through modifying existing lines (extend/lengthen); Printing documents to paper using the print command; orthographic projection techniques.

Note: Examiner shall test the knowledge of students by conducting viva voce from the drawing sheets and through use of Auto CAD.

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BASIC ELECTRICAL ENGINEERING LAB.

Subject Code: BELEE0-102 **L T P C**
0 0 2 1

EXPERIMENTS/DEMONSTRATIONS

1. To study basic safety precautions. Introduction and use of measuring instruments – voltmeter, ammeter, multi-meter, oscilloscope. real-life resistors, capacitors and inductors.
2. To verify Ohm's law.
3. To verify Kirchhoff's voltage and current laws.
4. To verify Superposition Theorem.
5. To verify Thevenin Theorem.
6. To obtain the sinusoidal steady state response of R-L circuit – impedance calculation and verification. Observation of phase differences between current and voltage.
7. To obtain the sinusoidal steady state response of R-C circuit – impedance calculation and verification. Observation of phase differences between current and voltage.
8. To study resonance phenomenon in R-L-C series circuits.
9. To perform open circuit and short circuit test on a single phase transformer and calculate the efficiency.
10. Demonstration of cut-out sections of machines: Induction machine (squirrel cage rotor and slip ring arrangement) and single-phase induction machines.
11. To connect, start and reverse the direction of rotation by change of phase-sequence of connections of three phase induction motor.
12. To connect, start and reverse the direction of rotation of single-phase induction motor.
13. To demonstrate working of DOL starter for three-phase induction motor.
14. To demonstrate working of star-delta starter for three-phase induction motor.
15. To demonstrate the components of LT switchgear.

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Laboratory Outcomes

1. Get an exposure to common electrical components and their ratings.
2. Make electrical connections by wires of appropriate ratings.
3. Understand the usage of common electrical measuring instruments.
4. Understand the basic characteristics of transformers and electrical induction motors.

DRUG ABUSE: PROBLEM, MANAGEMENT AND PREVENTION

Subject Code: BHUMA0-104 **L T P C** **Duration: 30 Hrs.**
3 0 0 0

UNIT-I

Meaning of Drug Abuse:
Meaning: Drug abuse, Drug dependence and Drug addiction. Nature and extent of drug abuse in India and Punjab.

UNIT-II

Consequences of Drug Abuse:
Individual: Education, Employment, Income.
Family: Violence.
Society: Crime.
Nation: Law and Order problem.

UNIT-III

Prevention of Drug Abuse:

Role of Family: Parent-child relationship, Family support, supervision, shipping values, active scrutiny.

School: Counselling, Teacher as role-model, Parent-teacher-health professional coordination, Random testing on students.

UNIT-IV

Treatment and Control of Drug Abuse:

Medical Management: Medication for treatment and to reduce withdrawal effects.

Psychological Management: Counselling, Behavioural and Cognitive therapy.

Social Management: Family, Group therapy and Environmental intervention.

Treatment: Medical, Psychological and Social Management.

Control: Role of Media and Legislation.

Recommended Books:

1. Ram Ahuja, 'Social Problems in India', Rawat Publications, Jaipur, **2003**.
2. 'Extent, Pattern and Trend of Drug Use in India', Ministry of Social Justice and Empowerment, Govt. of India, **2004.**
3. J.A. Inciardi, 'The Drug Crime Connection', Sage Publications, Beverly Hills, **1981**.
4. T. Kapoor, 'Drug Epidemic among Indian Youth', Mittal Publications, New Delhi, **1985**.
5. Kessel, Neil and Henry Walton, 'Alcoholism, Harmond Worth', Penguin Books, **1982**.
6. Ishwar Modi and Shalini Modi, 'Addiction and Prevention', Rawat Publications, Jaipur, **1997.**
7. 'National Household Survey of Alcohol and Drug Abuse', Clinical Epidemiological Unit, All India Institute of Medical Sciences, New Delhi, **2003 & 2004**.
8. Ross Coomber and Others, 'Key Concept in Drugs and Society', Sage Publications, New Delhi, **2013**.
9. Bhim Sain, 'Drug Addiction Alcoholism, Smoking Obscenity', Mittal Publications, New Delhi, **1991**.
10. Ranvinder Singh Sandhu, 'Drug Addiction in Punjab: A Sociological Study', Guru Nanak Dev University, Amritsar, **2009**.
11. Chandra Paul Singh, 'Alcohol and Dependence among Industrial Workers', Shipra, Delhi, **2000**.
12. S. Sussman and S.L. Ames, 'Drug Abuse: Concepts, Prevention and Cessation', Cambridge University Press, **2008**.
13. P.S. Verma, 'Punjab's Drug Problem: Contours and Characteristics', Vol. LII, No. 3, P.P. 40-43, Economic and Political Weekly, **2017**.
14. 'World Drug Report', United Nations Office of Drug and Crime, **2016**.
15. 'World Drug Report', United Nations Office of Drug and Crime, **2017**.

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CHEMISTRY-I

Subject Code: BCHEM0-101	**L T P C** **3 1 0 4**	**Duration: 42 Hrs.**

Course Objectives:

1. To understand the atomic and & molecular nature of various molecules
2. To understand the band structures
3. To elaborate the applications of spectroscopic techniques
4. To understand the thermodynamic functions and their applications
5. To rationalize periodic properties
6. To understand the concepts of stereochemistry and preparation of organic molecules

UNIT-I

1. Atomic and Molecular Structure: (12 Hrs.)

Bohr Theory of Hydrogen atom, Spectrum of H atom, Sommerfeld extension of Bohr Theory, Particle and wave nature of electron, De-Broglie equation, Aufbau principle, Compton effect, Schrodinger wave equation, Laplacian and Hamiltonian operator, Linear Combination of atomic orbitals. Molecular orbitals of diatomic molecules and Energy level diagrams of homonuclear and heteronuclear diatomics. Pi-molecular orbitals of butadiene and benzene and aromaticity. Crystal field theory and the energy level diagrams for transition metal ions and their magnetic properties. Band structure of solids and the role of doping on band structures.

UNIT-II

2. Spectroscopic Techniques and Applications: (8 Hrs.)

Principles and selection rules of Electronic spectroscopy and Fluorescence spectroscopy along with their applications. Principles and selection rules of Vibrational and rotational spectroscopy of diatomic molecules and their Applications. Nuclear magnetic resonance up to spin-spin coupling and magnetic resonance imaging.

3. Intermolecular Forces and Potential Energy Surfaces: (4 Hrs.)

Ideal gas equation, Ionic, dipolar and van Der Waals interactions. Real gas equation. Equations of state of real gases and critical phenomena. Potential energy surfaces of H_3, and HCN

UNIT-III

4. Use of Free Energy in Chemical Equilibria: (6 Hrs.)

Ideal Solution, Non Ideal Solutions, Thermodynamic functions: energy, entropy and free energy. Numerical problems based on entropy and free energies. Free energy and emf. Cell potentials, the Nernst equation and applications. Acid base, oxidation reduction and solubility equilibria. Thermodynamic properties of ideal solutions. Introduction to Electrochemical Corrosion and its mechanism. Use of free energy considerations in metallurgy through Ellingham diagrams.

5. Periodic Properties: (4 Hrs.)

Effective nuclear charge, penetration of orbitals, variations of s, p, d and f orbital energies of atoms in the periodic table, electronic configurations, atomic and ionic sizes, ionization energies, electron affinity and electronegativity, polarizability, oxidation states, coordination numbers and geometries, hard soft acids and bases principle.

UNIT-IV

6. Stereochemistry: (4 Hrs.)

Representations of 3-dimensional structures, structural isomers and stereoisomers, configurations and symmetry and chirality, enantiomers, diastereomers, optical activity, absolute configurations and conformational analysis of butane. Isomerism in transitional metal compounds.

7. Organic Reactions and Synthesis of a Drug Molecule: (4 Hrs.)

Introduction to reactions involving substitution, addition, elimination, oxidation, reduction, cyclization and ring openings. Synthesis of a commonly used drug molecule – β lactum, Paracetamol, Chloroquine and Aspirin

Recommended Text Books:

1. B.H. Mahan, 'University Chemistry'.
2. M.J. Sienko and R.A. Plane 'Chemistry: Principles and Applications'.
3. C.N. Banwell, 'Fundamentals of Molecular Spectroscopy'.
4. B.L. Tembe, Kamaluddin and M.S. Krishnan, 'Engineering Chemistry (NPTEL Web-book).
5. P.W. Atkins, 'Physical Chemistry'.
6. K.P.C. Volhardt and N.E. Schore 'Organic Chemistry: Structure and Function', 5th Edn., http://bcs.whfreeman.com/vollhardtschore5e/default.asp

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Course Outcomes:
The concepts developed in this course will aid in quantification of several concepts in chemistry that have been introduced at the 10+2 levels in schools. Technology is being increasingly based on the electronic, atomic and molecular level modifications.
Quantum theory is more than 100 years old and to understand phenomena at nanometer levels, one has to base the description of all chemical processes at molecular levels. The course will enable the student to:
1. Analyze microscopic chemistry in terms of atomic and molecular orbitals and intermolecular forces.
2. Rationalize bulk properties and processes using thermodynamic considerations.
3. Distinguish the ranges of the electromagnetic spectrum used for exciting different molecular energy levels in various spectroscopic techniques
4. Rationalize periodic properties such as ionization potential, electronegativity, oxidation states and electronegativity.
5. List major chemical reactions that are used in the synthesis of molecules.

MATHEMATICS-II (CALCULUS, ORDINARY DIFFERENTIAL EQUATIONS AND COMPLEX VARIABLE)

Subject Code: BMATH2-201 **L T P C** **Duration: 46 Hrs.**
3 1 0 4

UNIT-I

Calculus (Integration): (10 Hrs.)
Double integrals (Cartesian & polar coordinates), change of order of integration in double integrals, Change of variables (Cartesian to polar), Applications: areas and volumes, Center of mass and Gravity (constant and variable densities);

UNIT-II

Multivariable Calculus (Integration): (12 Hrs.)
Triple integrals (Cartesian & polar coordinates), Simple applications involving cubes, sphere and rectangular parallelepipeds; Scalar line integrals, vector line integrals, scalar surface integrals, vector surface integrals, Theorems of Green, Gauss and Stokes (statement only), simple applications involving cubes, sphere and rectangular parallelepipeds.

UNIT-III

First Order Ordinary Differential Equations: (6 Hrs.)
Linear and Bernoulli's equations, exact equation, Equations not of first degree: equations solvable for p, equations solvable for y, equations solvable for x and Clairaut's type.

Ordinary Differential Equations of higher Orders: (6 Hrs.)
Second order linear differential equations with variable coefficients, method of variation of parameters, Cauchy-Euler equation; Power series solutions, Frobenius method.

UNIT-IV

Complex Variable – Differentiation: (12 Hrs.)
Differentiation, Cauchy-Riemann equations, analytic functions, harmonic functions, finding harmonic conjugate; elementary analytic functions (exponential, trigonometric, logarithm) and their properties; Bilinear transformation and its properties, Conformal transformation, Special Conformal transformations.

Recommended Books:
1. G.B. Thomas and R.L. Finney, 'Calculus and Analytic Geometry', 9th Edn., Pearson, Reprint, **2002**.
2. Erwin Kreyszig, 'Advanced Engineering Mathematics', 9th Edn., John Wiley & Sons, **2006**.

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3. W.E. Boyce and R.C. DiPrima, 'Elementary Differential Equations and Boundary Value Problems', 9th Edn., Wiley India, **2009**.
4. S.L. Ross, 'Differential Equations', 3rd Edn., Wiley India, **1984**.
5. E.A. Coddington, 'An Introduction to Ordinary Differential Equations', Prentice Hall India, **1995**.
6. E.L. Ince, 'Ordinary Differential Equations', Dover Publications, **1958**.
7. J.W. Brown and R.V. Churchill, 'Complex Variables and Applications', 7th Edn., McGraw Hill, **2004**.
8. B.S. Grewal, 'Higher Engineering Mathematics', Khanna Publishers, 36th Edn., **2010**.

Course Outcomes:

The objective of this course is to familiarize the prospective engineers with techniques in multivariate integration, ordinary and partial differential equations and complex variables. It aims to equip the students to deal with advanced level of mathematics and applications that would be essential for their disciplines.

The students will learn:

1. The mathematical tools needed in evaluating multiple integrals and their usage.
2. The effective mathematical tools for the solutions of differential equations that model physical processes.
3. The tools of differentiation and integration of functions of a complex variable that are used in various techniques dealing engineering problems.

ENGLISH

Subject Code: BHUMA0-101 **L T P C** **2 0 0 2** **Duration: 25 Hrs.**

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UNIT-I

1. Vocabulary Building:

1.1 The concept of Word Formation
1.2 Root words from foreign languages and their use in English
1.3 Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives.
1.4 Synonyms, antonyms, and standard abbreviations.

UNIT-II

2. Basic Writing Skills:

2.1 Sentence Structures
2.2 Use of phrases and clauses in sentences
2.3 Importance of proper punctuation
2.4 Creating coherence
2.5 Organizing principles of paragraphs in documents
2.6 Techniques for writing precisely

UNIT-III

3. Identifying Common Errors in Writing:

3.1 Subject-verb agreement
3.2 Noun-pronoun agreement
3.3 Misplaced modifiers
3.4 Articles
3.5 Prepositions
3.6 Redundancies
3.7 Clichés

UNIT-IV

4. Nature and Style of Sensible Writing:
4.1 Describing
4.2 Defining
4.3 Classifying
4.4 Providing examples or evidence
4.5 Writing introduction and conclusion

5. Writing Practices:
5.1 Comprehension
5.2 Précis Writing
5.3 Essay Writing

Recommended Books:

1. Michael Swan, 'Practical English Usage', OUP, **1995**.
2. F.T. Wood, 'Remedial English Grammar', Macmillan, **2007.**
3. William Zinsser, 'On Writing Well', Harper Resource Book, **2001.**
4. Liz Hamp-Lyons and Ben Heasly, 'Study Writing', Cambridge University Press, **2006**.
5. Sanjay Kumar and Pushp Lata, 'Communication Skills', Oxford University Press, **2011**.
6. 'Exercises in Spoken English', Parts. I-III. CIEFL, Hyderabad. Oxford University Press.

Course Outcomes:

1. The student will acquire basic proficiency in English including reading and listening comprehension, writing and speaking skills.

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PROGRAMMING FOR PROBLEM SOLVING

Subject Code: BCSCE0-101 **L T P C** **3 0 0 3** **Duration: 41 Hrs.**

UNIT-I

1. Introduction to Programming: (6 Hrs.)

Introduction to components of a computer system (disks, memory, processor, where a program is stored and executed, operating system, compilers etc.). Idea of Algorithm: steps to solve logical and numerical problems. Representation of Algorithm: Flowchart/Pseudocode with examples. From algorithms to programs; source code, variables (with data types) variables and memory locations, Syntax and Logical Errors in compilation, object and executable code.

2. Arithmetic Expressions and Precedence: (12 Hrs.)

Conditional Branching and Loops. Writing and evaluation of conditionals and consequent branching. Iteration and loops.

UNIT-II

3. Arrays: (5 Hrs.)

Arrays (1-D, 2-D), Character arrays and Strings

4. Basic Algorithms: (5 Hrs.)

Searching, Basic Sorting Algorithms (Bubble, Insertion and Selection), Finding roots of equations, notion of order of complexity through example programs (no formal definition required)

UNIT-III

5. Function: (4 Hrs.)

Functions (including using built in libraries), Parameter passing in functions, call by value, Passing arrays to functions: idea of call by reference

6. Recursion: (4 Hrs.)

Recursion, as a different way of solving problems. Example programs, such as Finding

Factorial, Fibonacci series, Ackerman function etc. Quick sort or Merge sort.

UNIT-IV

7. Structure: (3 Hrs.)
Structures, Defining structures and Array of Structures

8. Pointers: (2 Hrs.)
Idea of pointers, Defining pointers, Use of Pointers in self-referential structures, notion of linked list (no implementation)

9. File Handling: (only if time is available, otherwise should be done as part of the lab)

Recommended Text Books:

1. Byron Gottfried, 'Schaum's Outline of Programming with C', McGraw Hill.
2. E. Balaguruswamy, 'Programming in ANSI C', Tata McGraw Hill.

Recommended Reference Books:

1. Brian W. Kernighan and Dennis M. Ritchie, 'The C Programming Language', Prentice Hall of India.

Course Outcomes:

The student will learn

1. To formulate simple algorithms for arithmetic and logical problems.
2. To translate the algorithms to programs (in C language).
3. To test and execute the programs and correct syntax and logical errors.
4. To implement conditional branching, iteration and recursion.
5. To decompose a problem into functions and synthesize a complete program using divide and conquer approach.
6. To use arrays, pointers and structures to formulate algorithms and programs.
7. To apply programming to solve matrix addition and multiplication problems and searching and sorting problems.
8. To apply programming to solve simple numerical method problems, namely rot finding of function, differentiation of function and simple integration.

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CHEMISTRY-I LAB.

Subject Code: BCHEM0-101 **L T P C**
0 0 2 1

Course Objectives:

1. To learn the preparation and standardization of solutions
2. To learn the estimation of various physical properties of given liquid samples
3. To estimate various crucial parameters for water sample
4. To learn the preparation of various molecules and detection of functional groups.

Choice of 10-12 experiments from the following:

1. Preparation of a standard solution
2. Determination of surface tension and viscosity
3. Thin layer chromatography
4. Determination of total Alkalinity/ Acidity of a water sample.
5. Determination of residual chlorine in water sample
6. Estimation of total, temporary and permanent hardness of water
7. Determination of the rate constant of a reaction
8. Determination of strength of an acid conductometrically
9. Potentiometry - determination of redox potentials and emfs
10. Synthesis of a polymer
11. Saponification /acid value of an oil
12. Detection and confirmation of organic functional groups.

13. Models of spatial orientation
14. To test the validity of Lambert Beer law/ Determination of λ_{max} /Determination of unknown concentration of a solution.
15. Determination of the partition coefficient of a substance between two immiscible liquids
16. Adsorption of acetic acid by charcoal
17. Synthesis of a drug – Acetaminophen, Aspirin

Laboratory Outcomes:

The chemistry laboratory course will consist of experiments illustrating the principles of chemistry relevant to the study of science and engineering. The students will learn to:

1. Estimate rate constants of reactions from concentration of reactants/products as a function of time
2. Measure molecular/system properties such as surface tension, viscosity, conductance of solutions, redox potentials, chloride content of water, etc.
3. Synthesize a small drug molecule and analyze a salt sample

ENGLISH LAB.

Subject Code: BHUMA0-102 **L T P C**
0 0 2 1

Oral Communication

(This unit involves interactive practice sessions in Language Lab.)

1. Listening Comprehension
2. Pronunciation, Intonation, Stress and Rhythm
3. Common Everyday Situations: Conversations and Dialogues
4. Communication at Workplace
5. Interviews
6. Formal Presentations

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PROGRAMMING FOR PROBLEM SOLVING LAB.

Subject Code: BCSCE0-102 **L T P C**
0 0 4 2

NOTE: The laboratory should be preceded or followed by a tutorial to explain the approach or algorithm to be implemented for the problem given.

Tutorial 1: Problem solving using computers:
Lab1: Familiarization with programming environment
Tutorial 2: Variable types and type conversions:
Lab 2: Simple computational problems using arithmetic expressions
Tutorial 3: Branching and logical expressions:
Lab 3: Problems involving if-then-else structures
Tutorial 4: Loops, while and for loops:
Lab 4: Iterative problems e.g., sum of series
Tutorial 5: 1D Arrays: searching, sorting:
Lab 5: 1D Array manipulation
Tutorial 6: 2D arrays and Strings
Lab 6: Matrix problems, String operations
Tutorial 7: Functions, call by value:
Lab 7: Simple functions

Tutorial 8 &9: Numerical methods (Root finding, numerical differentiation, numerical integration):
Lab 8 and 9: Programming for solving Numerical methods problems
Tutorial 10: Recursion, structure of recursive calls
Lab 10: Recursive functions
Tutorial 11: Pointers, structures and dynamic memory allocation
Lab 11: Pointers and structures
Tutorial 12: File handling:
Lab 12: File operations
Laboratory Outcomes:

1. To formulate the algorithms for simple problems
2. To translate given algorithms to a working and correct program
3. To be able to correct syntax errors as reported by the compilers
4. To be able to identify and correct logical errors encountered at run time
5. To be able to write iterative as well as recursive programs
6. To be able to represent data in arrays, strings and structures and manipulate them through a program
7. To be able to declare pointers of different types and use them in defining self-referential structures.
8. To be able to create, read and write to and from simple text files.

MANUFACTURING PRACTICES (THEORY & LAB.)

Subject Code: BMFPR0-101	**L T P C** **1 0 4 3**	**Duration: 80 Hrs.**

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Lectures & Videos: (10 Hrs.)

1. Manufacturing Methods- casting, forming, machining, joining, advanced manufacturing Methods.
2. CNC machining, Additive manufacturing.
3. Fitting operations & power tools.
4. Sheet Metal Operations.
5. Electrical & Electronics.
6. Carpentry.
7. Plastic moulding (injection moulding, blow moulding, extrusion moulding), glass cutting.
8. Metal casting.
9. Welding (arc welding & gas welding), brazing.

Recommended Text/Reference Books:

1. S.K. Hajra Choudhury, A.K. Hajra Choudhury and S.K. Nirjhar Roy, ‘Elements of Workshop Technology’, Vol.-I, **2008** and Vol.-II **2010**, Media Promoters and Publishers Pvt. Ltd., Mumbai.
2. S. Kalpakjian, Steven S. Schmid, ‘Manufacturing Engineering and Technology’, 4th Edn., Pearson Education India Edn., **2002**.
3. Gowri P. Hariharan and A. Suresh Babu, ‘Manufacturing Technology – I’, Pearson, **2008**.
4. Roy A. Lindberg, ‘Processes and Materials of Manufacture’, 4th Edn., Prentice Hall India, **1998**.
5. P.N. Rao, ‘Manufacturing Technology’, Vol.-I and Vol.-II, Tata McGraw Hill House, **2017**.

Course Outcomes:
1. Upon completion of this course, the students will gain knowledge of the different manufacturing processes which are commonly employed in the industry, to fabricate components using different materials.

Workshop Practice: (70 Hrs.)
1. Machine shop **(10 Hrs.)**
2. Fitting shop **(8 Hrs.)**
3. Carpentry **(6 Hrs.)**
4. Electrical & Electronics **(8 Hrs.)**
5. Welding shop **(8 Hrs. (Arc welding 4 Hrs. + Gas welding 4 Hrs.)**
6. Casting **(8 Hrs.)**
7. Sheet Metal Operations **(10 Hrs.)**
8. Smithy **(6 Hrs.)**
9. Plastic moulding & Glass Cutting **(6 Hrs.)**
10. Examinations could involve the actual fabrication of simple components, utilizing one or more of the techniques covered above.

Laboratory Outcomes:
1. Upon completion of this laboratory course, students will be able to fabricate components with their own hands.
2. They will also get practical knowledge of the dimensional accuracies and dimensional tolerances possible with different manufacturing processes.
3. By assembling different components, they will be able to produce small devices of their interest.

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HUMAN VALUES AND PROFESSIONAL ETHICS

Subject Code: BHUMA0-103 **L T P C** **3 0 0 0** **Duration: 30 Hrs.**

UNIT-I (8 Hrs.)

Meaning of values, Values as social fact, Universal values – equality, justice, freedom/ liberty, inclusion. Distinction between social and culture values and values associated with crafts and occupations. Work and leisure as values – Marx and Veblen

UNIT-II (9 Hrs.)

Values, morality, ethics and their relation with Religion, values as mechanisms of control and coercion. Functional Theory of Values of Talcott Parsons, Theory of Basic Values of Shalom Schwartz, Theory of Protestant Ethic and Capitalism of Max Weber, Bhagwat Gita and Theory of Karma-Dharma, Sikhism and theory of work, dignity of labour, meditation and sharing.

UNIT-III (7 Hrs.)

Meaning and types of Professional Ethics, Goals of professional work and their problems, Normative and evaluative elements in professional work, Duties and obligations, Professional rights, Virtues in professional life (honesty, trustworthiness, transparency, competence, integrity and exemplary conduct), Engineering ethics and service ideals.

UNIT-IV (6 Hrs.)

Technology for and against mankind and environment- fulfilment of human needs, and industrial disasters: case studies – Bhopal Gas Tragedy, Chernobyl and Fukushima Disasters; Equality at work place: gender discrimination and caste/class-based exclusions.

Recommended Books:

1. Schwartz, H. Shalom, 'An Overview of the Schwartz Theory of Basic Values'. Online Readings in Psychology and Culture. **2** (1). doi:10.9707/2307-0919.1116, **2012**.

2. John Berry, Janek, Pandey; Poortinga, Ype 'Handbook of Cross-cultural Psychology', 2nd Edn.. Boston, MA: Allyn and Bacon. p. 77. ISBN 9780205160747, **1997**.
3. Timo Airaksinen, 'The Philosophy of Professional Ethics', University of Helsinki, Finland.
4. Manju Jitendra Jain, 'Yes, It's Possible', Kalpana Publications, Mumbai, **2011**.

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SOFT SKILLS-I

Subject Code: **BHUM0-F91** **L T P C**
0 0 2 1

Course Objectives
The course aims to cause a basic awareness about the significance of soft skills in professional and interpersonal communications and facilitate an all-round development of personality.

Course Outcomes
At the end of the course, the student will be able to develop his/her personal traits and expose their personality effectively.

UNIT-1

SOFT SKILLS- Introduction to Soft Skills, Aspects of Soft Skills, Identifying your Soft Skills, Negotiation skills, Importance of Soft Skills, Concept of effective communication.
SELF-DISCOVERY- Self-Assessment, Process, Identifying strengths and limitations, SWOT Analysis Grid.

UNIT-2

FORMING VALUES- Values and Attitudes, Importance of Values, Self-Discipline, Personal Values - Cultural Values-Social Values-some examples, Recognition of one's own limits and deficiencies.

UNIT-3

ART OF LISTENING- Proxemics, Haptics: The Language of Touch, Meta Communication, Listening Skills, Types of Listening, Listening tips.

UNIT-4

ETIQUETTE AND MANNERS- ETIQUETTE- Introduction, Modern Etiquette, Benefits of Etiquette, Taboo topics, Do's and Don'ts for Men and Women. MANNERS- Introduction, Importance of manners at various occasions, Professional manners, Mobile manners. CORPORATE GROOMING TIPS- Dressing for Office: Do's and Don'ts for Men and Women, Annoying Office Habits.

RECOMMENDED BOOKS

1. K. Alex, S. Chand Publishers.
2. Butterfield, Jeff, 'Soft Skills for Everyone', Cengage Learning, New Delhi, **2010**.
3. G.S. Chauhan and Sangeeta Sharma, 'Soft Skills', Wiley, New Delhi, **2016**.
4. Klaus, Peggy, Jane Rohman & Molly Hamaker, 'The Hard Truth About Soft Skills', Harper Collins E-books, London, **2007**.
5. S.J. Petes, Francis, 'Soft Skills and Professional Communication', Tata McGraw Hill Education, New Delhi, **2011**.

SOFT SKILLS-II

Subject Code: **BHUM0-F92** **L T P C**
0 0 2 1

Course Objectives
The course aims to address various challenges of communication as well as behavioural skills faced by individual at work place and organisations. Also, it aims to enhance the employability of the students.

Course Outcomes
At the end of the course the student will be able to understand the importance of goal setting. They will also be able to handle stress in their lives and future in a better way.

UNIT-1

DEVELOPING POSITIVE ATTITUDE- Introduction. Formation of attitude. Attitude in workplace. Power of positive attitude. Examples of positive attitudes. Negative attitudes. Examples of negative attitude. overcoming negative attitude and its consequences.
IMPROVING PERCEPTION- Introduction. Understanding perception. perception and its application in organizations.

UNIT-2

CAREER PLANNING-Introduction. Tips for successful career planning. Goal setting-immediate, short term and long term. Strategies to achieve goals. Myths about choosing career.

UNIT-3

ART OF READING-Introduction. Benefits of reading. Tips for effective reading. the SQ3R technique. Different stages of reading. determining reading rate of students. Activities to increase the reading rate. Problems faced. Becoming an effective reader.

UNIT-4

STRESS MANAGEMENT - Introduction. meaning. positive and negative stress. Sources of stress. Case studies. signs of stress. Stress management tips. Teenage stress.

RECOMMENDED BOOKS

1. K. Alex, S. Chand Publishers.
2. Rizvi, M. Ashraf, ‘Effective Technical Communication’, McGraw Hill.
3. Mohan Krishna & Meera Banerji, ‘Developing Communication Skills’, Macmillan.
4. Kamin, Maxine, ‘Soft Skills Revolution: A Guide for Connecting with Compassion for Trainers, Teams & Leaders’, Pfeiffer & Amp; Company, Washington, DC, **2013.**

SOFT SKILLS-III

Subject Code: BHUM0-F93 **L T P C**
0 0 2 1

Course Objectives

The course aims to equip the students with effective writing skills in English. Also, to make the students understand their role as team players in organisations.

Course Outcomes

At the completion of the course, the student will become well –versed with the behavioural skills. They will also understand the role of body language and non-verbal communication during the interview process.

UNIT-1

ART OF WRITING - Introduction, Importance of Writing Creative Writing, Writing tips, Drawback of written communication.

ART OF BUSINESS WRITING - Introduction, Business Writing, Business Letter, Format and Styles, Types of business letters, Art of writing correct and precise mails, Understand netiquette.

UNIT-2

BODY LANGUAGE - Introduction- Body Talk, Forms of body language, uses of body language, Body language in understanding Intra and Inter-Personal Relations, Types of body language, Gender differences, Gaining confidence with knowledge of Kinesics.

UNIT-3

TEAM BUILDING AND TEAM WORK - Introduction, Meaning, Characteristics of an effective team, Role of a Team Leader, Role of Team Members, inter group Collaboration-Advantages, Difficulties faced, Group Exercises-Team Tasks and Role-Play, Importance of Group Dynamics.

UNIT-4

TIME MANAGEMENT - Introduction, the 80-20 Rule, three secrets of Time Management, Time Management Matrix, Effective Scheduling, Time Wasters, Time Savers, Time Circle Planner, Difficulties in Time Management, Overcoming Procastination.

RECOMMENDED BOOKS

1. K. Alex, S. Chand Publishers.
2. R.C. Sharma and Krishna Mohan, 'Business Correspondence and Report Writing', TMH, New Delhi, **2016.**
3. N. Krishnaswami and T. Sriraman, 'Creative English for Communication', Macmillan.
4. Penrose, John M., et al., 'Business Communication for Managers', Thomson South Western, New Delhi, **2007**.
5. Holtz, Shel, 'Corporate Conversations', PHI, New Delhi, **2007**.

SOFT SKILLS-IV

Subject Code: **BHUM0-F94**

L	T	P	C
0	0	2	1

Course Objectives

The course aims at the key areas like conversation skills, group skills and persuasion skills required during the interview process in an organisation.

Course Outcomes

At the end of the course, the student will be able to:

1. Demonstrate soft skills required for business situations.
2. Analyze the value of soft skills for career enhancement.
3. Apply soft skills to workplace environment.
4. Confidently participate in GD and interview process.

UNIT-1

ART OF SPEAKING- Introduction. Communication process. Importance of communication, channels of communication. Formal and informal communication. Barriers to communication. Tips for effective communication. tips for conversation. Presentation skills. Effective multi-media presentation skills. Speeches and debates. Combating nervousness. Patterns and methods of presentation. Oral presentation, planning and preparation.

UNIT-2

GROUP DISCUSSION- Introduction. Importance of GD. Characters tested in a GD. Tips on GD. Essential elements of GD. Traits tested in a GD .GD etiquette. Initiating a GD. Non-verbal communication in GD. Movement and gestures to be avoided in a GD. Some topics for GD.

UNIT-3

PREPARING CV/RESUME-Introduction – meaning – difference among bio-data, CV and resume. CV writing tips. Do's and don'ts of resume preparation. Vocabulary for resume, common resume mistakes, cover letters, tips for writing cover letters.

UNIT-4

INTERVIEW SKILLS - Introduction. Types of interview. Types of question asked. Reasons for rejections. Post-interview etiquette. Telephonic interview. Dress code at interview. Mistakes during interview. Tips to crack on interview. Contextual questions in interview skills. Emotional crack an interview. Emotional intelligence and critical thinking during interview process.

RECOMMENDED BOOKS

1. K. Alex, S. Chand Publishers.
2. Lucas, Stephen E., 'The Art of Public Speaking', 11th Edn., International Edn., McGraw Hill Book Co., **2014**.
3. Goleman, Daniel, 'Working with Emotional Intelligence', Banton Books, London, **1998**.
4. Thrope, Edgar and Showick Trope, 'Winning at Interviews', Pearson Education, **2004.**
5. Turk, Christopher, 'Effective Speaking', South Asia Division: Taylor & Francis, 1**985**.

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	
BMEE0-F91	Industrial Safety and Environment	B.Tech. Mechanical Engg.
BCIE0-F91	Environmental Pollution	B.Tech. Civil Engg.
BCIE0-F92	Traffic Engineering	
BELE0-F91	Elements of Power Plants	B.Tech. Electrical Engg.
BELE0-F92	Basics of Instrumentation Engineering	
BELE0-F93	Substation Equipment	

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PLANT UTILITIES & CONTROL

Subject Code: BFOT0-F91 **L T P C 3 0 0 3** **Contact Hrs. 38**

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.

PERSONNEL & INDUSTRIAL MANAGEMENT

Subject Code: BBAD0-F92 **L T P C** **Duration: 40 Hrs.**
3 0 0 3

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

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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** **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 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.

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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 3 0 0 3	Duration: 38 Hrs.

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 -

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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.

CELLULAR AND MOBILE COMMUNICATION

Subject Code: BECE0-F92 **L T P C** **Duration: 37 Hrs.**
3 0 0 3

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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.

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.

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BIOMEDICAL ELECTRONICS AND INSTRUMENTATION

Subject Code: BECE0-F93 **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 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.

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.

INDUSTRIAL SAFETY AND ENVIOREMENT

Subject Code: BMEE0 –F91 **L T P C** **Duration: 38 Hrs.**
3 0 0 3

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.

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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.

ENVIRONMENTAL POLLUTION

Subject Code: BCIE0-F91 **L T P C 3 0 0 3** **Contact Hrs. 36**

UNIT -I

Introduction: Environment. Pollution, Pollution control

Air Pollution: Air Pollutants: Types, Sources, Effects; Air Pollution Meteorology: Lapse Rate, Inversion, Plume Pattern; Air Pollution Dispersion Model: Point Source Gaussian Plume Model, Stability Classes, Stability Charts, Design of Stack Height.

Air pollution Control: Self cleansing properties of the environment; Dilution method; Engineered Control of Air Pollutants: Control of the particulates, Control of Gaseous Pollutants, Control of Air pollution from Automobiles.

UNIT -II

Noise Pollution: Definition; Sound Pressure, Power and Intensity; Noise Measurement, Power and Intensity, Levels, Frequency Band, Effects; Control.

Water pollution: Pollution Characteristics of Typical Industries, Suggested Treatments.

UNIT -III

Global Environmental Issues: Ozone Depletion, Acid Rain, Global Warming-Green House Effects.

UNIT -IV

Administrative Control on Environment: Functions of Central and State Pollution Control Boards; Environmental Clearance Process for Industries and Infrastructural Projects

Recommended Books:
1. G. Masters, W. Ela, 'Introduction to Environmental Engineering and Science', PHI.
2. A. Sincero, G. Sincero 'Environmental Engineering: A Design Approach', PHI.
3. P.V. Rowe 'Environmental Engineering', TMH.
4. S.K. Garg, 'Environmental Engineering', Khanna Publishers.
5. Rao and Rao, 'Air Pollution', TMH.
6. A.K. Chatterjee, 'Water Supply, Waste Disposal and Environmental Pollution Engineering', Khanna Publishers.
7. P. N. Modi, Environmental Engineering, Vol.-II.
8. Rajagopalan, 'Environmental Modelling', Oxford University Press.

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TRAFFIC ENGINEERING

Subject Code: BCIE0-F92 **L T P C** **Contact Hrs. 36**
3 0 0 3

Unit-I

Introduction: Elements of Traffic Engineering, Components of traffic system – road users, vehicles, highways and control devices.

Vehicle Characteristics: IRC standards, Design speed, volume, Highway capacity and levels of service, capacity of urban and rural roads, PCU concept and its limitations.

Unit-II

Traffic Stream Characteristics: Traffic stream parameters, characteristics of interrupted and uninterrupted flows.

Traffic Studies: Traffic volume studies, origin destination studies, speed studies, travel time and delay studies, parking studies, accident studies.

Unit-III

Traffic Regulation and Control: Signs and markings, Traffic System Management, At-grade intersections, Channelization, Roundabouts.

Traffic Signals: Pre-timed and traffic actuated. Design of signal setting, phase diagrams, timing diagram, Signal co-ordination.

Unit-IV

Grade Separated Intersections: Geometric elements for divided and access controlled highways and expressways.

Traffic Safety: Principles and practices, Road safety audit.

Intelligent Transportation System: Applications in Traffic Engineering.

Recommended Books

1. R.M. William and P.R. Roger, 'Traffic Engineering', Prentice Hall.
2. C.J. Khisty and B.L. Kent, 'Transportation Engineering – An Introduction', Prentice Hall of India Pvt. Ltd.
3. L.R. Kadiyali, 'Traffic Engineering & Transport'.

MRSPTU

ELEMENTS OF POWER PLANTS

Subject Code: BELE0-F91 **L T P C** **Contact Hrs. 36**
3 0 0 3

Learning Objectives:

1. To introduce the students to the classification of steam and hydro-electric power plants and make them familiar with the main equipment and machinery used in them.
2. To provide them basic concepts of nuclear and gas power plants.
3. To impart knowledge about pollution control and combined operation of different plants.

Course Outcomes:

1. The students will acquire knowledge about various equipment used in thermal, hydro and nuclear power generation.
2. They will also become familiar with equipment used in gas power plants.
3. They will come to know about the importance of coordinated operation of different power plants and methods of pollution control.

UNIT-I (10 Hrs.)

Steam Power Plants: Classification of steam generators, types of condensers, types of steam turbines and their efficiencies, Operation of plant, Description of Rankin cycle, coal handling system, combustion system, Ash handling, Feed pumps, Heat exchangers, Economizers, Super heaters, Reheaters, Air preheaters, Feed water heaters, Evaporators.

UNIT-II (8 Hrs.)

Nuclear Power Plants: Nuclear physics, Binding energy, Radioactive decay. Fertile material, Mass defect, Nuclear reactions type and application, Generation of nuclear energy by fission, Nuclear reactors. Safety measures, Future of nuclear power.

UNIT-III (11 Hrs.)

Hydro-Electric Power Plants: Hydrological cycle, Hydrograph, Flow duration curve, Classification of hydro plants, Selection of water turbines for hydro power plant.

Gas Turbine: Elements of gas turbines, Open and closed cycles for gas turbines, Performance terms, Plant layout, applications.

UNIT-IV (9 Hrs.)

Combined Operation of Different Power Plants: Advantages of combined operation of plants, load division between power stations, coordination of different types of Power Plants.

Pollution Control: Pollution from thermal and nuclear plants, Particulate emission and control, electrostatic precipitator, solid waste disposal.

Recommended Books:

1. Chakrabarti, Soni, Gupta and Bhatanagar, 'A Textbook on Power System Engineering', Dhanpat Rai & Co., **2013**.
2. EI-Wakil M.M., 'Power Plant Technology', 2nd Reprint, Tata McGraw Hill Edn., **2010**.
3. R.K. Rajput, 'Power Plant Engineering', 4th Edn., Luxmi Publications, **2010**.
4. P.C. Sharma, 'Power Plant Engineering', Kataria and Sons, **2009**.
5. B.G.A. Skrotzki and W.A. Vapot, 'Power Station Engineering and Economy', 31st Reprint, Tata McGraw Hill Education Private Ltd., **2009**.
6. P.K. Nag, 'Power Plant Engineering', 4th Edn., McGraw Hill Education (India) Private Ltd., **2014**.
7. G.R. Nagpal, 'Power Plant Engineering, Khanna Publishers', 16th Edn., **2013**.
8. S.C. Arora, S. Domkundwar, 'Power Plant Engineering', 6th Edn., Dhanpat Rai, **2013**.

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BASICS OF INSTRUMENTATION ENGINEERING

Subject Code: BELE0-F92 **L T P C** **3 0 0 3** **Contact Hrs. 39**

Learning Objectives:

1. To acquire knowledge about the various elements of instrumentation systems.
2. To acquire knowledge about working of data acquisition and corresponding signal conditioning.
3. To know about different types of display devices and recorders.

Course Outcomes:

1. Student will get knowledge about various types of transducers, signal conditioning and data acquisition systems.
2. Students will get acquainted with digital measurement systems and display devices
3. Students will be able to know about various types of recorders and recording methods.

UNIT-I (10 Hrs.)

Transducers: Introduction to sensors, transducers, detectors, actuators, Electrical transducers, and its classification, Characteristics and choice of transducers, Resistive and Capacitive transducers, Potentiometers, Strain gauges and its types, Thermistors, RTD, Thermocouples, LVDT, RVDT, Piezo electric transducers, Hall effect transducers, Encoders, Synchros.

UNIT-II (10 Hrs.)

Signal Conditioning: Introduction, role of operational amplifiers in signal conditioning, characteristics of op-amps, instrumentation amplifier, filters, general consideration of A/D and D/A convertors.

Data Acquisition Systems: instrumentation systems and its types, Analog data acquisition system, Digital data acquisition system, recorders, multiplexing and sample/hold circuits in data acquisition system.

UNIT-III (9 Hrs.)

Digital Measurement and Display Devices: Introduction, types of instruments used in digital measurement systems, digital display methods, segmental displays, Dot Matrices, rear projection display, LED, LCD, segmental gas discharge displays, Electronic counters, digital voltmeters and its types.

UNIT-IV (10 Hrs.)

Recorders: Requirement of recording, Analog and digital recorders, Graphic recorders, Strip chart recorders, Null type recorders, Potentiometric type recorders, single and multi-point recorders, X-Y records, Ultraviolet recorders, magnetic tape recorders, Frequency and pulse duration modulation type recording, Introduction to direct recording.

Recommended Books:

1. Halfrick Albert D. and Cooper Willium D,, 'Modern Electronic Instrumentation and Measurement Techniques', PHI, **1990**.
2. A.K. Sawhney, 'Electronic Instrumentation and Measurement', Dhanpat Rai and Sons, 19th Edn., **2011**.
3. Jones Larry D. and Chin A. Foster, 'Electronic Instruments and Measurement', 2nd Edn., **1995**.
4. Morris Alan S. and Langari Reza, 'Measurement and Instrumentation, Theory and Applications', Academic Press, Elsevier, **2016**.
5. Malaric Roman, 'Instrumentation and Measurement in Electrical Engineering', Brown Walker Press, Boca Raton, Florida, USA, **2011**.
6. David Bell, 'Electronic Instrumentation and Measurements', 2nd Edn., PHI, **2003**.
7. M.M.S. Anand, 'Electronic Instruments and Instrumentation Technology', PHI, **2004**.
8. H.S. Kalsi, 'Electronic Instrumentation', 2nd Edn., TMH, **2006**.

SUBSTATION EQUIPMENT

Subject Code: BELE0-F92	L T P C 3 0 0 3	Contact Hrs. 39

Learning Objectives:

1. To provide knowledge about substation, its layout and main equipment present in it.
2. To impart knowledge about power, current and potential transformer.
3. To understand the use of capacitor banks in a substation.

Course Outcomes:

1. Students will get familiar with main equipment used in substations.

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2. They will be able to know about the use of different types of transformers.
3. They will develop understanding about the importance of capacitor banks.

UNIT-1 (10 Hrs.)

Substation: Introduction, classification and layout of substation, Single Bus bar, Mesh Substation, Factors affecting layout of substation, types of bus bars, Substation equipment specifications, testing of substation Equipment.

Power Transformer: Introduction and Working Principle of Power Transformer, Classification and their types, important characteristics of Transformer Oil.

UNIT-II (10 Hrs.)

Current Transformers (CT): Basic functions of Current Transformer, Rating and Performance of CTs, Burden, Theory and Operation of CT, Diagram of CT's Connection of Power Transformer and Selection of CT.

Potential Transformers (PT): Terminology, requirement of VA Burden, Testing and Commissioning of PTs, Capacitor Voltage Transformer.

Earthing: Introduction and purpose of Earthing, tolerable limits of body currents, soil resistivity, earth resistance and its measurement, tolerable and actual step and touch voltage, types of Earthing, grounded and ungrounded neutral system, Types, Methods and selection of grounding neutral.

UNIT-III (9 Hrs.)

Capacitor Banks: - Need for Reactive Compensation, Power Factor Improvement and its Benefits, Purpose of Installation of Capacitor Bank, Protection of Capacitor Bank and Pre-Commissioning Checks and tests, Series and Shunt Compensators, Rating and operation of Shunt Capacitor banks.

UNIT-IV (10 Hrs.)

Station Battery and Charging Equipment: Introduction, Variable Load Battery and System Tester, Testing of Battery Charger and Battery, Types of Batteries, Basic Charging Methods.

Computer Applications in Substation Engineering: Introduction, System Components, Communication Infrastructure and Methods, Trends in SCADA, Remote Terminal Unit, MODEM.

Recommended Books:

1. R.S. Dahiya and Attri Vinay, 'Sub Station Engineering, Design, Concepts and Computer Application', S.K. Kataria & Sons Publishers, **2013.**
2. S. Rao, 'Electrical Substation Engineering and Practice', Khanna Publishers, **1992**
3. P.S. Satnam and P.V. Gupta, 'Substation Design and Equipment', Dhanpat Rai Publications, **2013**.
4. McDonald John D., 'Electric Power Substations Engineering', 3rd Edn., CRC Press, **2012.**

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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	B.Tech. EEE
BEEE0-F95	High Volatge Engineering	
BEEE0-F96	Nano Science and Nano Technology	
BECE0-F94	Communication Systems	B.Tech. ECE
BECE0-F95	Robotics and Automation	
BECE0-F96	Electronic System Design	
BCIE0-F93	Building Maintenance	B.Tech. Civil Engineering
BCIE0-F94	Civil Engineering Materials	
BCIE0-F95	Fluid Mechanics	
BELE0-F94	Renewable Energy Sources	B.Tech. Electrical Engineering
BELE0-F95	Basics of Transformers	
BELE0-F96	Electrical Machines & Drives	
BELE0-F97	Electrical Machines and Power Utilization	
BMEE0-F91	Heat and Mass Transfer	
BCSE0-F91	Computer Programming and Data Structure	

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DATA PROCESS ANALYSIS

Subject Code: BFOT0-F92 **L T P C** **Contact Hrs. 36**
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', 7^{th} 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

Course 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.

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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 Pvt. 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.

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ENTERPRENEURSHIP

Subject Code: BBAD0-F95 **L T P C** **Duration: 40 Hrs.**
3 0 0 3

Course 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

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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.)

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 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 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.

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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 signaling, polar signaling, 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.

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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.

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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.

BUILDING MAINTENANCE

Subject Code: BCIE0-F93 **L T P C** **Contact Hrs. 36**
3 0 0 3

UNIT-I

Importance of Maintenance, Deterioration and Durability: Factors affecting decision to carryout maintenance, 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

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

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

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.

1. Repair of existing damp proofing systems in roofs, floors and wet areas.
2. Protection, repair and maintenance of RCC elements.
3. Repair, maintenance of foundations, basements and DPC
4. Repair of finishes.
5. Repair of building joints.
6. Repair of water supply and sanitary systems, underground and overhead tanks.
7. Common strengthening techniques
8. Maintenance of Industrial Floors

Maintenance of Multi-Storey Buildings: Specials features for maintenance of multi-storey buildings, including fire protection system, elevators booster pumps, generator sets.

Recommended Books:

1. A.C. Panchdari, 'Maintenance of Buildings', New Age International (P) Limited Publishers.

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CIVIL ENGINEERING MATERIALS

Subject Code: BCIE0-F94 **L T P C** **Contact Hrs. 36**
3 0 0 3

UNIT-I

STONES – BRICKS – CONCRETE BLOCKS: Stone as building material – Criteria for selection Tests on stones – Deterioration and Preservation of stone work – Bricks – Classification – Manufacturing of clay bricks – Tests on bricks – Compressive Strength – Water Absorption – Efflorescence – Bricks for special use – Refractory bricks – Cement, Concrete blocks – Light, weight concrete blocks.

UNIT-II

LIME – CEMENT – AGGREGATES – MORTAR: Lime – Preparation of lime mortar – Cement – Ingredients – Manufacturing process – Types and Grades – Properties of cement and Cement mortar – Hydration – Compressive strength – Tensile strength – Fineness– Soundness and consistency – Setting time – Industrial byproducts – Fly ash – Aggregates – Natural stone aggregates – Crushing strength – Impact strength – Flakiness Index – Elongation Index – Abrasion Resistance – Grading – Sand Bulking.

UNIT-III

CONCRETE: Concrete – Ingredients – Manufacturing Process – Batching plants – RMC – Properties of fresh concrete – Slump – Flow and compaction Factor – Properties of hardened concrete – Compressive, Tensile and shear strength – Modulus of rupture – Tests – Mix specification – Mix proportioning – BIS method – High Strength Concrete and HPC – Self compacting Concrete – Other types of Concrete – Durability of Concrete.

UNIT-IV

TIMBER AND OTHER MATERIALS: Timber – Market forms – Industrial timber– Plywood – Veneer – Thermacole – Panels of laminates – Steel – Aluminum and Other Metallic Materials – Composition – Aluminium composite panel – Uses – Market forms – Mechanical treatment – Paints – Varnishes – Distempers – Bitumens.

MODERN MATERIALS: Glass – Ceramics – Sealants for joints – Fibre glass reinforced plastic – Clay products – Refractories – Composite materials – Types – Applications of laminar composites – Fibre textiles – Geomembranes and Geotextiles for earth reinforcement.

Recommended Books:

1. P.C. Varghese, 'Building Materials', PHI Learning Pvt. Ltd, New Delhi, **2012**.
2. R.K. Rajput, 'Engineering Materials', S. Chand and Company Ltd., **2008**.
3. M.S. Shetty, 'Concrete Technology (Theory and Practice)', S. Chand and Company Ltd., **2008**.
4. M.L. Gambhir, 'Concrete Technology', 3rd Edn., Tata McGraw Hill Education, **2004.**
5. S.K. Duggal, 'Building Materials', 4th Edn., New Age International, **2008**.

Reference Books:

1. K.S. Jagadish, 'Alternative Building Materials Technology', New Age International, **2007**.
2. M.L. Gambhir & Neha Jamwal, 'Building Materials, Products, Properties and Systems', Tata McGraw Hill Educations Pvt. Ltd, New Delhi, **2012**.
3. IS456 – 2000: Indian Standard Specification for Plain and Reinforced Concrete, **2011.**
4. IS4926–2003: Indian Standard Specification for Ready–Mixed Concrete, **2012.**
5. IS383–1970: Indian Standard Specification for Coarse and Fine Aggregate from Natural Sources for Concrete, 2011 6. IS1542–1992: Indian Standard Specification for Sand for Plaster, **2009.**

FLUID MECHANICS

Subject Code: BCIE0-F95 **L T P C** **Contact Hrs. 36**
3 0 0 3

Course Objectives:
To provide the fundamental knowledge of fluid, its properties and behavior under various conditions of internal and external flows.

Course Outcomes:
At the end of the course, students will be able to-
1. State the Newton's law of viscosity and explain the mechanics of fluids at rest and in motion by observing the fluid phenomena.
2. Examine energy losses in pipe transitions and sketch energy gradient lines.
3. Examine the possibility of a flow using continuity equation.
4. Understand the concept of rotational, irrigational flows; stream functions, velocity potentials. Laplace equation etc.

Unit – I (12 Hrs.)

Fluid and their Properties: Concept of fluid, difference between solids, liquids and gases; ideal and real fluids; Continuum concept of fluid: density, specific weight and relative density; viscosity and its dependence on temperature; surface tension and capillarity, vapor pressure and cavitations; Newtonian and non-Newtonian fluids. Rotational flows- Rotational velocity and circulation.

Unit - II (10 Hrs.)

Kinematics of Fluid Flow: continuity equation, path lines, streak lines and streamlines, stream tube, stream function, velocity potential function, and flow net. Types of fluid flow, translation, rotation, circulation and vorticity, Vortex motion; Dynamics of fluid flow, Bernoulli's theorem, venturimeter, orifice-meter, Introduction to orifice and notch.

Unit - III (10 Hrs.)

Laminar Flow: shear stress distribution and velocity distribution in circular pipes and two parallel plates; kinetic energy correction factor and momentum energy correction factor, average velocity, shear stress and pressure gradient; Turbulent flow in pipes, Darcy equation

Unit - IV (8 Hrs.)

Dimensional Analysis and Similitude: Rayleigh's method and Buckingham's π-theorem, types of similarities, dimensionless numbers, model's law.

Recommended Books & References:
1. R.K. Bansal, 'A Textbook of Fluid Mechanics', 1st Edn., Laxmi Publications, **2016.**
2. Yunus Cengel, 'Fluid Mechanics in SI Units'**,** McGraw Hill Education, 3rd Edn., **2017.**
3. Biswas, 'Introduction to Fluid Mechanics and Fluid Machines', 3rd Edn., McGraw Higher Education, **2011.**

RENEWABLE ENERGY SOURCES

Subject Code: BELE0-F94 **L T P C** **Contact Hrs. 36**
3 0 0 3

Course Objectives:
1. To obtain knowledge about renewable energy sources and solar energy and their utilization.
2. To introduce to wind energy conversion and bio-mass energy conversion systems.

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3. To introduce to geothermal energy and energy from ocean. To make them aware about hydrogen energy sources.

Course Outcomes:

1. Students will get knowledge about utilization of renewable energy sources and solar energy.
2. They will learn about wind energy conversion and bio-mass energy conversion systems.
3. They will become aware about geothermal energy, energy from ocean and hydrogen energy sources.

UNIT-I (13 Hrs.)

Solar Energy: Conventional energy sources and availability, Introduction to new energy techniques& renewable energy sources; Solar Energy, Solar constant, Radiation geometry, Solar energy collectors, Concentrated and flat plate, Energy balance and collector efficiency, Solar energy storage, Application to space heating, distillation, cooking and greenhouse effect.

UNIT-II (12 Hrs.)

Wind and Bio-Energy: Basic principle of wind energy conversion, site selection, analysis of aerodynamic forces acting on wind mill blades and estimation of power output, Biomass conversion technology, photosynthesis, biogas plant, thermal gasification.

UNIT-III (10 Hrs.)

Geothermal Energy: Sources- hydrothermal, hot dry rock, geothermal fossil system, prime movers for geothermal energy.

Energy from Ocean: Ocean thermal electric conversion, energy from tides, small-scale hydroelectric development.

UNIT-IV (10 Hrs.)

Hydrogen Energy Sources: Introduction, hydrogen production methods, storage, utilization, magneto hydrodynamic power, thermionic generation, nuclear fusion energy.

Recommended Books:

1. G.D. Rai, 'Non-Conventional Energy Sources', Khanna Publishers, Delhi, **2011**.
2. S. Rao, B,B. Parulekar, 'Energy Technology: Non-Conventional Renewable and Conventional', Khanna Publishers, Delhi,
3. H.P. Garg and Jai Prakash, 'Solar Energy: Fundamentals and Applications', Tata McGraw Hill.
4. Saeed S. Hasan and D.K. Sharma, 'Non-Conventional Energy Resources', Katson Publishers, **2014**.
5. R.K. Rajput, 'Non-Conventional Energy Sources and Utilization', S. Chand Publishers, **2012**.
6. S.P. Sukhatme, 'Solar Energy: Principles of Thermal Collection and Storage', Tata McGraw Hill, N Delhi, **1984**.

BASICS OF TRANSFORMERS

Subject Code: BELE0-F95	**L T P C** **3 0 0 3**	**Contact Hrs. 36**

Course Objectives:

1. To aware the students about the basics of Transformer.
2. To provide basic concepts of different types of transformer connections and their applications.
3. To impart knowledge of single phase transformer, auto transformer and three phase transformer.

Course Outcomes:

1. Students will become familiar with different types of transformers.
2. Students will get Knowledge of different types of insulating materials used in transformers.

3. Students will get knowledge of applications of different types of transformer.

UNIT-I (13 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, voltage regulation and efficiency, condition for maximum efficiency, applications of transformers.

UNIT-II (10 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.

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.

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', 6th Edn., TMH, **2002.**
3. A.S. Langsdorf, 'Theory of AC Machinery', 2nd Edn., Tata McGraw Hill, **1955.**
4. Ashfaq Hussian, 'Electrical Machines', 2nd Edn., Dhanpat Rai and Company, **2002**.
5. S.J. Chapman, 'Electrical Machinery Fundamentals', 2nd Edn., McGraw Hill, New York, **1991.**

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ELECTRICAL MACHINES & DRIVES

Subject Code: BELE0-F96 **L T P C** **Contact Hrs. 36**

3 0 0 3

Course Objectives:

1. To make the students aware about the basics and need for energy efficient machines.
2. To make them familiar with the energy efficient motors and their applications.
3. To make them to understand the drive systems.

Course Outcomes:

1. The students will become aware about the need for energy efficient machines.
2. They will come to know about the energy efficient motors and their applications.
3. They will understand the adjustable speed systems.

UNIT-I (13 Hrs.)

Energy Efficient Motors: Review of induction motor characteristics, Standard motor efficiency, energy efficient motor, efficiency determination methods, Direct Measurement method, Loss segregation method, Comparison, motor efficiency labeling, energy efficient motor standards.

UNIT-II (10 Hrs.)

Power Factor: The power factor in sinusoidal systems, power factor improvement, power factor with nonlinear loads, Harmonics and power factor.

UNIT-III (12 Hrs.)

Application of Electric Motors: Varying duty applications, Voltage variation, Voltage Unbalance, over motoring, Poly-phase induction motors supplied by adjustable frequency power supplies.

UNIT-IV (10 Hrs.)

Induction Motors and Adjustable Drive Systems: Energy Conservation, adjustable speed systems, Application of adjustable speed systems to fans, pumps and constant torque loads.

Recommended Books:

1. Andreas John C., 'Energy Efficient Electric Motors', CRC Press, **1992**.
2. Emadi Ali, 'Energy Efficient Electric Motors', 3rd Edn., CRC Press, **2004**.
3. Thuman Albert, 'Introduction to Efficient Electric Systems Design', The Fairmount Press Prentice Hall, **1991.**
4. S.C. Tripathi, 'Electric Energy Utilization and Conservation', Tata McGraw Hill, **1991**.
5. Charles Belove, 'Handbook of Modern Electronics and Electrical Engineering', John Wiley and Sons, **1986**.

ELECTRICAL MACHINES AND POWER UTILIZATION

Subject Code: BELE0-F97 **L T P C** **Contact Hrs. 36**
3 0 0 3

Course Objectives:

To study different electrical power machines and their use in various applications in agricultural operations.

Course Outcomes:

Students will be able to acquire knowledge about:

1. Different types of circuits and their applications.
2. Principles and operation of transformers, DC machines and motors.
3. Various methods of power measurement.

Unit – I (10 Hrs.)

Electro motive force, reluctance, laws of magnetic circuits, determination of ampere-turns for series and parallel magnetic circuits, hysteresis and eddy current losses; Transformer- principle of working, construction of single phase transformer, EMF equation, phasor diagram on load.

Unit – II (12 Hrs.)

Leakage reactance, transformer on load, equivalent circuit, voltage regulation, power and energy efficiency, open circuit and short circuit tests, principles, operation and performance of DC machine (generator and motor), EMF and torque equations, armature reaction, commutation, excitation of DC generator and their characteristics.

Unit – III (12 Hrs.)

D.C. motor characteristics, starting of shunt and series motor, starters, speed control methods-field and armature control, poly-phase induction motor: construction, operation, equivalent circuit, phasor diagram, effect of rotor resistance, torque equation, starting and speed control methods.

Unit – IV (10 Hrs.)

Single Phase Induction Motor: Double field revolving theory, equivalent circuit, characteristics, phase split, shaded pole motors, disadvantage of low power factor and power factor improvement, various methods of single and three phase power measurement.

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Recommended Books & References:

1. P.S. Bimbhra, 'Electrical Machinery', Khanna Publishers, New Delhi, **1991**.
2. H. Cotton, 'Advanced Electrical Technology', 7th Edn., Wheeler Publishing, **1999.**
3. Nagrath, Kothari, 'Electric Machines', Tata McGraw Hill Publishing Company, New Delhi, **2010.**
4. A.K. Theraja and B.L. Theraja, 'A Textbook of Electrical Technology', Vol.-1, S. Chand Publisher, **2014.**

HEAT AND MASS TRANSFER

Subject Code: BMEE0-F91 **L T P C** **Contact Hrs. 36**
3 0 0 3

Course Objectives:
The course provides an introduction to heat and mass transfer and introduces practical application in industry. Basic tools to design process operations involving heat transfer and mass transfer are covered.

Course Outcomes:
After learning the Course, the students should be able to:

1. Understand basic concept of heat transfer.
2. To understand the concepts of heat transfer through extended surfaces.
3. Able to do basic calculations involving heat transfer as is typical for a engineer, this includes conduction, convection and radiation heat transfer as well as heat exchanger design.
4. Apply scientific and engineering principles to analyze and design aspects of engineering systems that relate to conduction, convection and radiation heat transfer.

Unit - I (8 Hrs.)

Introductory concepts, modes of heat transfer, thermal conductivity of materials, measurement. General differential equation of conduction; One dimensional steady state conduction through plane and composite walls, tubes and spheres with and without heat generation, Electrical analogy.

Unit - II (10 Hrs.)

Insulation materials, critical thickness of insulation, Fins, Free and forced convection; Newton's law of cooling, heat transfer coefficient in convection; Dimensional analysis of free and forced convection; Useful non dimensional numbers and empirical relationships for free and forced convection.

Unit - III (10 Hrs.)

Equation of laminar boundary layer on flat plate and in a tube, Laminar forced convection on a flat plate and in a tube; combined free and forced convection. Introduction- Absorptivity, reflectivity and transmissivity of radiation; Black body and monochromatic radiation, Planck's law, Stefan-Boltzman law, Kirchoff's law, grey bodies and emissive power, solid angle, intensity of radiation.

Unit - IV (12 Hrs.)

Heat transfer analysis involving conduction, convection and radiation by networks, Types of heat exchangers, fouling factor, log mean temperature difference, heat exchanger performance, transfer units. Heat exchanger analysis restricted to parallel and counter flow heat exchangers. Steady state molecular diffusion in fluids at rest and in laminar flow, Flick's law, mass transfer coefficients. Reynold's analogy.

Recommended Books & References:

1. R.K. Rajput, 'Heat and Mass Transfer', S. Chand Publication, **2008.**

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2. P.K. Nag, 'Heat & Mass Transfer', McGraw Hill, **2011.**
3. Yunus Cengel, 'Heat and Mass Transfer Fundamentals and Applications', McGraw Hill**, 2017.**
4. Incropera and Dewitt, 'Fundamental of Heat and Mass Transfer', Wiley Publication.
5. Mills and Ganesan, 'Heat Transfer', Pearson Education.

COMPUTER PROGRAMMING AND DATA STRUCTURES

Subject Code: BCSE0-F91 **L T P C** **Contact Hrs. 40**
3 0 0 3

Course Objectives:
The objective of this course is to make students to learn basic principles of Problem solving, implementing through C programming language and to design & develop programming skills and to gain knowledge of data structures and their applications.

Course Outcomes:
On completion of this course, students are able to:
1. Design and develop modular programming skills.
2. Effective utilization of memory using pointer technology
3. Understands the basic concepts of pointers and data structures.

Unit – I (8 Hrs.)

Introduction to high level languages, Primary data types and user defined data types, Variables, type casting, Operators, Building and evaluating expressions, Standard library functions, Managing input and output.

Unit – II (12 Hrs.)

Decision making, Branching, Looping, Arrays and User defined functions, passing arguments and returning values, recursion, scope and visibility of a variable, String functions, Structures and union, Pointers, Stacks, Push/Pop operations, Queues, Insertion and deletion operations, Linked lists.

Unit – III (10 Hrs.)

Familiarizing with Turbo C IDE; Building an executable version of C program; Creating programs using decision making statements such as if, go to & switch; Developing program using loop statements while, do & for; Using nested control structures.

Unit – IV (10 Hrs.)

Familiarizing with one and two dimensional arrays; Using string functions; developing structures and union; Creating user defined functions; Using local, global & external variables; Insertion/Deletion in data structures.

Recommended Books & References:

1. A.S. Tanenbaum, Y. Langsam, and M.J. Augenstein, 'Data Structures Using C', PHI/Pearson Education.
2. Ashok N. Kamthane, 'Programming and Data Structures, Pearson Publisher, **2009.**
3. B.A. Forouzan and R.F. Gilberg, 'C Programming & Data Structures', 3rd Edn., Cengage Publisher.
4. Dharmender S. Kushwaha, A.K. Mishra, 'Data Structures: A Programming Approach with C', PHI Learning Publisher, **2014.**

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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	B.Tech. ECE
BECE0-F98	Digital Signal Processing	
BECE0-F99	Antenna and Wave Propagation	
BELE0-F97	Energy Management	B.Tech. Electrical Engineering
BELE0-F98	Special Electrical Machines	
BELE0-F99	Microcontrollers	

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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

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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** **3 0 0 3**	**Duration: 38 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 Outcomes:

1. An ability and development of skill of students to design highly effective communication system.

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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’, PHI.
5. R.E. Collins, ‘Antennas and Radio Propagation’, McGraw Hill.

ENERGY MANAGEMENT

Subject Code: BELE0-F97 **L T P C** **Duration: 38 Hrs.**
3 0 0 3

Learning Objectives:

1. To understand the importance of energy management and audit.
2. To study various types of energy dissipating elements in electrical system.
3. To understand energy audit processes of these systems used in the industry.

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Course Outcomes:

1. Students will gain the knowledge about various types of energy dissipating systems.
2. Students will get knowledge about various types of losses occurring in electrical systems.
3. Students will become aware about the Energy and load management.

UNIT-I (12 Hrs.)

Energy Scenario: 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-II (12 Hrs.)

Electrical System: Electricity tariff, Load management and maximum demand control, Power factor improvement, Distribution and transformer losses. Losses in induction motors, Motor efficiency, Factors affecting motor performance, Rewinding and motor replacement issues, energy efficient motors. Light source, Choice of lighting, Luminance requirements, and Energy conservation avenues

UNIT-III (11 Hrs.)

Energy Management and Audit: 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.

UNIT-IV (10 Hrs.)

Financial Management: Investment-need, Appraisal and criteria, Financial analysis techniques-Simple payback period, Return on investment, Net present value, Internal rate of return, Cash flows, Risk and sensitivity analysis, Financing options, Energy performance contracts and role of ESCOs.

Recommended Books:

1. Y.P. Abbi and S. Jain, 'Handbook on Energy Audit and Environment Management', T E R I Press, **2006**.
2. Doti Steve, PE, CEM, 'Commercial Energy Auditing Reference Handbook', CRC Press, Taylor & Francis Group, **2010**.
3. Desai Sonal, 'Handbook of Energy Audit', McGraw Hill Education, New Delhi, **2017**.
4. Al-Shemeri Tarik, 'Energy Audits, A Workbook for Energy Management in Buildings', John Wiley & Sons, **2011**.
5. Capehart, Turner and Kennedy, 'Guide to Energy Management', CRC Press, Taylor & Francis Group, **2008**.

SPECIAL ELECTRICAL MACHINES

Subject Code: BELE0-F98	**L T P C** **3 0 0 3**	**Duration: 38 Hrs.**

Learning Objectives:

To impart knowledge on construction, principle of operation, performance, control and applications of

1. Synchronous Reluctance motors and Switched Reluctance motors.
2. Permanent magnet brushless D.C. motors and permanent magnet synchronous motors.
3. Stepper motors.

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Course Outcomes:

1. Students will come to know about construction, types and principle of operation of synchronous reluctance motors, switched reluctance motors, permanent magnet brushless D.C. motors, permanent magnet synchronous motors and stepping motors.
2. They will develop understanding about performance characteristics of all these motors.
3. They will learn about control and applications of these motors.

UNIT-I (15 Hrs.)

Synchronous Reluctance Motors: Constructional features, Types, Axial and Radial flux motors, Operating principles, Variable Reluctance and Hybrid Motors, SYNREL Motors, Voltage and Torque Equations, Phasor diagram Characteristics, applications.

Switched Reluctance Motors: Constructional features, Rotary and Linear SRMs, Principle of operation, Torque production, Steady state performance prediction, Analytical method, Power Converters and their controllers, Methods of Rotor position sensing, Sensor less operation, Closed loop control of SRM, Characteristics, applications.

UNIT-II (10 Hrs.)

Permanent Magnet Brushless D.C. Motors: Permanent Magnet materials, Magnetic Characteristics, Permeance coefficient -Principle of operation, Types, Magnetic circuit analysis, EMF and torque equations, Commutation, Power controllers, Motor characteristics, control and applications.

UNIT-III (10 Hrs.)

Permanent Magnet Synchronous Motors: Principle of operation, Ideal PMSM, EMF and Torque equations, Armature reaction MMF, Synchronous Reactance Sine wave motor with practical windings, Phasor diagram, Torque/speed characteristics, Power controllers, Converter Volt-ampere requirements.

UNIT-IV (10 Hrs.)

Stepper Motors: Constructional features, Principle of operation, Variable reluctance motor, Hybrid motor, Single and multi-stack configurations, Torque equations, Modes of excitations, Characteristics, Drive circuits, Microprocessor control of stepping motors, Closed loop control.

Recommended Books:

1. T.J.E. Miller, 'Brushless Permanent Magnet and Reluctance Motor Drives', Clarendon Press, Oxford, **1989**.
2. T. Kenjo, 'Stepping Motors and Their Microprocessor Controls', Clarendon Press, London, **1984**.
3. A.F. Fitzgerald, Kingsley Charles, Umans Stephen, 'Electric Machinery', McGraw Hill Education, **2017**.
4. E.G. Janardanan, 'Special Electrical Machines', PHI, **2014**.
5. R. Srinivasan, 'Special Electrical Machines', Lakhshmi Publications, **2013**.

MICROCONTROLLERS

Subject Code: BELE0-F99 **L T P C** **Duration: 38 Hrs.**
3 0 0 3

Learning Objectives:

1. To acquire knowledge about architecture of 8051 microcontroller.
2. To understand program development tools and programming methods of 8051 microcontroller.

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3. To interface peripheral devices with microcontrollers.

Course Outcomes:

1. The students will become familiar with architecture of 8051 microcontroller.
2. The students will learn about instruction set and assembly language programming of 8051 microcontroller.
3. Students will learn how to interface 8051 with peripheral devices.

UNIT-I (10 Hrs.)

8051 Microcontroller Architecture: Introduction to MCS -51 Family microcontrollers, Architectural block Diagram, Pin diagram and Pin Functions, General Purpose and Special Function Registers, Oscillator and clock circuit, Reset circuit, I/O Port circuits, Memory organization, Internal program and data memory.

UNIT-II (14 Hrs.)

Introduction to Program Development Tools (IDE): Concept of IDE, Editor, Assembler, Compiler, Linker, Simulator, Debugger and assembler directives.

8051 Assembly Language Programming: Programming model of 8051, Addressing modes, data transfer instructions, I/O Port programming, Arithmetic and Logical instructions, Bit level instructions, Branching instructions (Jump and loop Jump and call), Concept of stack, subroutine and related instructions, writing programs (like time delay using loop, data conversions HEX to ASCII, BCD to ASCII, use of look up table etc.) in assembly language 8051 and testing the same using IDE.

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UNIT-III (12 Hrs.)

External Memory Interfacing: Memory address decoding, interfacing 8031/8051 with ROM/EPROM and Data ROM

8051 Timer/Counter and Programming: Use of counter as timer, Timer/Counters and associated registers, Various modes of timer/counter operations, Time delay programs in Assembly language/ Embedded C

8051 Serial Port and Programming: Basics of serial communication, RS232 standards, 8051 connection to RS232, Serial data input/output and associated registers, Various modes of serial data communication, serial data communication programs in Assembly language/ Embedded C.

8051 Interrupts: Concept of Interrupt, interrupt versus polling, Types of interrupts in 8051, Reset, interrupt control and associated registers, interrupt vectors, Interrupt execution, RETI instruction, software generated interrupt, interrupt handler subroutine for timer/counter and serial data transmission/reception in Assembly language/ Embedded C.

UNIT-IV (9 Hrs.)

Applications and design of microcontroller based systems: Interfacing of LEDs, 7 Segment display device, LCD display, DIP Switches, Push Button switches, Key debounce techniques, Keyboard connections, load per key and matrix form, Interfacing A/D converter, D/A converter, Relay, Opto-isolator, stepper motor and DC motor

Recommended Books:

1. M.A. Mazidi, J.G. Mazidi and R.D. Mckinlay, 'The 8051 Microcontroller and Embedded Systems: using Assembly and C', Pearson Education, **2007**.
2. Sunil Mathur, 'MICROPROCESSOR 8085 & ITS INTERFACING', 2nd Edn., Prentice Hall of India, **2011.**
3. Mandal Soumitra Kumar, 'Microprocessors and Microcontrollers: Architecture, Programming and Interfacing Using 8085, 8086 and 8051', McGraw Hill Education, **2017**.

4. B. Ram, 'Fundamentals of Microprocessors and Microcontrollers', Dhanpat Rai Publications Pvt. Ltd., **2008**.
5. R.S. Gaonkar, 'The 8085 Microprocessor-Architecture, Programming and Interfacing', 6th Edn., Penram International Publishing (India) Pvt. Ltd., **2013**.
6. D.V. Hall, S.S.S.P. Rao, 'Microprocessors and Interfacing', 3rd Edn., McGraw Hill Education, **2012**.

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1st Semester		Contact Hrs.			Marks			Credits
Code	**Course**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
MCSCE1-101	Mathematical Foundations of Computer Science	3	0	0	40	60	100	3
MCSCE1-102	Advanced Data Structures	3	0	0	40	60	100	3
MCSCE1-103	Research Methodology and IPR	2	0	0	40	60	100	2
MCSCE1-104	Lab.-I (Advanced Data Structures Lab)	0	0	4	60	40	100	2
Departmental Elective-I		3	0	0	40	60	100	3
MCSCE1-156	Machine Learning							
MCSCE1-157	Wireless Sensor Networks							
MCSCE1-158	Introduction to Intelligent Systems							
Departmental Elective-II		3	0	0	40	60	100	3
MCSCE1-159	Data Science							
MCSCE1-160	Distributed Systems							
MCSCE1-161	Advanced Wireless and Mobile Networks							
Lab.-II (Based on any one Departmental Elective chosen in 1st semester)		0	0	4	60	40	100	2
MCSCE1-162	Machine Learning Lab							
MCSCE1-163	Wireless Sensor Networks Lab							
MCSCE1-164	Introduction to Intelligent Systems Lab							
MCSCE1-165	Data Science Lab							
MCSCE1-166	Distributed Systems Lab							
MCSCE1-167	Advanced Wireless and Mobile Networks Lab							
Audit Course (Choose any one)		2	0	0	100	0	100	0
MHUMA0-101	English For Research Paper Writing							
MCIVE0-101	Disaster Management							
MHUMA0-102	Sanskrit for Technical Knowledge							
MHUMA0-103	Value Education							
MHUMA0-104	Constitution of India							
MHUMA0-105	Pedagogy Studies							
MHUMA0-106	Stress Management by Yoga							
MHUMA0-107	Personality Development through Life Enlightenment Skills							
Total		**16**	**0**	**8**	**420**	**380**	**800**	**18**

2nd Semester		Contact Hrs.			Marks			Credits
Code	**Course**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
MCSCE1-205	Advanced Algorithms	3	0	0	40	60	100	3
MCSCE1-206	Soft Computing	3	0	0	40	60	100	3
Lab.-III (Based on Cores of 2nd Semester)		0	0	4	60	40	100	2
MCSCE1-268	Advanced Algorithm Lab							
MCSCE1-269	Soft Computing Lab							
Departmental Elective-III		3	0	0	40	60	100	3
MCSCE1-270	Data Preparation and Analysis							
MCSCE1-271	Secure Software Design & Enterprise Computing							
MCSCE1-272	Computer Vision							
Departmental Elective-IV		3	0	0	40	60	100	3
MCSCE1-273	Human and Computer Interaction							
MCSCE1-274	GPU Computing							
MCSCE1-275	Digital Forensics							
Lab.-IV 2 (Based on Electives of 2nd Semester)		0	0	4	60	40	100	2
MCSCE1-276	Data Preparation and Analysis Lab							
MCSCE1-277	Secure Software Design & Enterprise Computing Lab							
MCSCE1-278	Computer Vision Lab							
MCSCE1-279	Human and Computer Interaction Lab							
MCSCE1-280	GPU Computing Lab							
MCSCE1-281	Digital Forensics Lab							
MCSCE1-207	Mini Project With Seminar	0	0	4	60	40	100	2
Audit Course (Choose any one)		2	0	0	-	-	-	0
MHUMA0-101	English For Research Paper Writing							
MCIVE0-101	Disaster Management							
MHUMA0-102	Sanskrit for Technical Knowledge							
MHUMA0-103	Value Education							
MHUMA0-104	Constitution of India							
MHUMA0-105	Pedagogy Studies							
MHUMA0-106	Stress Management by Yoga							
MHUMA0-107	Personality Development through Life Enlightenment Skills							
Total		**14**	**0**	**12**	**340**	**360**	**700**	**18**

Note: Choose any one Audit Course in the table for 2nd semester except the one chosen in 1st semester.

MATHEMATICAL FOUNDATION OF COMPUTER SCIENCE

Subject Code: MCSCE1-101 **L T P C** **Duration: 38 Hrs.**
3 0 0 3

Course Objectives:
To understand the mathematical fundamentals that is prerequisites for a variety of courses like:
1. Data mining, Network protocols, analysis of Web traffic, Computer security, Software engineering, Computer architecture, operating systems, distributed systems, Bioinformatics, Machine learning.
2. To develop the understanding of the mathematical and logical basis to many modern techniques in information technology like machine learning, programming language design, and concurrency.
3. To study various sampling and classification problems.

Course Outcomes:
After completion of course, students would be able to:
CO1: To understand the basic notions of discrete and continuous probability.
CO2: To understand the methods of statistical inference, and the role that sampling distributions play in those methods.
CO3: To be able to perform correct and meaningful statistical analyses of simple to moderate complexity.

UNIT-I

Probability mass, density, and cumulative distribution functions, parametric families of distributions, Expected value, variance, conditional expectation, Applications of the univariate and multivariate Central Limit Theorem, Probabilistic inequalities, Markov chains.

UNIT-II

Random samples, sampling distributions of estimators, Methods of Moments and Maximum Likelihood.
Statistical inference, Introduction to multivariate statistical models: regression and classification problems, principal components analysis, The problem of overfitting model assessment.

UNIT-III

Graph Theory: Isomorphism, Planar graphs, graph coloring, Hamilton circuits and Euler cycles. Permutations and Combinations with and without repetition. Specialized techniques to solve combinatorial enumeration problems.

UNIT-IV

Applications of Mathematics in various fields of Computer science and engineering.
Recent Trends in various distribution functions in mathematical field of computer science for varying fields like bioinformatics, soft computing, and computer vision.

Recommended Books:

1. John Vince, ‘Foundation Mathematics for Computer Science’, Springer.
2. K. Trivedi, ‘Probability and Statistics with Reliability, Queuing, and Computer Science Applications’, Wiley.
3. M. Mitzenmacher and E. Upfal, ‘Probability and Computing: Randomized Algorithms and Probabilistic Analysis’.
4. Alan Tucker, ‘Applied Combinatorics’, Wiley.

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ADVANCED DATA STRUCTURES

Subject Code: MCSCE1-102 **L T P C** **Duration: 38 Hrs.**
3 0 0 3

Course Objectives:

1. The student should be able to choose appropriate data structures, understand the ADT/libraries and use it to design algorithms for a specific problem.
2. Students should be able to understand the necessary mathematical abstraction to solve problems.
3. To familiarize students with advanced paradigms and data structure used to solve algorithmic problems.
4. Student should be able to come up with analysis of efficiency and proofs of correctness.

Course Outcomes:

After completion of course, students would be able to:

CO1: Understand the implementation of symbol table using hashing techniques

CO2: Develop and analyze algorithms for red-black trees, B-trees and Splay trees.

CO3: Develop algorithms for text processing applications.

CO4: Identify suitable data structures and develop algorithms for computational geometry problems

UNIT–I

Dictionaries: Definition, Dictionary Abstract Data Type, Implementation of Dictionaries. **Hashing**: Review of Hashing, Hash Function, Collision Resolution Techniques in Hashing, Separate Chaining, Open Addressing, Linear Probing, Quadratic, Probing, Double Hashing, Rehashing, Extendible Hashing.

UNIT–II

Skip Lists: Need for Randomizing Data Structures and Algorithms, Search and Update Operations on Skip Lists, Probabilistic Analysis of Skip Lists, Deterministic Skip Lists

Trees: Binary Search Trees, AVL Trees, Red Black Trees, 2-3 Trees, B-Trees, Splay Trees

UNIT–III

Text Processing: Sting Operations, Brute-Force Pattern Matching, The Boyer-Moore Algorithm, The Knuth-Morris-Pratt Algorithm, Standard Tries, Compressed Tries, Suffix Tries, The Huffman Coding Algorithm, The Longest Common Subsequence Problem (LCS), Applying Dynamic Programming to the LCS Problem.

UNIT – IV

Computational Geometry: One Dimensional Range Searching, Two Dimensional Range Searching, constructing a Priority Search Tree, Searching a Priority Search Tree, Priority Range Trees, Quad trees, k-D Trees.

Recent Trends in Hashing, Trees, and various computational geometry methods for efficiently solving the new evolving problem.

Recommended Books:

1. Mark Allen Weiss, ‘Data Structures and Algorithm Analysis in C++’, 2nd Edn., Pearson, **2004**.
2. M.T. Goodrich, Roberto Tamassia, ‘Algorithm Design’, John Wiley, **2002**.

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RESEARCH METHODOLOGY AND IPR

Subject Code: MCSCE1-103 **L T P C** **Duration: 28 Hrs.**
2 0 0 2

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:
At the end of this course, students will be able to

CO1: Understand research problem formulation, analyze research related information, Follow research ethics

CO2: Understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity.

CO3: Understanding that when IPR would take such important place in growth of individuals & nation, it is needless to emphasis the need of information about Intellectual Property Right to be promoted among students in general & engineering in particular.

CO4: Understand that IPR protection provides an incentive to inventors for further research work and investment in R & D, which leads to creation of new and better products, and in turn brings about, economic growth and social benefits.

UNIT-I

Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations.

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UNIT-II

Effective literature studies approaches, analysis Plagiarism, Research ethics, Effective technical writing, how to write report, Paper Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee.

UNIT-III

Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. Introduction to international Scenario on Intellectual Property, Procedure for grants of patents, Patenting under PCT.

UNIT-IV

Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases.

New Developments in IPR: Administration of Patent System. New developments in IPR: introduction to IPR of Biological Systems, Computer Software etc. Traditional Knowledge Case Studies, IPR or IITs

Recommended Books:

1. Stuart Melville and Wayne Goddard, 'Research methodology: An Introduction for Science & Engineering Students'.
2. Wayne Goddard and Stuart Melville, 'Research Methodology: An Introduction'.
3. Ranjit Kumar, 2^{nd} Edn., 'Research Methodology: A Step by Step Guide for Beginners'.
4. Halbert, 'Resisting Intellectual Property', Taylor & Francis Ltd., **2007**.
5. Mayall , 'Industrial Design', McGraw Hill, **1992**.
6. Niebel , 'Product Design', McGraw Hill, **1974**.
7. Asimov, 'Introduction to Design', Prentice Hall, **1962**.

8. Robert P. Merges, Peter S. Menell, Mark A. Lemley, 'Intellectual Property in New Technological Age', **2016**.
9. T. Ramappa, 'Intellectual Property Rights Under WTO', S. Chand, **2008.**

LAB.-I (ADVANCED DATA STRUCTURES)

Subject Code: MCSCE1-104	**L T P C** **0 0 4 2**	**Duration: 60 Hrs.**

Programs may be implemented using C/C++/java

EXP 1: Program to store k keys into an array of size n at the location computed using a hash function, loc = key % n, where k<=n and k takes values from [1 to m], m>n. To handle the collisions, use the following collision resolution techniques,

a) Linear probing,
b) Quadratic probing,
c) Double hashing/rehashing,
d) Chaining

EXP 2: Program for Binary Search Tree to implement following operations:

a) Insertion,
b) Deletion,
   i) Delete a node with only child,
   ii) Delete a node with both children
c) Finding an element,
d) Finding Min element,
e) Finding Max element,
f) Left child of the given node,
g) Right child of the given node,
h) Finding the number of nodes, leaves nodes, full nodes, ancestors, descendants.

EXP 3: Program for AVL Tree to implement following operations: (For nodes as integers)

a) Insertion: Test program for all cases (LL, RR, RL, LR rotation),
b) Deletion: Test Program for all cases (R0, R1, R-1, L0, L1, L-1),
c) Display: using set notation.

EXP 4: Program to implement Red-Black trees with insertion and deletion operation for the given input data as Integers/Strings

EXP 5: Program to implement insertion, deletion, display and search operation in m-way B tree (i.e. a non-leaf node can have at most m children) for the given data as integers.

EXP 6: Program to perform string matching using Knuth-Morris-Pratt algorithm.

EXP 7: Program to perform string matching using Boyer-Moore algorithm.

EXP 8: Program to implement 2-D range search over computational geometry problem

EXP 9: Program on latest efficient algorithms on trees for solving contemporary problems.

Mini Project: Student has to do a project assigned from course contents in a group of two or three students. The team will have to demonstrate as well as have to give a presentation of the same.

MACHINE LEARNING

Subject Code: MCSCE1-156	**L T P C** **3 0 0 3**	**Duration: 38 Hrs.**

Course Objectives:

1. To learn the concept of how to learn patterns and concepts from data without being explicitly programmed in various IOT nodes.

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2. To design and analyse various machine learning algorithms and techniques with a modern outlook focusing on recent advances.
3. Explore supervised and unsupervised learning paradigms of machine learning.
4. To explore Deep learning technique and various feature extraction strategies.

Course Outcomes:

After completion of course, students would be able to:

CO1: Extract features that can be used for a particular machine learning approach in various IOT applications.

CO2: To compare and contrast pros and cons of various machine learning techniques and to get an insight of when to apply a particular machine learning approach.

CO3: To mathematically analyze various machine learning approaches and paradigms.

UNIT-I

Supervised Learning (Regression/Classification) Basic Methods: Distance-based methods, Nearest-Neighbours, Decision Trees, Naive Bayes Linear models: Linear Regression, Logistic Regression, Generalized Linear Models Support Vector Machines, Nonlinearity and Kernel Methods Beyond Binary Classification.

UNIT-II

Unsupervised Learning Clustering: K-means/Kernel K-means Dimensionality Reduction: PCA and kernel PCA Matrix Factorization and Matrix Completion Generative Models (mixture models and latent factor models)

Evaluating Machine Learning algorithms and Model Selection, Introduction to Statistical Learning Theory, Ensemble Methods (Boosting, Bagging, Random Forests).

UNIT-III

Sparse Modeling and Estimation, Modeling Sequence/Time-Series Data, Deep Learning and Feature Representation Learning.

Scalable Machine Learning (Online and Distributed Learning). A selection from some other advanced topics, e.g., Semi-supervised Learning, Active Learning, Reinforcement Learning, Inference in Graphical Models, Introduction to Bayesian Learning and Inference.

UNIT-IV

Recent trends in various learning techniques of machine learning and classification methods for IOT applications, Introduction to Various models for IOT applications.

Recommended Books:

1. Kevin Murphy, ‘Machine Learning: A Probabilistic Perspective’, MIT Press, **2012**.
2. Trevor Hastie, Robert Tibshirani, Jerome Friedman, ‘The Elements of Statistical Learning’, Springer, **2009** (freely available online).
3. Christopher Bishop, ‘Pattern Recognition and Machine Learning’, Springer, **2007**.

WIRELESS SENSOR NETWORKS

Subject Code: MCSCE1-157 **L T P C** **Duration: 38 Hrs.**
3 0 0 3

Course Objectives:

1. Architect sensor networks for various application setups.
2. Devise appropriate data dissemination protocols and model links cost
3. Understanding of the fundamental concepts of wireless sensor networks and have a basic knowledge of the various protocols at various layers.
4. Evaluate the performance of sensor networks and identify bottlenecks.

Course Outcomes:

After completion of course, students would be able to:

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CO1: Describe and explain radio standards and communication protocols for wireless sensor networks.
CO2: Explain the function of the node architecture and use of sensors for various applications.
CO3: Be familiar with architectures, functions and performance of wireless sensor networks systems and platforms.

UNIT-I

Introduction to Wireless Sensor Networks: Course Information, Introduction to Wireless Sensor Networks: Motivations, Applications, Performance metrics, History and Design factors,
Network Architecture: Traditional layered stack, Cross-layer designs, Sensor Network Architecture Hardware Platforms: Motes, Hardware parameters.

UNIT-II

Introduction to ns-3: Introduction to Network Simulator 3 (ns-3), Description of the ns-3 core module and simulation example.
Medium Access Control Protocol Design: Fixed Access, Random Access, WSN protocols: synchronized, duty-cycled.
Introduction to Markov Chain: Discrete time Markov Chain definition, properties, classification and analysis.
MAC Protocol: Introduction to analysis of MAC Protocols.

UNIT-III

Routing Protocols: Introduction, MANET protocols
Routing Protocols for WSN: Resource-aware routing, Data-centric, Geographic Routing, Broadcast, Multicast.
Opportunistic Routing Analysis: Introduction to opportunistic routing.

UNIT-IV

Security: Possible attacks, countermeasures, SPINS, Static and dynamic key distribution.
ADVANCED TOPICS Recent development in WSN standards, software applications.

Recommended Books:

1. W. Dargie and C. Poellabauer, 'Fundamentals of Wireless Sensor Networks –Theory and Practice', Wiley, **2010.**
2. Kazem Sohraby, Daniel Minoli and Taieb Znati, 'Wireless Sensor Networks -Technology, Protocols, and Applications', Wiley Interscience, **2007**.
3. Takahiro Hara, Vladimir I. Zadorozhny and Erik Buchmann, 'Wireless Sensor Network Technologies for the Information Explosion Era', Springer, **2010**.

INTRODUCTION TO INTELLIGENT SYSTEMS

Subject Code: MCSCE1-158 **L T P C** **Duration: 38 Hrs.**
3 0 0 3

Course Objectives:
The aim of the course is to introduce to the field of Artificial Intelligence(AI) with emphasis on its use to solve real world problems for which solutions are difficult to express using the traditional algorithmic approach.

Course Outcomes:
After completion of course, students would be:
CO1 Able to demonstrate knowledge of the fundamental principles of intelligent systems and would be able to analyses and compare the relative merits of a variety of AI problem solving techniques.

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UNIT-I

Biological Foundations to Intelligent Systems I: Artificial neural networks, Backpropagation networks, Radial basis function networks, and recurrent networks.
Biological foundations to intelligent systems II: Fuzzy logic, knowledge Representation and inference mechanism, genetic algorithm, and fuzzy neural networks.

UNIT-II

Search Methods Basic concepts of graph and tree search. Three simple search methods: breadth-first search, depth-first search, iterative deepening search. Heuristic search methods: best-first search, admissible evaluation functions, hill- climbing search. Optimization and search such as stochastic annealing and genetic algorithm.

UNIT-III

Knowledge representation and logical inference Issues in knowledge representation. Structured representation, such as frames, and scripts, semantic networks and conceptual graphs. Formal logic and logical inference. Knowledge-based systems structures, its basic components. Ideas of Blackboard architectures.

UNIT-IV

Reasoning under uncertainty and Learning Techniques on uncertainty reasoning such as Bayesian reasoning, Certainty factors and Dempster-Shafer Theory of Evidential reasoning, A study of different learning and evolutionary algorithms, such as statistical learning and induction learning.
Recent trends in Fuzzy logic, Knowledge Representation.

Recommended Books:

1. G.F. Luger and W.A. Stubblefield, 'Artificial Intelligence: Structures and Strategies for Complex Problem Solving', 6th Edn., Addison Wesley, **2008**.
2. S. Russell and P. Norvig, 'Artificial Intelligence: A Modern Approach', 3rd Edn., Prentice-Hall, **2009**.

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DATA SCIENCE

Subject Code: MCSCE1-159 **L T P C** **Duration: 38 Hrs.**
3 0 0 3

Course Objectives:

1. Provide you with the knowledge and expertise to become a proficient data scientist.
2. Demonstrate an understanding of statistics and machine learning concepts that are vital for data science;
3. Produce Python code to statistically analyses a dataset
4. Critically evaluate data visualizations based on their design and use for communicating stories from data

Course Outcomes:

On completion of the course the student should be able to
CO1: Explain how data is collected, managed and stored for data science;
CO2: Understand the key concepts in data science, including their real-world applications and the toolkit used by data scientists
CO3: Implement data collection and management scripts using MongoDB

UNIT-I

Introduction to Core Concepts and Technologies: Introduction, Terminology, data science process, data science toolkit, Types of data, Example applications.
Data Collection and Management: Introduction, Sources of data, Data collection and APIs, Exploring and fixing data, Data storage and management, Using multiple data sources.

UNIT-II

Data Analysis: Introduction, Terminology and concepts, Introduction to statistics, Central tendencies and distributions, Variance, Distribution properties and arithmetic, Samples/CLT, Basic machine learning algorithms, Linear regression, SVM, Naive Bayes.

UNIT-III

Data Visualization: Introduction, Types of data visualization, Data for visualization: Data types, Data encodings, Retinal variables, Mapping variables to encodings, Visual encodings.

UNIT-IV

Applications of Data Science, Technologies for visualization, Bokeh (Python)
Recent trends in various data collection and analysis techniques, various visualization techniques, application development methods of used in data science.

Recommended Books:

1. Cathy O'Neil and Rachel Schutt, 'Doing Data Science, Straight Talk from the Frontline', O'Reilly.
2. Jure Leskovek, Annand Rajaraman and Jeffrey Ullman, 'Mining of Massive Datasets', Vol.- 2.1, Cambridge University Press.

DISTRIBUTED SYSTEMS

Subject Code: MCSCE1-160 **L T P C** **Duration: 38 Hrs.**
3 0 0 3

Course Objectives:
Course Outcomes: After completion of course, students would be:
CO1: Design trends in distributed systems.

UNIT-I

Introduction: Distributed data processing; What is a DDBS; Advantages and disadvantages of DDBS; Problem areas; Overview of database and computer network concepts
Distributed Database Management System Architecture: Transparencies in a distributed DBMS; Distributed DBMS architecture; Global directory issues.

UNIT-II

Distributed Database: Design Alternative design strategies; Distributed design issues; Fragmentation; Data allocation. BASICS OF SEMANTIC DATA CONTROL, QUERY PROCESSING ISSUES Objectives of query processing; Characterization of query processors; Layers of query processing; Query decomposition; Localization of distributed data.

UNIT-III

Distributed Query Optimization: Factors governing query optimization; Centralized query optimization; Ordering of fragment queries;
Transaction Management The transaction concept; Goals of transaction management; Characteristics of transactions; Taxonomy of transaction models.
Concurrency Control Concurrency control in centralized database systems; Concurrency control in DDBSs; Distributed concurrency control algorithms; Deadlock management.

UNIT-IV

Reliability: Reliability issues in DDBSs; Types of failures; Reliability techniques; Commit protocols; Recovery protocols.
Parallel Database Systems: Parallel architectures; parallel query processing and optimization; load balancing.
Advanced Topics: Mobile Databases, Multi-databases.

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Recommended Books:

1. M.T. Ozsu and P. Valduriez, 'Principles of Distributed Database Systems', Prentice Hall, **1991**.
2. D. Bell and J. Grimson, 'Distributed Database Systems', Addison Wesley, **1992**.

ADVANCED WIRELESS AND MOBILE NETWORKS

Subject Code: MCSCE1-161 **L T P C** **Duration: 38 Hrs.**
3 0 0 3

Course Objectives:

1. The students should get familiar with the wireless/mobile market and the future needs and challenges.
2. To get familiar with key concepts of wireless networks, standards, technologies and their basic operations
3. To learn how to design and analyse various medium access
4. To learn how to evaluate MAC and network protocols using network simulation software tools.
5. The students should get familiar with the wireless/mobile market and the future needs and challenges.

Course Outcomes:

After completion of course, students would be:

CO1: Demonstrate advanced knowledge of networking and wireless networking and understand various types of wireless networks, standards, operations and use cases.

CO2: Be able to design WLAN, WPAN, WWAN, Cellular based upon underlying propagation and performance analysis.

CO3: Demonstrate knowledge of protocols used in wireless networks and learn simulating wireless networks.

CO4: Design wireless networks exploring trade-offs between wire line and wireless links.

CO5: Develop mobile applications to solve some of the real world problems.

UNIT-I

Introduction: Wireless Networking Trends, Key Wireless Physical Layer Concepts, Multiple Access Technologies -CDMA, FDMA, TDMA, Spread Spectrum technologies, Frequency reuse, Radio Propagation and Modelling, Challenges in Mobile Computing: Resource poorness, Bandwidth, energy etc. WIRELESS LOCAL AREA NETWORKS: IEEE 802.11 Wireless LANs Physical & MAC layer, 802.11 MAC Modes (DCF& PCF) IEEE 802.11 standards, Architecture & protocols, Infrastructure vs. Adhoc Modes, Hidden Node & Exposed Terminal Problem, Problems, Fading Effects in Indoor and outdoor WLANs, WLAN Deployment issues.

UNIT-II

Wireless Cellular Networks: 1G and 2G, 2.5G, 3G, and 4G, Mobile IPv4, Mobile IPv6, TCP over Wireless Networks, Cellular architecture, Frequency reuse, Channel assignment strategies, Handoff strategies, Interference and system capacity, improving coverage and capacity in cellular systems, Spread spectrum Technologies.

UNIT-III

WiMAX (Physical layer, Media access control, Mobility and Networking), IEEE 802.22 Wireless Regional Area Networks, IEEE 802.21 Media Independent Handover Overview **Wireless Sensor Networks:** Introduction, Application, Physical, MAC layer and Network Layer, Power Management, Tiny OS Overview.

UNIT-IV

WIRELESS PANs Bluetooth AND Zigbee, Introduction to Wireless Sensors.

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Security: Security in wireless Networks Vulnerabilities, Security techniques, Wi-Fi Security, DoS in wireless communication.
Advanced Topics: IEEE 802.11x and IEEE 802.11i standards, Introduction to Vehicular Adhoc Networks.
Recommended Books:

1. J. Schiller, 'Mobile Communications', Addison Wesley, **2000.**
2. W. Stallings, 'Wireless Communications and Networks', Pearson Education, **2005.**
3. Stojmenic Ivan, 'Handbook of Wireless Networks and Mobile Computing', John Wiley and Sons Inc., **2002**.
4. Yi Bing Lin and Imrich Chlamtac, 'Wireless and Mobile Network Architectures', John Wiley and Sons Inc., **2000**.
5. Pandya Raj, 'Mobile and Personal Communications Systems and Services', PHI.

MACHINE LEARNING LAB.

Subject Code: MCSCE1-162 **L T P C 0 0 4 2** **Duration: 60 Hrs.**

Programs may be implemented using WEKA/R/PYTHON etc. similar software
Expt. 1: Study of platform for Implementation of Assignments Download the open source software of your interest. Document the distinct features and functionality of the software platform. You may choose WEKA, R or any other software.
Expt. 2: Supervised Learning – Regression Generate a proper 2-D data set of N points. Split the data set into Training Data set and Test Data set.
a) Perform linear regression analysis with Least Squares Method.
b) Plot the graphs for Training MSE and Test MSE and comment on Curve Fitting and Generalization Error.
c) Verify the Effect of Data Set Size and Bias-Variance Trade off.
d) Apply Cross Validation and plot the graphs for errors. v) Apply Subset Selection Method and plot the graphs for errors. Describe your findings in each case.

Expt. 3: Supervised Learning – Classification Implement Naïve Bayes Classifier and K-Nearest Neighbour Classifier on Data set of your choice. Test and Compare for Accuracy and Precision.
Expt. 4: Unsupervised Learning Implement K-Means Clustering and Hierarchical clustering on proper data set of your choice. Compare their Convergence.
Expt. 5: Dimensionality Reduction Principal Component Analysis-Finding Principal Components, Variance and Standard Deviation calculations of principal components.
Expt. 6: Supervised Learning and Kernel Methods Design, Implement SVM for classification with proper data set of your choice. Comment on Design and Implementation for Linearly non-separable Dataset.
Mini Project: Student has to do a project assigned from course contents in a group of two or three students. The team will have to demonstrate as well as have to give a presentation of the same.

WIRELESS SENSOR NETWORKS LAB.

Subject Code: MCSCE1-163 **L T P C 0 0 4 2** **Duration: 60 Hrs.**

Programs may be implemented using NS2/NS3
Expt. 1: Introduction to Network Simulators used for Wireless Sensor Networks.
Expt. 2: Introduction to TCL scripting: Demonstration of one small network simulator setup.

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Expt. 3: To study various trace files formats of Network Simulators.
Expt. 4: To create a sensor network setup using the nodes configured with fixed initial energy, transmission power, reception power, routing agent, transport agent and application in rectangular area.
Expt. 5: Create different simulation scenarios by varying MAC protocols.
Expt. 6: Compute the performance of above created simulation scenarios of network in terms of total energy consumption, transmission latency, number of packets generated, received and dropped.
Expt. 7: To implement and compare various routing protocols using above mentioned performance metrics.
Mini Project: Student has to do a project assigned from course contents in a group of two or three students. The team will have to demonstrate as well as have to give a presentation of the same.

INTRODUCTION TO INTELLIGENT SYSTEMS LAB.

Subject Code: MCSCE1-164 **L T P C** **0 0 4 2** **Duration: 60 Hrs.**

Programs may be implemented using Matlab/Python
Expt. 1: Implementation of simple artificial neural network.
Expt. 2: Implementation of neural network with backpropagation.
Expt. 3: Implementation of radial basis function network
Expt. 4: Implementation of recurrent neural network.
Expt. 5: Implementation of fuzzy neural network.
Expt. 6: Implementation of iterative deepening search.
Expt. 7: Implementation of Hill climbing Search algorithm.
Expt. 8: Implementation of optimization genetic algorithm.
Expt. 9: Implementation of induction based learning method such as decision tree.
Expt. 10: Implementation of statistical learning methods such as naive Bayes.
Mini Project: Student has to do a project assigned from course contents in a group of two or three students. The group of students must submit a project report of 8 to 10 pages (approximately) and the team will have to demonstrate as well as have to give a presentation of the same.

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DATA SCIENCE LAB.

Subject Code: MCSCE1-165 **L T P C** **0 0 4 2** **Duration: 60 Hrs.**

Programs may be implemented using Matlab/Python/R
Expt. 1: **Introduction to R:** This Cycle introduces you to the use of the R statistical package within the Data Science and Big Data Analytics environment. After completing the tasks in this cycle you should able to: a. Read data sets into R, save them, and examine the contents.
Tasks you will complete in this Cycle include:
a) Invoke the R environment and examine the R workspace.
b) Created table and datasets in R.
c) Examine, manipulate and save datasets. d. Exit the R environment.
Expt. 2: **Basic Statistics and Visualization:** This Cycle introduces you to the analysis of data using the R statistical package within the Data Science and Big Data Analytics environment. After completing the tasks in Tins Cycle you should able to:
a) Perform summary (descriptive) statistics on the datasets.

b) Create basic visualizations using R both to support investigation of the data as well as exploration of the data.
c) Create plot visualizations of the data using a graphics package.

Tasks you will complete in this Cycle include:

a) Reload data sets into the R statistical package.
b) Perform summary statistics on the data.
c) Remove outliers from the data.
d) Plot the data using R.
e) Plot the data using lattice and ggplot.

Expt. 3: **K-means Clustering:** This Cycle is designed to investigate and practice K-means Clustering. After completing the tasks in This Cycle you should able to:

a) Use R functions to create K-means Clustering models.
b) Use ODBC connection to the database and execute SQL statements and load datasets from the database in an R environment.
c) Visualize the effectiveness of the K-means Clustering algorithm using graphic capabilities in R.
d) Use the ODBC connection in the R environment to create the average household income from the census database as test data for K-means Clustering.
e) Use R graphics functions to visualize the effectiveness of the K-means Clustering algorithm.

Expt. 4: **Association Rules:** This Cycle is designed to investigate and practice Association Rules. After completing the tasks in This Cycle you should able to: a. Use R functions for Association Rule based models. Tasks you will complete in this Cycle include:

a) Use the R-Studio environment to code Association Rule models.
b) Apply constraints in the Market Basket Analysis methods such as minimum thresholds on support and confidence measures that can be used to select interesting rules from the set of all possible rules.
c) Use R graphics "rules" to execute and inspect the models and the effect of the various thresholds.

Expt. 5: Linear Regression: This Cycle is designed to investigate and practice linear regression. After completing the tasks in This Cycle you should able to:

a) Use R functions for Linear Regression (Ordinary Least Squares - OLS).
b) Predict the dependent variables based on the model.
c) Investigate different statistical parameter tests that measure the effectiveness of the model. Tasks you will complete in This Cycle include:

a) Use the R-Studio environment to code OLS models
b) Review the methodology to validate the model and predict the dependent variable for a set of given independent variables
c) Use R graphics functions to visualize the results generated with the mode

Expt. 6: **Naïve Bayesian Classifier:** This Cycle is designed to investigate and practice Navive Bayesian classifier. After completing the tasks in this Cycle you should able to:

a) Use R functions for Naïve Bayesian Classification
b) Apply the requirements for generating appropriate training data
c) Validate the effectiveness of the Naïve Bayesian Classifier with the big data.

Tasks you will complete in Tins Cycle include:

a) Use R-Studio environment to code the Naïve Bayesian Classifier
b) Use the ODBC connection to the "census" database to create a training data set for Naïve Bayesian Classifier from the big data.
c) Use the Naive Bayesian Classifier program and evaluate how well it predicts the results using the training data and then compare the results with original data.

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Expt. 7: **Decision Trees:** This Cycle is designed to investigate and practice Decision Tree (DT) models covered in the course work. After completing the tasks in This Cycle you should able to:
a) Use R functions for Decision Tree models.
b) Predict the outcome of an attribute based on' the model.
Tasks you will complete in This Cycle include:
a) Use the R-Studio environment to code Decision Tree Models.
b) Build a Decision Tree Model based on data whose schema is composed of attributes.
c) Predict the outcome of one attribute based on the model.
Mini Project: Student has to do a project assigned from course contents in a group of two or three students. The team will have to demonstrate as well as have to give a presentation of the same.

DISTRIBUTED SYSTEMS LAB.

Subject Code: MCSCE1-166 **L T P C** **Duration: 60 Hrs.**
0 0 4 2

Programs may be implemented using any open source tool
Expt. 1: Installation and configuration of database packages.
Expt. 2: Creating and managing database objects (Tables, views, indexes etc.)
Expt. 3: Creating and managing database security through user management.
Expt. 4: Creating and maintaining database links.
Expt. 5: Implement Partitioning on the database tables.
Expt. 6: Implement various Transaction concurrency control methods [i.e. lock's] by executing multiple update and queries.
Expt. 7: Performance tuning of SQL queries.
Mini Project: Student has to do a project assigned from course contents in a group of two or three students. The team will have to demonstrate as well as have to give a presentation of the same.

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ADVANCED WIRELESS AND MOBILE NETWORKS LAB.

Subject Code: MCSCE1-167 **L T P C** **Duration: 60 Hrs.**
0 0 4 2

Programs may be implemented using NS2/NS3/Omnet++
Expt. 1: Setup & Configuration of Wireless Access Point (AP)
Expt. 2: Study of WLAN: Ad Hoc & Infrastructure Mode
Expt. 3: Study of Bluetooth Protocol and Applications
Expt. 4: GSM modem study and SMS client-server application
Expt. 5: Mobile Internet and WML
Expt. 6: J2ME Program for Mobile Node Discovery
Expt. 7: Mobile protocol study using omnet++
Expt. 8: Wireless Network Security: kismet and Netstumbler
Expt. 9: Design and Program Income Tax and Loan EMI Calculator for Mobile Phones
Mini Project: Implementation of Mobile Network using Network Simulator (NS2/NS3).

ADVANCED ALGORITHMS

Subject Code- MCSCE1-205 **L T P C 3 0 0 3** **Duration: 45 Hrs.**

Course Objectives:

1. Introduce students to the advanced methods of designing and analysing algorithms.
2. The student should be able to choose appropriate algorithms and use it for a specific problem.
3. To familiarize students with basic paradigms and data structures used to solve advanced algorithmic problems.
4. Students should be able to understand different classes of problems concerning their computation difficulties.
5. To introduce the students to recent developments in the area of algorithmic design.

Course Outcomes:

After completion of course, students would be able to:

CO1: Analyze the complexity/performance of different algorithms.

CO2: Determine the appropriate data structure for solving a particular set of problems.

CO3: Categorize the different problems in various classes according to their complexity.

CO4: Students should have an insight of recent activities in the field of the advanced data structure.

UNIT-I (12 Hrs.)

Sorting: Review of various sorting algorithms, topological sorting Graph: Definitions and Elementary Algorithms: Shortest path by BFS, shortest path in edge-weighted case (Dijkasra's), depth-first search and computation of strongly connected components, emphasis on correctness proof of the algorithm and time/space analysis, example of amortized analysis.
Matroids: Introduction to greedy paradigm, algorithm to compute a maximum weight maximal independent set. Application to MST. Graph Matching: Algorithm to compute maximum matching. Characterization of maximum matching by augmenting paths, Edmond's Blossom algorithm to compute augmenting path.

UNIT-II (11 Hrs.)

Flow-Networks: Maxflow-mincut theorem, Ford-Fulkerson Method to compute maximum flow, Edmond-Karp maximum-flow algorithm. Matrix Computations: Strassen's algorithm and introduction to divide and conquer paradigm, inverse of a triangular matrix, relation between the time complexities of basic matrix operations, LUP-decomposition.

UNIT-III (11 Hrs.)

Shortest Path in Graphs: Floyd-Warshall algorithm and introduction to dynamic programming paradigm. More examples of dynamic programming. Modulo Representation of integers/polynomials: Chinese Remainder Theorem, Conversion between base-representation and modulo-representation. Extension to polynomials.

UNIT-IV (11 Hrs.)

Linear Programming: Geometry of the feasibility region and Simplex algorithm. NP-completeness: Examples, proof of NP-hardness and NP-completeness. One or more of the following topics based on time and interest Approximation algorithms, Randomized Algorithms, Advanced Number Theoretic Algorithm.
Recent Trends in problem solving paradigms using recent searching and sorting techniques by applying recently proposed data structures.

Recommended Books:

1. Cormen, Leiserson, Rivest, Stein, ‘Introduction to Algorithms’.
2. Aho, Hopcroft, Ullman, ‘The Design and Analysis of Computer Algorithms’.
3. Kleinberg and Tardos, ‘Algorithm Design’.

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SOFT COMPUTING

Subject Code: MCSCE1-206 **L T P C** **Duration: 45 Hrs.**
3 0 0 3

Course Objectives:

1. To introduce soft computing concepts and techniques and foster their abilities in designing appropriate technique for a given scenario.
2. To implement soft computing based solutions for real-world problems.
3. To give students knowledge of non-traditional technologies and fundamentals of artificial neural networks, fuzzy sets, fuzzy logic, genetic algorithms.
4. To provide student hand-on experience on MATLAB to implement various strategies.

Course Outcomes:

After completion of course, students would be able to:

CO1: Identify and describe soft computing techniques and their roles in building intelligent machines

CO2: Apply fuzzy logic and reasoning to handle uncertainty and solve various engineering problems.

CO3: Apply genetic algorithms to combinatorial optimization problems.

CO4: Evaluate and compare solutions by various soft computing approaches for a given problem.

UNIT-I (11 Hrs.)

Introduction to Soft Computing and Neural Networks: Evolution of Computing: Soft Computing Constituents, From Conventional AI to Computational Intelligence: Machine Learning Basics.

Fuzzy Logic: Fuzzy Sets, Operations on Fuzzy Sets, Fuzzy Relations, Membership Functions: Fuzzy Rules and Fuzzy Reasoning, Fuzzy Inference Systems, Fuzzy Expert Systems, Fuzzy Decision Making.

UNIT-II (11 Hrs.)

Neural Networks: Machine Learning Using Neural Network, Adaptive Networks, Feed forward Networks, Supervised Learning Neural Networks, Radial Basis Function Networks: Reinforcement Learning, Unsupervised Learning Neural Networks, Adaptive Resonance architectures, Advances in Neural networks

UNIT-III (13 Hrs.)

Genetic Algorithms: Introduction to Genetic Algorithms (GA), Applications of GA in Machine Learning: Machine Learning Approach to Knowledge Acquisition.

UNIT-IV (10 Hrs.)

Matlab/Python Lib: Introduction to Matlab/Python, Arrays and array operations, Functions and Files, Study of neural network toolbox and fuzzy logic toolbox, Simple implementation of Artificial Neural Network and Fuzzy Logic.

Recent Trends in deep learning, various classifiers, neural networks and genetic algorithm. Implementation of recently proposed soft computing techniques.

Recommended Books:

1. Jyh: Shing Roger Jang, Chuen:Tsai Sun, EijiMizutani, 'Neuro: Fuzzy and Soft Computing17', Prentice-Hall of India, **2003**.
2. George J. Klir and Bo Yuan, 'Fuzzy Sets and Fuzzy Logic: Theory and Applications17', Prentice Hall, **1995**.
3. MATLAB Toolkit Manual.

ADVANCED ALGORITHMS LAB.

Subject Code: MCSCE1-268 **L T P C** **Duration: 60 Hrs.**
0 0 4 2

Programs may be implemented using C/C++/java
Expt. 1: Program to implement Dijkstra's algorithm for single-source shortest path in a weighted directed graph.
Expt. 2: Program to find all-pairs shortest path using Floyd-Warshall algorithm.
Expt. 3: Program to find inverse of a triangular matrix using divide and conquer strategy.
Expt. 4: Program to convert base (decimal/hexa) representation to modulo representation.
Mini Project: Student has to do a project assigned from course contents in a group of two or three students. The team will have to demonstrate as well as have to give a presentation of the same.

SOFT COMPUTING LAB.

Subject Code: MCSCE1-269 **L T P C** **Duration: 60 Hrs.**
0 0 4 2

Programs may be implemented using Matlab/Python
Expt. 1: Program to implement array operations in Python
Expt. 2: Program to append strings using functions in Python
Expt. 3: Study of Neural Network Tool Box/ use of Library functions
Expt. 4: Study of Fuzzy Logic Tool Box/ use of Library functions
Expt. 5: Program to perform operations on fuzzy sets.
Mini Project: Student has to do a project assigned from course contents in a group of two or three students. The team will have to demonstrate as well as have to give a presentation of the same.

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DATA PREPARATION AND ANALYSIS

Subject Code: MCSCE1-270 **L T P C** **Duration: 45 Hrs.**
3 0 0 3

Course Objectives:
To prepare the data for analysis and develop meaningful Data Visualizations
Course Outcomes:
After completion of course, students would be:
CO1 Able to extract the data for performing the Analysis.

UNIT-I (11 Hrs.)

Data Gathering and Preparation: Data formats, parsing and transformation, Scalability and real-time issues.

UNIT-II (12 Hrs.)

Data Cleaning: Consistency checking, Heterogeneous and missing data, Data Transformation and segmentation.

UNIT-III (11 Hrs.)

Exploratory Analysis: Descriptive and comparative statistics, Clustering and association, Hypothesis generation.

UNIT-IV (11 Hrs.)

Visualization: Designing visualizations, Time series, Geolocated data, Correlations and connections, Hierarchies and networks, interactivity.

Recommended Books:

1. Glenn J. Myatt, 'Making Sense of Data: A Practical Guide to Exploratory Data Analysis and Data Mining'.

SECURE SOFTWARE DESIGN AND ENTERPRISE COMPUTING

Subject Code: MCSCE1-271 **L T P C 3 0 0 3** **Duration: 45 Hrs.**

Course Objectives:

1. To fix software flaws and bugs in various software.
2. To make students aware of various issues like weak random number generation, information leakage, poor usability, and weak or no encryption on data traffic
3. Techniques for successfully implementing and supporting network services on an enterprise scale and heterogeneous systems environment.
4. Methodologies and tools to design and develop secure software containing minimum vulnerabilities and flaws.

Course Outcomes:

After completion of course, students would be able to:

CO1: Differentiate between various software vulnerabilities.

CO2: Software process vulnerabilities for an organization.

CO3: Monitor resources consumption in a software.

CO4: Interrelate security and software development process

UNIT-I (11 Hrs.)

Secure Software Design Identify software vulnerabilities and perform software security analysis, Master security programming practices, Master fundamental software security design concepts, perform security testing and quality assurance.

UNIT-II (11 Hrs.)

Enterprise Application Development Describe the nature and scope of enterprise software applications, Design distributed Ntier software application, Research technologies available for the presentation, business and data tiers of an enterprise software application, Design and build a database using an enterprise database system, Develop components at the different tiers in an enterprise system, Design and develop a multi-tier solution to a problem using technologies used in enterprise system, Present software solution.

Enterprise Systems Administration Design, implement and maintain a directory-based server infrastructure in a heterogeneous systems environment, Monitor server resource utilization for system reliability and availability, Install and administer network services (DNS/DHCP/Terminal Services/Clustering/Web/Email).

UNIT-III (11 Hrs.)

Obtain the ability to manage and troubleshoot a network running multiple services, Understand the requirements of an enterprise network and how to go about managing them.

UNIT-IV (12 Hrs.)

Handle insecure exceptions and command/SQL injection, defend web and mobile applications against attackers, software containing minimum vulnerabilities and flaws.

Case study of DNS server, DHCP configuration and SQL injection attack.

Recommended Books:

1. Theodor Richardson, Charles N Thies, 'Secure Software Design', Jones & Bartlett.
2. Kenneth R. van Wyk, Mark G. Graff, Dan S. Peters, Diana L. Burley, 'Enterprise Software Security', Addison Wesley.

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COMPUTER VISION

Subject Code: MCSCE1-272 **L T P C** **Duration: 45 Hrs.**
3 0 0 3

Course Objectives:
1. Be familiar with both the theoretical and practical aspects of computing with images.
2. Have described the foundation of image formation, measurement, and analysis.
3. Understand the geometric relationships between 2D images and the 3D world.
4. Grasp the principles of state-of-the-art deep neural networks.

Course Outcomes:
After completion of course, students would be able to:
CO1 Developed the practical skills necessary to build computer vision applications.
CO2 To have gained exposure to object and scene recognition and categorization from images.

UNIT-I (11 Hrs.)

Overview, computer imaging systems, lenses, Image formation and sensing, Image analysis, pre-processing and Binary image analysis.
Edge detection, Edge detection performance, Hough transform, corner detection.

UNIT-II (11 Hrs.)

Segmentation, Morphological filtering, Fourier transform.

UNIT-III (11 Hrs.)

Feature extraction, shape, histogram, color, spectral, texture, using CVIP tools, Feature analysis, feature vectors, distance /similarity measures, data pre- processing.

UNIT-IV (12 Hrs.)

Pattern Analysis: Clustering: K-Means, K-Medoids, Mixture of Gaussians Classification: Discriminant Function, Supervised, Un-supervised, Semi supervised. Classifiers: Bayes, KNN, ANN models; Dimensionality Reduction: PCA, LDA, ICA, and Nonparametric methods.
Recent trends in Activity Recognition, computational photography, Biometrics.

Recommended Books:
1. Computer Vision: Algorithms and Applications by Richard Szeliski.
2. Deep Learning, by Good fellow, Bengio, and Courville.
3. Dictionary of Computer Vision and Image Processing, by Fisheretal.

HUMAN AND COMPUTER INTERACTION

Subject Code: MCSCE1-273 **L T P C** **Duration: 45 Hrs.**
3 0 0 3

Course Objectives:
1. Learn the foundations of Human Computer Interaction
2. Be familiar with the design technologies for individuals and persons with disabilities
3. Be aware of mobile Human Computer interaction.
4. Learn the guidelines for user interface.
5. Understand the structure of models and theories of human computer interaction and vision.
6. Design an interactive web interface on the basis of models studied.

Course Outcomes:
After completion of course, students would be
CO1: Understand the structure of models and theories of human computer interaction and vision.
CO2: Design an interactive web interface on the basis of models studied.

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UNIT-I (11 Hrs.)

Human: I/O channels – Memory – Reasoning and problem solving; The computer: Devices – Memory – processing and networks; Interaction: Models– frameworks – Ergonomics – styles – elements – interactivity- Paradigms.

UNIT-II (12 Hrs.)

Interactive Design basics – process – scenarios – navigation – screen design – Iteration and prototyping. HCI in software process – software life cycle – usability engineering – Prototyping in practice – design rationale. Design rules– principles, standards, guidelines, rules. Evaluation Techniques – Universal Design.

Cognitive models –Socio-Organizational issues and stake holder requirements – Communication and collaboration Models-Hypertext, Multimedia and WWW.

UNIT-III (11 Hrs.)

Mobile Ecosystem: Platforms, Application frameworks- Types of Mobile Applications: Widgets, Applications, Games- Mobile Information Architecture, Mobile 2.0, Mobile Design: Elements of Mobile Design, Tools.

UNIT-IV (11 Hrs.)

Designing Web Interfaces – Drag & Drop, Direct Selection, Contextual Tools, Overlays, Inlays and Virtual Pages, Process Flow. Case Studies.

Recent Trends: Speech Recognition and Translation, Multimodal System.

Recommended Books:

1. Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale, 'Human Computer Interaction', 3rd Edn., Pearson Education, **2004.**
2. Brian Fling, 'Mobile Design and Development', 1st Edn., O17Reilly Media Inc., **2009**.
3. Bill Scott and Theresa Neil, 'Designing Web Interfaces', 1st Edn., O17Reilly, **2009**.

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GPU COMPUTING

Subject Code: MCSCE1-274	**L T P C**	**Duration: 45 Hrs.**
	3 0 0 3	

Course Objectives:

To learn parallel programming with Graphics Processing Units (GPUs).

Course Outcomes:

After completion of course, students would be:

CO1 Students would learn concepts in parallel programming, implementation of programs on GPUs, debugging and profiling parallel programs.

UNIT-I (11 Hrs.)

Introduction: History, Graphics Processors, Graphics Processing Units, GPGPUs. Clock speeds, CPU / GPU comparisons, Heterogeneity, Accelerators, Parallel programming, CUDA Open CL/Open ACC, Hello World Computation Kernels, Launch parameters, Thread hierarchy, Warps/ Wave fronts, Thread blocks / Workgroups, Streaming multiprocessors, 1D / 2D/ 3D thread mapping, Device properties, Simple Programs.

UNIT-II (12 Hrs.)

Memory: Memory hierarchy, DRAM / global, local / shared, private / local, textures, Constant Memory, Pointers, Parameter Passing, Arrays and dynamic Memory, Multidimensional Arrays, Memory Allocation, Memory copying across devices, Programs with matrices, Performance evaluation with different memories.

UNIT-III (11 Hrs.)

Synchronization: Memory Consistency, Barriers (local versus global), Atomics, Memory fence. Prefix sum, Reduction. Programs for concurrent Data Structures such as Worklists, Linked-lists. Synchronization across CPU and GPU Functions: Device functions, Host functions, Kernels functions, using libraries (such as Thrust), and developing libraries.

UNIT-IV (11 Hrs.)

Support: Debugging GPU Programs. Profiling, Profile tools, Performance aspects Streams: Asynchronous processing, tasks, Task-dependence, Overlapped data transfers, Default Stream, Synchronization with streams. Events, Event-based- Synchronization - Overlapping data transfer and kernel execution, pitfalls.

Case Studies: Image Processing, Graph algorithms, Simulations, Deep Learning.

Advanced Topics: Dynamic parallelism, Unified Virtual Memory, Multi-GPU processing, Peer access, Heterogeneous processing.

Recommended Books:

1. David Kirk, Wen-meiHwu, Morgan Kaufman, 'Programming Massively Parallel Processors: A Hands-on Approach', (ISBN: 978-0123814722), **2010**.
2. Shane Cook; Morgan Kaufman, 'CUDA Programming: A Developer's Guide to Parallel Computing with GPUs', (ISBN: 978-0124159334), **2012**.

DIGITAL FORENSICS

Subject Code: MCSCE1-275 **L T P C** **Duration: 45 Hrs.**
3 0 0 3

Course Objectives:

1. Provides an in-depth study of the rapidly changing and fascinating field of computer forensics.
2. Combines both the technical expertise and the knowledge required to investigate, detect and prevent digital crimes.
3. Knowledge on digital forensics legislations, digital crime, forensics processes and procedures, data acquisition and validation, e-discovery tools.
4. E-evidence collection and preservation, investigating operating systems and file systems, network forensics, art of steganography and mobile device forensics.

Course Outcomes:

After completion of course, students would be able to:

CO1: Understand relevant legislation and codes of ethics

CO2: Computer forensics and digital detective and various processes, policies and procedures

CO3: E-discovery, guidelines and standards, E-evidence, tools and environment.

CO4: Email and web forensics and network forensics.

UNIT-I (11 Hrs.)

Digital Forensics Science: Forensics science, computer forensics, and digital forensics. Computer Crime: Criminalistics as it relates to the investigative process, analysis of cyber-criminalistics area, holistic approach to cyber-forensics.

Cyber Crime Scene Analysis: Discuss the various court orders etc., methods to search and seizure electronic evidence, retrieved and un-retrieved communications, Discuss the importance of understanding what court documents would be required for a criminal investigation.

UNIT-II (12 Hrs.)

Evidence Management & Presentation: Create and manage shared folders using operating system, importance of the forensic mindset, define the workload of law enforcement, explain what the normal case would look like, define who should be notified of a crime, parts of gathering evidence, Define and apply probable cause.

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UNIT-III (11 Hrs.)

Computer Forensics: Prepare a case, begin an investigation, understand computer forensics workstations and software, conduct an investigation, complete a case, Critique a case, Network Forensics: open-source security tools for network forensic analysis, requirements for preservation of network data.

UNIT-IV (11 Hrs.)

Mobile Forensics: mobile forensics techniques, mobile forensics tools. Legal Aspects of Digital Forensics: IT Act 2000, amendment of IT Act 2008.

Recent trends in mobile forensic technique and methods to search and seizure electronic evidence.

Recommended Books:

1. John Sammons, 'The Basics of Digital Forensics', Elsevier.
2. John Vacca, 'Computer Forensics: Computer Crime Scene Investigation', Laxmi Publications.

DATA PREPARATION AND ANALYSIS LAB.

Subject Code: MCSCE1-276 **L T P C** **Duration: 60 Hrs.**
0 0 4 2

Programs to be implemented using WEKA.

Expt. 1: Using weka tool to explore the data.
Expt. 2: Using weka tool to do Parametric–Means.
Expt. 3: Using weka tool to do Parametric -T-Test.
Expt. 4: Using weka tool to do Correlation analysis
Expt. 5: Preprocess the given data using weka tool.
Expt. 6: Apply different classification techniques to classify the given data set.
Expt. 7: Apply various clustering techniques to cluster the data.
Expt. 8: Apply various association rule mining algorithms.
Expt. 9: Implement classification using Decision tree.
Expt. 10: Apply Visualization methods using weka tool.

Mini Project: Student has to do a project assigned from course contents in a group of two or three students. The team will have to demonstrate as well as have to give a presentation of the same.

SECURE SOFTWARE DESIGN AND ENTERPRISE COMPUTING LAB.

Subject Code: MCSCE1-277 **L T P C** **Duration: 60 Hrs.**
0 0 4 2

Expt.1: Program to implement authentication to prevent various attacks.
Expt.2: Program to Limit or increasingly delay failed login attempts.
Expt.3: Create a scenario to test authentication of various security attacks.
Expt.4: Program to debug backdrop entry of given source code.
Expt.5: Program to debug HTTP headers, input fields, hidden fields, drop down lists, and other web components.
Expt.6: Program to test Input filtering via white list validation
Expt.7: Create a scenario to Set Up Your Own Private Cloud Storage.
Expt.8: Setup and configuration Various network services (DNS/ DHCP/ Terminal Services/ Clustering/ Web/ Email).
Expt.9: Design and build a database using an enterprise database system.

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Expt.10: Design and implement a directory-based server infrastructure in a heterogeneous systems environment.
Expt.11: An attacker wishing to execute SQL injection manipulates a standard SQL query to exploit non-validated input vulnerabilities in a database. Show different ways that this attack vector can be executed.
Expt.12: Install IBM Rhapsody Tool using NetBeans for Java and Junit (a unit testing tool).
Expt.13: Create a Unified Modelling Language (UML) Class diagram and a UML Sequence diagram using IBM's Rhapsody modelling tool.
Expt.14: Configure NetBeans to use JUnit and test code written for the classes and methods described in the UML.

COMPUTER VISION LAB.

Subject Code: MCSCE1-278 **L T P C** **0 0 4 2** **Duration: 60 Hrs.**

Programs may be implemented using MATLAB/C/C++/Java/Python on binary/grayscale/color images.
Expt. 1: Implementation of basic image transformations: a. Log b. Power law c. Negation
Expt. 2: Implementation the following:
a) Histogram processing
b) Histogram equalization/matching
Expt. 3: Implementation of piecewise linear transformations
a) Contrast stretching
b) Grey level slicing
c) Bit plane slicing
Expt. 4: Implementation of image enhancement/smoothing using
a) Linear (weighted and non-weighted filters)
b) Order statistics filters (Nonlinear filters) i. Mean ii. Median iii. Min iv. Max v. Average
Expt. 5: Implementation of image enhancement/sharpening using
a) Laplacian operators
b) Sobel's operators
c) Robert's cross operators
Expt. 6: Implement the 2D-DFT to obtain Fourier coefficients and reconstruct the image, i.e., IDFT.
Expt. 7: Implement image enhancement using Fourier low pass filters,
a) Ideal,
b) Butterworth,
c) Gaussian
Expt. 8: Implement image enhancement using Fourier high pass filters,
a) Ideal,
b) Butterworth,
c) Gaussian
Expt. 9: Implement algorithms to detect the following in an image,
a) Point,
b) Line,
c) Boundary
Expt. 10: Implement Hough transform to detect a line.
Mini Project: Student has to do a project assigned from course contents in a group of two or three students. The team will have to demonstrate as well as have to give a presentation of the same.

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HUMAN AND COMPUTER INTERACTION LAB.

Subject Code: MCSCE1-279	L T P C 0 0 4 2	Duration: 60 Hrs.

Programs may be implemented using C, C++, Python

Expt. 1: To understand the trouble of interacting with computers - Redesign interfaces of home appliances.

Expt. 2: Design a system based on user-centred approach.

Expt. 3: Understand the principles of good screen design.

Expt. 4: Redesign existing Graphical User Interface with screen complexity

Expt. 5: Implementation of Different Kinds of Menus

Expt. 6: Implementation of Different Kinds of Windows

Expt. 7: Design a system with proper guidelines for icons

Mini Project: Student has to do a project assigned from course contents in a group of two or three students. The team will have to demonstrate as well as have to give a presentation of the same.

GPU COMPUTING LAB.

Subject Code: MCSCE1-280	L T P C 0 0 4 2	Duration: 60 Hrs.

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Programs may be implemented using C.

Expt. 1: Setting up Cuda environment.

Expt. 2: Program for parallel matrix multiplication with Cuda.

Expt. 3: Program to demonstrate grids, blocks and threads.

Expt. 4: Program for parallel radix sort.

Expt. 5: Demonstrate parallel reduction with Cuda.

Expt. 6: Program to demonstrate parallel programming for merging two lists.

Expt. 7: Program to demonstrate concept of global memory.

Expt. 8: Program to demonstrate concept of multi-GPUs.

Expt. 9: Program to demonstrate concept of profiling with parallel Nsight.

Expt. 10: Implementation of deep networks for image classification with GPU programming.

DIGITAL FORENSICS LAB.

Subject Code: MCSCE1-281	L T P C 0 0 4 2	Duration: 60 Hrs.

Programs may be implemented using tools mentioned below:

1. SysInternals Suite Microsoft System utilities for diagnosis of Windows systems
2. SANS SIFT SANS Investigate Forensic Toolkit (SIFT)
3. Wireshark Network protocol analyser
4. Trinity Rescue Kit: A Linux based recovery and repair toolkit for Windows computers.
5. Kali Linux A Pen Test toolkit based on Linux. This should only be used to check your own equipment or equipment you have been asked to test.

Expt. 1: To Develop multifaceted cyber-crime scenario (cyber-crime and cyber-terrorism) Build a top-down systematic process

a) Structure the team and players
b) Use an integrated Framework (SI-FI)
c) Integrate GOTS, COTS, and R & D Tools Use real investigators/compliment with technology experts

d) Carefully collect all data, decisions actions during experiment
e) Develop metrics for evaluation that match scenario
f) Quantify results

Expt. 2: To perform packet-level analysis using appropriate tools (e.g., Wireshark, tcpdump).
Expt. 3: To identify and extract data of forensic interest in diverse media (i.e., media forensics).
Expt. 4: To identify, modify, and manipulate applicable system components within Windows, UNIX, or Linux (e.g., passwords, user accounts, files).
Expt. 5: To collect, process, package, transport, and store electronic evidence to avoid alteration, loss, physical damage, or destruction of data.
Expt. 6: To set up a forensic workstation.
Expt. 7: To use forensic tool suites (e.g., EnCase, Sleuthkit, FTK).
Expt. 8: To use virtual machines. (e.g., Microsoft Hyper-V, VMWare vSphere, Citrix XenDesktop/Server, Amazon Elastic Compute Cloud, etc.).
Expt. 9: To conduct forensic analyses in multiple operating system environments (e.g., mobile device systems).
Expt. 10: To analyse captured malicious code (e.g., malware forensics).
Expt. 11: To use binary analysis tools (e.g., Hexedit, command code xxd, hexdump).
Expt. 12: To implement one-way hash functions (e.g., Secure Hash Algorithm [SHA], Message Digest Algorithm [MD5]).
Expt. 13: To analyse anomalous code as malicious or benign.
Expt. 14: To identify obfuscation techniques.
Expt. 15: To interpret results of debugger to ascertain tactics, techniques, and procedures.

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ENGLISH FOR RESEARCH PAPER WRITING

Subject Code: MHUMA-101 **L T P C** **Duration: 30 Hrs.**
2 0 0 0

Course Objectives:
Students will be able to:
1. Understand that how to improve your writing skills and level of readability
2. Learn about what to write in each section
3. Understand the skills needed when writing a Title Ensure the good quality of paper at very first-time submission.

UNIT-I

Planning and Preparation, Word Order, breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness

Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticising, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts. Introduction

UNIT-II

Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check.

key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature, skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions.

UNIT-III

Useful phrases, how to ensure paper is as good as it could possibly be the first- time submission

Recommended Books:
1. R. Goldbort, 'Writing for Science', Yale University Press (available on Google Books) Model Curriculum of Engineering & Technology PG Courses, Vol.-I, **2006**.
2. R. Day, 'How to Write and Publish a Scientific Paper', Cambridge University Press, **2006**.
3. N. Highman, 'Handbook of Writing for the Mathematical Sciences', SIAM. Highman's Book, **1998**.
4. Adrian Wallwork, English for Writing Research Papers, Springer New York Dordrecht Heidelberg, London, **2011**.

DISASTER MANAGEMENT

Subject Code: MCIVE0-101 | **L T P C** **2 0 0 0** | **Duration: 30 Hrs.**

Course Objectives:

Students will be able to:
1. Learn to demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response.
2. Critically evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
3. Develop an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.
4. Critically understand the strengths and weaknesses of disaster management approaches, planning and programming in different countries, particularly their home country or the countries they work in

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UNIT-I

Introduction Disaster: Definition, Factors and Significance; Difference Between Hazard and Disaster; Natural and Manmade Disasters: Difference, Nature, Types and Magnitude.

Repercussions of Disasters and Hazards: Economic Damage, Loss of Human and Animal Life, Destruction of Ecosystem. Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts and Famines, Landslides and Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks and Spills, Outbreaks of Disease and Epidemics, War and Conflicts.

UNIT-II

Disaster Prone Areas in India Study of Seismic Zones; Areas Prone to Floods and Droughts, Landslides and Avalanches; Areas Prone to Cyclonic and Coastal Hazards with Special Reference to Tsunami; Post-Disaster Diseases and Epidemics

UNIT-III

Disaster Preparedness and Management Preparedness: Monitoring of Phenomena Triggering a Disaster or Hazard; Evaluation of Risk: Application of Remote Sensing, Data from Meteorological and Other Agencies, Media Reports: Governmental and Community Preparedness.

UNIT-IV

Risk Assessment Disaster Risk: Concept and Elements, Disaster Risk Reduction, Global and National Disaster Risk Situation. Techniques of Risk Assessment, Global Co-Operation in Risk Assessment and Warning, People's Participation in Risk Assessment. Strategies for Survival.

Disaster Mitigation Meaning, Concept and Strategies of Disaster Mitigation, Emerging Trends in Mitigation. Structural Mitigation and Non-Structural Mitigation, Programs of Disaster Mitigation in India.

Recommended Books:
1. R. Nishith, A.K. Singh, 'Disaster Management in India: Perspectives, Issues and Strategies', New Royal Book Company, Model Curriculum of Engineering & Technology PG Courses, Vol.-I.
2. Sahni, Pardeep et. al.(Eds.), 'Disaster Mitigation Experiences and Reflections', Prentice Hall of India, New Delhi.
3. S.L. Goel, 'Disaster Administration and Management, Text and Case Studies', Deep & Deep Publication Pvt. Ltd., New Delhi.

SANSKRIT FOR TECHNICAL KNOWLEDGE

Subject Code: MHUMA0-102 **L T P C** **Duration: 30 Hrs.**
2 0 0 0

Course Objectives:
1. To get a working knowledge in illustrious Sanskrit, the scientific language in the world
2. Learning of Sanskrit to improve brain functioning
3. Learning of Sanskrit to develop the logic in mathematics, science & other subjects
4. Enhancing the memory power
5. The engineering scholars equipped with Sanskrit will be able to explore the
6. Huge knowledge from ancient literature

Alphabets in Sanskrit, Past/Present/Future Tense
Simple Sentences
Order
Introduction of roots
Technical information about Sanskrit Literature
Technical concepts of Engineering-Electrical, Mechanical
Architecture, Mathematics

Recommended Books:
1. Vishwas, 'Abhyaspustakam', Samskrita-Bharti Publication, New Delhi.
2. 'Teach Yourself Sanskrit', Prathama Deeksha-VempatiKutumbshastri, Rashtriya Sanskrit Sansthanam, New Delhi, Publication.
3. Suresh Soni, 'India's Glorious Scientific Tradition', Ocean Books Pvt. Ltd., New Delhi.

Course Outcomes:
Students will be able to
1. Understanding basic Sanskrit language
2. Ancient Sanskrit literature about science & technology can be understood
3. Being a logical language will help to develop logic in students.

VALUE EDUCATION

Subject Code: MHUMA0-103 **L T P C** **Duration: 30 Hrs.**
2 0 0 0

Course Objectives:
Students will be able to
1. Understand value of education and self- development
2. Imbibe good values in students
3. Let the should know about the importance of character

UNIT-I

Content Hours Values and self-development –Social values and individual attitudes.

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Work ethics, Indian vision of humanism. Moral and non- moral valuation. Standards and principles. Value judgements.

UNIT-II

Importance of cultivation of values. Sense of duty. Devotion, Self-reliance. Confidence, Concentration. Truthfulness, Cleanliness. Honesty, Humanity. Power of faith, National Unity. Patriotism, Love for nature, Discipline.

UNIT-III

Personality and Behavior Development - Soul and Scientific attitude. Positive Thinking. Integrity and discipline. Punctuality, Love and Kindness. Avoid fault Thinking. Free from anger, Dignity of labor. Universal brotherhood and religious tolerance. True friendship. Happiness Vs suffering, love for truth. Aware of self-destructive habits. Association and Cooperation. Doing best for saving nature.

UNIT-IV

Character and Competence –Holy books vs Blind faith, Self-management and Good health.
Science of reincarnation, Equality, Nonviolence, Humility, Role of Women.
All religions and same message, mind your Mind, Self-control, Honesty, Studying effectively.

Recommended Books:

1. S.K. Chakroborty, 'Values and Ethics for Organizations Theory and Practice', Oxford University Press, New Delhi.

Course Outcomes:

Students will be able to

1. Knowledge of self-development
2. Learn the importance of Human values
3. Developing the overall personality

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CONSTITUTION OF INDIA

Subject Code: MHUMA0-104 **L T P C** **Duration: 30 Hrs.**
2 0 0 0

Course Objectives:

Students will be able to:

1. Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
2. To address the growth of Indian opinion regarding modern Indian intellectuals' constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.
3. To address the role of socialism in India after the commencement of the Bolshevik Revolution in 1917 and its impact on the initial drafting of the Indian Constitution.

UNIT-1

History of Making of the Indian Constitution: History, Drafting Committee, (Composition & Working). Philosophy of the Indian Constitution: Preamble Salient Features

UNIT-II

Contours of Constitutional Rights & Duties: Fundamental Rights, Right to Equality, Right to Freedom, Right against Exploitation, Right to Freedom of Religion, Cultural and Educational Rights, Right to Constitutional Remedies, Directive Principles of State Policy, Fundamental Duties.

UNIT III

Organs of Governance: Parliament, Composition, Qualifications and Disqualifications, Powers and Functions, Executive, President, Governor, Council of Ministers, Judiciary, Appointment and Transfer of Judges, Qualifications, Powers and Functions

UNIT IV

Local Administration: District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation. **Pachayati Raj:** Introduction, PRI: Zila Pachayat. Elected officials and their roles, CEO Zila Pachayat: Position and role. Block level: Organizational Hierarchy (Different departments), **Village Level:** Role of Elected and Appointed officials, importance of grass root democracy **Election Commission:** Election Commission: Role and Functioning. Chief Election Commissioner and Election Commissioners. State Election Commission: Role and Functioning. Institute and Bodies for the welfare of SC/ST/OBC and women.

Recommended Books:

1. 'The Constitution of India', (Bare Act), Government Publication, **1950**.
2. S.N. Busi, B.R. Ambedkar, 'Framing of Indian Constitution', 1st Edn., **2015**.
3. M.P. Jain, 'Indian Constitution Law', 7th Edn., Lexis Nexis, **2014**.
4. D.D. Basu, 'Introduction to the Constitution of India', Lexis Nexis, **2015**.

Course Outcomes:

Students will be able to:

1. Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.
2. Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India. Discuss the circumstances surrounding the foundation of the Congress Socialist Party [CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution. 4. Discuss the passage of the Hindu Code Bill of 1956.

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PEDAGOGY STUDIES

Subject Code: MHUMA0-105	**L T P C**	**Duration: 30 Hrs.**
	2 0 0 0	

Course Objectives:

Students will be able to:

1. Review existing evidence on the review topic to inform programme design and policy making undertaken by the DfID, other agencies and researchers.
2. Identify critical evidence gaps to guide the development.

UNIT-I

Introduction and Methodology: Aims and rationale, Policy background, Conceptual framework and terminology, Theories of learning, Curriculum, Teacher education. Conceptual framework, Research questions. Overview of methodology and Searching.

Thematic overview: Pedagogical practices are being used by teachers in formal and informal, classrooms in developing countries. Curriculum, Teacher education.

UNIT-II

Evidence on the effectiveness of pedagogical practices, Methodology for the in depth stage: quality assessment of included studies. How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy? Theory of change. Strength and nature of the body of evidence for effective pedagogical practices. Pedagogic theory and pedagogical approaches. Teachers' attitudes and beliefs and Pedagogic strategies.

UNIT-III

Professional Development: alignment with classroom practices and follow- up, support Peer support, Support from the head teacher and the community. Curriculum and assessment, Barriers to learning: limited resources and large class sizes.

UNIT IV

Research Gaps and Future Directions: Research design, Contexts, Pedagogy, Teacher education, Curriculum and assessment, Dissemination and research impact.

Recommended Books:

1. J. Ackers, F. Hardman, 'Classroom Interaction in Kenyan Primary Schools, Compare', 31 (2): 245-261, **2001**.
2. M. Agrawal, 'Curricular Reform in Schools: The Importance of Evaluation, Journal of Curriculum Studies', 36 (3): 361-379, **2004**.
3. K. Akyeampong, 'Teacher Training in Ghana - Does it Count?', Multi-site Teacher Education Research Project (MUSTER) Country Report 1. London: DFID, **2003**.
4. K. Akyeampong, K. Lussier, J. Pryor, J. Westbrook, 'Improving Teaching and Learning of basic Maths and Reading in Africa: Does Teacher Preparation Count?', International Journal Educational Development, 33 (3): 272–282, **2013**.
5. R.J. Alexander, 'Culture and Pedagogy: International Comparisons in Primary Education, Oxford and Boston', Blackwell, **2001**.
6. M. Chavan, 'Read India: A Mass Scale, Rapid, 'Learning to Read' Campaign, **2003**.
7. www.pratham.org/images/resource%20working%20paper%202.pdf.

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Course Outcomes:

Students will be able to understand:

1. What pedagogical practices are being used by teachers in formal and informal classrooms in developing countries?
2. What is the evidence on the effectiveness of these pedagogical practices, in what conditions, and with what population of learners?
3. How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy?

STRESS MANAGEMENT BY YOGA

Subject Code: MHUMA0-106 **L T P C** **Duration: 30 Hrs.**
2 0 0 0

Course Objectives:

1. To achieve overall health of body and mind
2. To overcome stress

UNIT-I

Definitions of Eight parts of Yog. (Ashtanga)

UNIT-II

Yam and Niyam. Do`s and Don'ts in life:

a) Ahinsa, satya, astheya, bramhacharya and aparigraha
b) Shaucha, santosh, tapa, swadhyay, ishwar pranidhan

UNIT-III

Asan and Pranayam:

a) Various yog poses and their benefits for mind & body
b) Regularization of breathing techniques and its Effects-Types of pranayam

Recommended Books:

1. 'Yogic Asanas for Group Tarining', Part-I, Janardan Swami Yogabhyasi Mandal, Nagpur.
2. 'Rajayoga or Conquering the Internal Nature', Swami Vivekananda, Advaita Ashrama (Publication Department), Kolkata.

Course Outcomes:

Students will be able to:

1. Develop healthy mind in a healthy body thus improving social health also
2. Improve efficiency.

PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILLS

Subject Code: MHUMA0-107 **L T P C** **Duration: 30 Hrs.**
2 0 0 0

Course Objectives:

1. To learn to achieve the highest goal happily
2. To become a person with stable mind, pleasing personality and determination
3. To awaken wisdom in students

Course Outcomes:

Students will be able to

1. Study of Shrimad-Bhagwad-Geeta will help the student in developing his personality and achieve the highest goal in life
2. The person who has studied Geeta will lead the nation and mankind to peace and prosperity
3. Study of Neetishatakam will help in developing versatile personality of students.

UNIT-I

Neetisatakam-Holistic development of personality Verses- 19,20,21,22 (wisdom), Verses- 29,31,32 (pride & heroism) Verses- 26,28,63,65 (virtue), Verses- 52,53,59 (dont's), Verses- 71,73,75,78 (do's)

UNIT-II

Approach to day to day work and duties.2 Shrimad BhagwadGeeta: Chapter 2-Verses 41, 47,48, Chapter 3-Verses 13, 21, 27, 35, Chapter 6-Verses 5,13,17, 23, 35, Chapter 18-Verses 45, 46, 48

UNIT-III

Statements of basic knowledge.3 Shrimad BhagwadGeeta: Chapter2-Verses 56, 62, 68, Chapter 12 -Verses 13, 14, 15, 16,17, 18, Personality of Role model. Shrimad Bhagwad Geeta: Chapter2-Verses 17, Chapter 3-Verses 36,37,42, Chapter 4-Verses 18, 38,39, Chapter18 – Verses 37,38,63

Recommended Books:

1. 'Srimad Bhagavad Gita', Swami Swarupananda Advaita Ashram (Publication Department), Kolkata.
2. 'Bhartrihari's Three Satakam (Niti-sringar-vairagya)', P. Gopinath, Rashtriya Sanskrit Sansthanam, New Delhi.

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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							
Open Elective – II (Select any One)		4	0	0	40	60	100	4
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.)

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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', <u>TMH.</u>
2. S.K. Gandhi, 'VLSI Fabrication Principles'.

REFERENCE BOOKS:
1. S.M. Sze, 'Semiconductor Devices Physics and Technology'.
2. K.R. Botkar, 'Integrated Circuits'.

ADVANCED SEMICONDUCTOR PHYSICS

Subject Code: MECE5-103	L T P C 4 0 0 4	Duration: 45 Hrs.

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

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:

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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 4 0 0 4** | **Duration: 45 Hrs.**

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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', 6^{th} 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', 5^{th} 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 4 0 0 4** | **Duration: 48 Hrs.**

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.

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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.

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.

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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.**

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.

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	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 architures and can design or analyses different problems associated with this domain

Parallel computer models: The state of computing, Classification of parallel computers,

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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.

CAD TOOLS FOR VLSI DESIGN

Subject Code: MECE5-268	**L T P C** **4 0 0 4**	**Duration: 48 Hrs.**

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** **4 0 0 4**	**Duration: 48 Hrs.**

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** **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.

LOW POWER VLSI DESIGN

Subject Code: MECE5-271 **L T P C** **Duration: 48 Hrs.**
4 0 0 4

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** **Duration: 45 Hrs.**
4 0 0 4

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.**

ERROR CONTROL AND CODING

Subject Code: MECE5-373 **L T P C** **4 0 0 4** **Duration: 45 Hrs.**

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** **4 0 0 4** **Duration: 45 Hrs.**

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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,

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.)

MRSPTU

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.

MRSPTU

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							
Open Elective – II (Select any One)		4	0	0	40	60	100	4
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**

ADVANCED COMMUNICATION SYSTEMS

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 Course, **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 4 0 0 4** | **Duration: 45 Hrs.**

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 4 0 0 4** | **Duration: 45 Hrs.**

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., <u>PHI</u>, **2003.**
2. W. Bolton, 'Mechatronics', 4th Edn., <u>Pearson</u>, **2011.**

SPEECH AND AUDIO PROCESSING

Subject Code: MECE1-162	**L T P C** **4 0 0 4**	**Duration: 45 Hrs.**

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. Course rules and equations: Perceptron, Hebb's, Delta, winner take all and out-star Course rules. Supervised Course Network: Perceptron Networks, Adaptive Linear Neuron, Multiple Adaptive Linear Neuron, Back Propagation Network, Associative memory networks, Unsupervised Course 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** **4 0 0 4**	**Duration: 48 Hrs.**

Course 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.

Course 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	

Course 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.

Course 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 Course, **2005**.

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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

Course 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.

Course 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 Course, **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** **4 0 0 4**	**Duration: 48 Hrs.**

Course 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.

Course 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 4 0 0 4** | **Duration: 48 Hrs.**

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

Course 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.

Course 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

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.

Course 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

Course 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.

Course 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** **Duration: 48 Hrs.**
4 0 0 4

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', 2^{nd} Edn.,
2. Laura Chappell, 'Network Analysis'.

MICRO & NANO ELECTRO MECHANICAL SYSTEM (MEMS & NEMS)

Subject Code: MECE1-271 **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.)

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**

Course 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.

Course 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

Course 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

Course 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

Course 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.

Course 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

Course 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

Course 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

Course 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.

Course 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 4 0 0 4** | **Duration: 45 Hrs.**

Course 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

Course 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 Course, **2005.**

DISSERTATION

Subject Code: MECE1-410 **L T P C**

Course 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.

Course 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.

Semester 1st		Contact Hrs.			Marks			Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
PE-501	Metal Casting	4	0	0	50	100	150	4
PE-502	Metal Cutting	4	0	0	50	100	150	4
PE-503	Metal Forming	4	0	0	50	100	150	4
PE-504	Welding Technology	4	0	0	50	100	150	4
PE-505	Computer Aided Design & Manufacturing	4	0	0	50	100	150	4
PE-506	Lab.-I	0	0	4	100	0	100	2
Total		**20**	**0**	**4**	**350**	**500**	**850**	**22**

Semester 2nd		Contact Hrs.			Marks			Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
PE-507	Non-Conventional Machining Processes	4	0	0	50	100	150	4
PE-508	Jig, Fixtures & Die Design	4	0	0	50	100	150	4
PE-509	Production Planning & Control	4	0	0	50	100	150	4
Departmental Elective-I		4	0	0	50	100	150	4
PE-510	Machine Tool Design							
PE-511	Cutting Tool Design							
PE-512	Industrial Tribology							
PE-513	Diagnostic Maintenance & Monitoring							
Departmental Elective-II		4	0	0	50	100	150	4
PE-514	Advanced Operations Research							
PE-515	Management of Production Systems							
PE-516	Simulation of Industrial Systems							
PE-517	Materials Technology							
PE-518	Lab. –II	0	0	4	100	0	100	2
Total		**20**	**0**	**4**	**350**	**500**	**850**	**22**

Semester 3rd		Contact Hrs.			Marks			Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
Departmental Elective-III		4	0	0	50	100	150	4
PE-619	Mechatronics							
PE-620	Robotics & Industrial. Automaton							
PE-621	Metrology & Industrial Inspection							
PE-622	Computer Aided Process Planning							
Departmental Elective-IV		4	0	0	50	100	150	4
PE-623	Methods Engineering & Ergonomics							
PE-624	Product Design & Development							
PE-625	Entrepreneurship							
PE-626	Statistics & Reliability Engineering							
PE-627	Project	0	0	10	50	50	100	10
PE-628	Seminar	0	0	4	100	0	100	4
Total		**8**	**0**	**14**	**250**	**250**	**500**	**22**

SEMESTER 4th		Contact Hrs			Evaluation Criteria	Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Satisfactory/ Unsatisfactory**	
PE-629	**Thesis**	**0**	**0**	**24**		**24**

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Overall

Semester	Marks	Credits
1st	850	22
2nd	850	22
3rd	500	22
4th	--	24
Total	**2200**	**90**

METAL CASTING

Subject Code: PE-501 **L T P C** **Duration: 45 Hrs.**
4 0 0 4

UNIT-I

Structure of silica and different types of clays, bonding mechanism of silica – water-clay systems. Swelling of clays, sintering adhesion and colloidal clay; silica grain shape and size distribution standard permeability A.F.S. clay. Characteristics, Ingredients and additives of moulding sand, core sands.

UNIT-II

Solidifications of Metals, nucleation, free energy concept, critical radius of nucleus. Nucleation and growth in metals and alloys. constitutional super cooling. Columnar equiacquiesced and dendritic structures. Freezing of alloys centreline feeding resistance. Rate of solidification, time of solidification, mould constant. Fluidity of metals, volumes redistribution. Analysis of the process.

UNIT-III

Riser design shape, size and placement. Effect of appendages on risering. Effective feeding distances for simple and complex shapes. Use of chills, gating design, filling time. Aspiration of gases. Top, bottom and inside gating. Directional solidifications stresses in castings. Metal mould reactions. Expansion scale and metal penetration. Analysis of the process.

UNIT-IV

Various moulding and casting processes, hot box, cold box process, investment, shell moulding, full mould process, die casting, ceramic shell mould, vacuum moulding etc. Non-ferrous Die-casting of Aluminium and its alloys, brass and bronze.

Recommended Books

1. Flimm, ‘Fundamentals of Metals Casting’, Addison Wesley.
2. Heine Loper and Resenthal, ‘Principles of Metal Casting’, McGraw Hill.
3. Hielel and Draper, ‘Product Design & Process Engineering’, McGraw Hill.
4. Salman & Simans, ‘Foundry Practice’, Issac Pitman.
5. ‘Metals Handbook- Metal Casting’, ASME.

METAL CUTTING

Subject Code: PE-502 **L T P C** **Duration: 45 Hrs.**
4 0 0 4

UNIT-I

Introduction: System of Tool nomenclature, Tool Geometry, Mechanism of Chip, formation and forces in orthogonal cutting, Merchant’s force diagram.
Oblique Cutting: Normal chip reduction coefficient under oblique cutting, true shear angle, effective rake, influx region consideration for deformation, direction of maximum elongation, effect of cutting variables on chip reduction co-efficient, forces system in oblique cutting, effect of wear land on force system, force system in milling, effect of helix angle.

UNIT-II

Fundamentals of Dynamometry: Theoretical determination of forces, angle relations, heat and

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temperature during metal cutting; distribution, measurement, analysis, theoretical estimation of work piece temperature, hot machining.

Fundamental Factors, which affect Tool Forces: Correlation of standard mechanized test. (Abuladze –relation), nature of contact and stagnant phenomenon, rates of strains, shear strain and normal strain distributions, cutting variables on cutting forces.

UNIT-III

Cutting Tools: Tools materials analysis of plastic failure (from stability criterion), Analysis failure by brittle fracture, wear of cutting tools, criterion, flank and crater wear analysis, optimum tool life, tool life equations, (Taylor's woxen etc.) Tool life test, machining optimization, predominant types of wear; abrasive, adhesive, diffusion wear models, wear measurements and techniques, theory of tool wear oxidative mathematical modelling for wear, test of machinability and influence of metallurgy on machinability. Economics of Metal machining.

UNIT-IV

Abrasive Machining: Mechanics of grinding, cutting action of grit, maximum grit chip thickness, energy and grit force temperature during grinding, wheel wear, grinding, process simulation, testing of grinding wheels, mechanics of lapping and honing, free body abrasion.

Recommended Books

1. Sen & Bhattacharya, 'Principles of Machine Tools', New Central Book Agency.
2. Brown, 'Machining of Metals', Prentice Hall.
3. Shaw, 'Principles of Metal Cutting', Oxford I.B.H.
4. Arshimov & Alekree, 'Metal Cutting Theory & Cutting Tool Design', MIR Publications.
5. Knowenberg, 'Machining Science & Applications', Longman Press.

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METAL FORMING

Subject Code: PE-503 **L T P C** **Duration: 45 Hrs.**
4 0 0 4

UNIT-I

Plasticity – True stress and true strain, true stress-strain curves, selection of stress-strain curves for cold and hot working, yield of isotropic plastic material, yield criteria. Tresca maximum sheer-strain energy criterion, plastic incompressibility, Poisson's ratio for plastic deformation flow rule, strain hardening function, heat generation and heat transfer in metal forming processes, temperatures in Quasi continuous forming operations. Examination of Metal forming processes.

UNIT-II

Prediction of working loads and maximum deformation analysis of the processes of wire drawing/tube drawing, strip drawing and extrusion. various parameters/variables affecting the processes of wire drawing, tube drawing, strip drawing and extrusion; various methods of tube drawing and their comparison. Working loads for plain strain forging of strip and disc under conditions of well lubrications and sticking of material with die and under mixed conditions, prediction of working loads under above approach (simple plain strain and axis symmetric problems).

UNIT-III

Lubrication in metal forming processes, principles and mechanism of lubrications, hydrodynamic and their film lubrication, boundary and extreme pressure lubricants, solid lubricants, lubricants used for rolling and cold drawing, forging, extrusion and deep drawing processes; defects in various metal forming processes like rolling, forging, extrusion, wire drawing and deep drawing and their causes and remedial measures.

UNIT-IV

Theory and deep drawing of circular blanks, analysis of the process, prediction of radial stress and punch load, ironing, wrinkling, blank holding and various parameters/variables affecting the deep drawing process.

Rolling: Classification of rolling mills, analysis of the process. Prediction of roll pressure for flat strip rolling in the leading and lagging zones, roll separating forces, torque on the roll, effect of front and back tensions, effect of support rolls, various factors which affect rolling force.

Recommended Books

1. Rowe, Arnold, 'An Introduction to the Principles of Metal Working'.
2. Avitzer, 'Metal Forming Analysis', McGraw Hill.
3. Johnson & Merlore, 'Plasticity for Mechanical Engineering', Van Northand.
4. 'High Velocity Working Metals', ASME; EEE.

WELDING TECHNOLOGY

Subject Code: PE-504	**L T P C** **4 0 0 4**	**Duration: 45 Hrs.**

MRSPTU

UNIT-I

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.

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.

UNIT-II

Coated Electrodes: Electrode coatings, classification of coatings of electrodes for SMAW, SAW fluxes, role of flux ingredients and shielding gases, classification of solid and flux code wires,

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.

UNIT-III

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.

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.

UNIT-IV

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.

Welding Techniques using Radiation Energy: Technique, scope and application of the electron beam and laser welding processes.

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. L.M. Gourd, 'Principles of Welding Technology', ELBS/Edward Arnold.
5. Lancaster, 'The Physics of Welding', Pergaman Press.
6. Lancster, 'The Metallurgy of Welding', George Allen & Unwin Ltd. U.K.
7. 'Welding Handbook', Vol. 1 & 2, 7th Edn., American Welding Society.
8. 'Metal Handbook', Vol 6, 73, ASME.
9. 'Procedure Handbook of ARC Welding', Lincoln Electric Co. USA.
10. Tylecote, 'The Solid Phase Welding of Metals', Edward Arnold Pvt. Ltd.
11. Richard L. Little, 'Welding & Welding Technology', McGraw Hill.
12. Rossi, 'Welding Technology', McGraw Hill.
13. Koenigsberger and Adaer, 'Welding Technology', Macmillan.

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COMPUTER AIDED DESIGN AND MANUFACTURING

Subject Code: PE-505 **L T P C** **Duration: 45 Hrs.**

4 0 0 4

UNIT-I

Introduction: CAD/CAM contents and tools; history of CAD/CAM development; CAD/CAM market trends; Definition of CAD/CAM tools, Industrial look at CAD/CAM.

CAD/CAM Hardware: Introduction; types of systems; CAD/CAM systems evaluation criteria; input devices; output devices, hardware integration and networking; hardware trends.

CAD/CAM Software: Introduction; graphics standards; basic definition and modes of graphic operations; user interface; software modules, modelling and viewing; software documentation; software development; efficient use of CAD/CAM Software; Software trends.

UNIT-II

Microprocessor based CAD/CAM: Introduction; several features, system implementation; hardware components and configuration; micro-based CAD software; file translation; operating systems, mechanical applications; micro-CAD trends; product distribution trends.

Mathematical Representation of Curves: Introduction; wire frame models; wire frame, entities, curves representation, parametric representation of analytical and synthetic curves, curve, manipulation; design and Engineering applications.

UNIT-III

Mathematical Representation of Surfaces: Introduction, surface models, surface entities, surface representation, parametric representation of analytic and synthetic surfaces, surface manipulation.

Mathematical Representation of Solids: Introduction, solid models, solid entities, solid representation, fundamentals of solid modelling, half –spaces; boundary representation; constructive solid geometry sweep representation, solid modelling based applications; design and engineering applications.

UNIT-IV

Geometric Transformations: Introduction; transformation of geometric models, mappings of geometric models; inverse transmission and mappings; projections of geometric models; design and Engineering applications.

Mechanical Assembly and Tolerance: Introduction; assembly modelling, representative schemes, generation of assembling sequences; tolerance concepts.

Part Programming and Manufacturing: NC, CNC and DMC machines, part programming, manufacturing processes, process planning, tool path generation; design and Engineering applications.

Recommended Books

1. Mikell P. Groover Mecry Wo Elimmers, Jr., 'CAD/CAM', **1991**.
2. Bedford Masa Chusetles, 'The CAD/CAM Hand Book'.
3. Mikell P. Groover, 'Automation, Production Systems and Computer Aided Manufacturing', Prentice Hall.
4. R.N. Pressman, J.E. William, 'Numerical Control and Computer Aided Manufacturing', John Wiley & Sons, New York.
5. Ibrahim Zeid, 'CAD/CAM Theory and Practice', Tata McGraw Hill, New Delhi, **1998.**

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LAB.-I

Subject Code: PE-506 **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 1st semester.

NON-CONVENTIONAL MACHINING PROCESSES

Subject Code: PE-507 **L T P C** **Duration: 45 Hrs.**
4 0 0 4

UNIT-I

New Technology, Introduction, Mechanical Processes, Abrasive jet Technology, Ultrasonic machining, whirling jet machining. Fundamental principles, process parameters, characteristics, Tool design, Metal removal rate-analysis, important part design, Analysis of the Process.

UNIT-II

Chemical and Electro-chemical machining –Introduction. Principles & scheme, Process parameters, metal removal rate, dynamic and hydro-dynamic & hydro-optimization, electrolytes.

UNIT-III

EDM: Introduction-basic principles & scheme, circuitry controls, metal removal rate, machining accuracy, optimization, selection of tool material and tool design, Di-electric, Analysis.

UNIT-IV

Laser Beam Machining & Electron beam machining back ground, production of Laser, machining by Laser and other applications, Electron beam action, Dimensionless analysis to establish correlation, behaviour EBM parameters.

High Velocity forming of metals, explosive forming principles and applications, Electro-hydraulic and other applications, Analysis of the process.

Recommended Books

1. 'Non-traditional Machining Methods', ASME.
2. Bhattayacharya, 'New Technology', I.E., India.
3. Rozenberg, 'Ultrasonic Cutting', Consultants Bureau, N.Y.
4. Lazarenko, 'Electro-spark Maching of Metals', Vol. 2, Consultant Bureau, N.Y.
5. D.E. Baar 'Electro chemical maching', McDonald.

JIG, FIXTURE & DIE DESIGN

Subject Code: PE-508	**L T P C** **4 0 0 4**	**Duration: 45 Hrs.**

MRSPTU

UNIT-I

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).

UNIT-II

Automatic loading and unloading devices.

Types of Frunions: Single, double and multi-axis and indexers.

UNIT-I

Transfer line jigs & fixtures for the operation of Multi-drilling, boring, milling and grinding. Assembly line fixtures. Universal Jigs and Fixtures.

UNIT-IV

Transfer-devices, transfer machine, modulation-design concept, in process gauging.

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, 'Jigs and Fixtures', Massachusettes Institute of Technology.
3. H.W. Hardy, 'Jigs and Fixtures Design'.
4. P.S. Haughton, 'Jigs and Fixtures Design'.
5. Parson, 'Jigs and Fixtures'.

PRODUCTION PLANNING & CONTROL

Subject Code: PE-509 | **L T P C** **4 0 0 4** | **Duration: 45 Hrs.**

Introduction; Pre-planning, market survey, machine and process capacity, capacity analysis; Effects of cyclic and random variations; Routing route sheets, common charts; Scheduling; various techniques of scheduling; Production order, dispatching of production orders, job card Inventory control, inventory costs, lot size models, back orders and last sales, quantity discounts, safety, stock, elementary control under risk; Materials purchasing, quotations; Rate controls; Introduction to value analysis.

Recommended Books

1. Eilon Macmillan, 'Elements of Production Planning and Control'.

MACHINE TOOL DESIGN

Subject Code: PE-510 | **L T P C** **4 0 0 4** | **Duration: 45 Hrs.**

UNIT-I

Introduction: Classification of machine tools, elements of machine tools, selection of speed and feed, gear box design various types of clutch systems, Sohopke and Report drives, double bond gears analysis, Lohr criterion for optimizing double bond gear.

Step less drives, mechanical step less drive analysis, hydraulic step less drive & circuit analysis, design features, throttle valves, tracer controlled hydraulic circuit, hydraulic servo controls, electrical step less drive circuits and charters tics.

UNIT-II

Strength and rigidity consideration, process capability and compliance, design of lathe bed, use of stiffness in bed, design of radial drill column and milling machine column.

Analysis of spindle bearings, slides and guides, design of spindle/arbor, antifriction and journal bearings, hydro-dynamic action in slides, analysis of hydrostatic bearings, roller guides, recirculating ball analysis, stick slip motion in guides-models, force analysis of lathe guide ways.

UNIT-III

Vibrations of Machine Tools and Dynamic Rigidity: Effects of vibrations, source of vibrations, self-excited vibration, single degree of freedom chatter, velocity principle and related models, regenerative principles, chatter in lathe, drilling milling and grinding. Tlusty and palace model, Peters model, elimentation of machine tool structures matrix, finite elements and lumped constant models.

UNIT-IV

Automation: Automation drives for machine tools, degree of automation, semi-automatics, analysis of collect action, design, of collet, bar feeding mechanism, tooling layout, single spindle, multispindle automatic, transfer machine, indexing Geneva mechanism, analysis, Swiss type automatic machine loading and unloading. Transfer-devices, modular –design concept in process gauging.

Control System of Machine Tools: Control: Mechanical, electrical, hydraulic, numerical, fluidic, basic principle of cam control, hydraulic controls, fluid controls, numerical controls, feedback systems, primary systems programming. Basic Devices, adaptive control.

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Recommended Books

1. Mehta, 'Machine Tool Design', Tata McGraw Hill.
2. Sen & Bhattacharya, 'Principles of Machine Tools', New Central Book Agency.
3. Basu & Pal, 'Machine Tool Design', Oxford & IBH.
4. Acherkan, 'Machine Tool Design', Vol. I to IV, Mir Publishers.
5. Koerigsberger, 'Design Principles of Metal Cutting Machine Tools', Pergaman Press.

CUTTING TOOL DESIGN

Subject Code: PE-511 **L T P C** **Duration: 45 Hrs.**
4 0 0 4

UNIT-I

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).

UNIT-II

Tool materials, developments of various tool materials, their relative characteristics, modern trend in tool development, concept of tool life.
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.

UNIT-III

Form tools; purpose and types, design procedure and sharpening.
Drills; purpose and principal types and their construction and geometry, development in the shape of twist drills analysis.

UNIT-IV

Milling Cutters; Purpose and types and their construction procedure of profile sharpened and form relieved cutters, design of hobs, analysis.
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.

INDUSTRIAL TRIBOLOGY

Subject Code: PE-512 **L T P C** **Duration: 45 Hrs.**
4 0 0 4

UNIT-I

Introduction: Friction, wear and lubrication, types of egg. Contacts: conforming and non-conforming. Types of motion; rubbing sliding. Oscillating. Rolling. and Surface of interactions: elastic and plastic deformations. Properties of materials. Surface energy and flash temperature theory.

MRSPTU

UNIT-II

Friction: Laws of sliding friction, concept of adhesion, Tabor's mode off friction elastic thermo friction, rolling friction, measurement of friction.

Wear: Laws of wear. Types of wear such as adhesive, delamination, abrasive, fatigue, corrosive, fretting, erosive, electrical and oxidative. Measurement of wear in dry at me sphere and different environments. Prevention and control of wear and friction in machines, wear of cutting tool and dies, study of abrasion in grinding, lapping and honing.

UNIT-III

Lubrication: Mechanisms of lubrication, Boundary. Squeeze film hydrodynamic and elasto hydro-dynamic and hydro static lubrications plasto hydrodynamic lubrication, solution of Reynolds's equation in two and three-dimensional flow. Pressure distribution load carrying capacity friction forces in oil film and Co-efficient of friction in joumal bearing. Sold lubricants types and applications.

Bearing Design: Design of bearing: clearance in journal bearing. minimum film thickness, sommar-field Number, Oil grooves and flow of oil in axial and circumferential grooves ca vi tat ions and turbulence in oil bearings. Heat generation and cooling or bearing Hydrostatic and dynamic and their applications in machine Tools. Design of air bearing and other gas bearing.

UNIT-IV

Rolling Friction: Reynold's slip, Heathe cote concept selection of roller bearings and their methods of lubrication design aspects and modes of bearing failures and elasto hydro dynamic lubrication.

Solid Lubricants: Their applications in metal forming processes.

Recommended Books

1. Aggarwal Sharma, 'A Test Book', Kataria.
2. 'Main Engg. Hand Book, A M/c Desig.', McGraw Hill.
3. B.S. Prabhu, 'Industrial Tribology, Tribology Failures and their Analysis'.

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DIAGNOSTIC MAINTENANCE AND MONITORING

Subject Code: PE-513	L T P C 4 0 0 4	Duration: 45 Hrs.

UNIT-I

Introduction to maintenance techniques. Preventive and predictive Maintenance. Observational and Estimation Techniques.

UNIT-II

Non-Destructive Testing. Malfunction Analysis of Materials.

UNIT-III

Wear Analysis through thermography and Ferrography. Application of Diagnostic Maintenance to Industrial Machines and plants such as Sugar Industry, Textile Mills, Thermal Power plants and Railways.

UNIT-IV

Maintenance planning and control of a large factory, work planning and work control. Replacement Analysis.

Recommended Books

1. A. Kelly, 'Maintenance Planning and Control', Butterworth & Co., **1984.**

2. G. Krishanan, 'Maintenance and Spare Parts Management', Prentice Hall, **1991**.

ADVANCED OPERATIONS RESEARCH

Subject Code: PE-514 **L T P C** **Duration: 45 Hrs.**
4 0 0 4

UNIT-I

Linear Programming: The Theory of simplex solution, alternative optimal solution, unbounded solutions, infeasible solutions, formulation of LP models for Production scheduling, network planning, inventory Maintenance and capital budgeting and similar industrial problems. Two phase method, revised simpler method and dual simplex method sensitivity analysis. The dual problem and its role for post optimality analysis. The transportation and assignment models. Travelling salesman model, and their industrial applications.

UNIT-II

Dynamic Optimization Models: Formulation of dynamic optimization models for common Industrial problems. Optimization of non-linear objective function by dynamic programming.
Non-linear Optimization Models: Non-linear objective queuing function o f unconstrained variables, quadratic programming.

UNIT-III

Queues Models: Queuing with single and parallel channels with limited and unlimited service. Bulk input, bulk service, priority queue discipline.
Simulation Models: Generation of Random number. Use of Coeff. random numbers for system simulation. Use of computers for system simulation.

UNIT-IV

Heuristic Models: Need for heuristic programming, examples of heuristic models for travelling salesman problems, facilities design and assembly line balancing.
Optimization Techniques: Introduction, theory and algorithms; classical method; non-linear optimization, unconstrained optimization, constrained optimization; langrangian multiplier method.

Recommended Books

1. Ackoff & Sasieni, 'Fundamental of Operation Research', Wiley Eastern.
2. Wagner, 'Principles of OR with Applications to Managerial Decisions', Prentice Hall.
3. Hillier & Lieberman Holder Day, 'Introduction to OR'.
4. P.K. Gupta & D.S. Hira, 'Operation Research'.

MANAGEMENT OF PRODUCTION SYSTEMS

Subject Code: PE-515 **L T P C** **Duration: 45 Hrs.**
4 0 0 4

UNIT-I

Systems Theory and Concepts: Systems defined, functional elements of a system, general system theory, systems theory and organization, systems concept and management. The systems approach, planning and systems concepts. Control and systems concepts, Information and systems concepts.

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UNIT-II

Quantitative Techniques of System Analysis: Systems analysis, problem solving, scientific method, mathematical analysis, models, computer techniques of analysis. Linear programming input output analysis, queuing Monte-Carlo techniques, Simulation, Industrial dynamics.

UNIT-III

Behavioural Aspects of System Design: The motivation factors in System design, leadership factors in system design. The need for systematic human relationships, the need for systems change, resistance to change, behavioural consequences of system changes, Microanalysis of complex, man machine open systems, concept as a basis of human integration, meeting the human and social problems.

Flow System: Increasing complexity in distribution and production, increasing cost of a distribution, the total flow system, planning the transformation, service system, integrating systems.

UNIT-IV

Program Management: Impact of advancing Technology, large scale integrating system. Program Management, concept functional stages of program-management organizational modifications, matrix organization, applications of program Management.

Management Cybernetics: Management cybernetics in controlling a manufacturing firm, production and inventory control systems, production, inventory, and employment control systems, the enterprise control systems.

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Recommended Books

1. Eilon, 'Elements of Production Planning and Control', Macmillan.
2. Groover, 'Automatic Production System and Computer Integrated Manufacturing', Prentice Hall.
3. Hitachi, Taylor & Francis, 'Manufacturing Systems Engineering', Hitogni.
4. Baudin, Yourdon, 'Manufacturing Systems and Analysis'.
5. R.N. Nauhria & Rajnish Parkash, 'Management of Systems'.
6. Elwood, S. Buffa, 'Modern Production Management', Wiley, Eastern, **1984.**
7. Rishards I. Koin, 'Production/Operations Management', TMH, **1979.**

SIMULATION OF INDUSTRIAL SYSTEMS

Subject Code: PE-516	**L T P C** **4 0 0 4**	**Duration: 45 Hrs.**

UNIT-I

1. **Introduction and Overview:** concept of system, system environment, elements of system, system modeling, types of models, Monte Carlo method, system simulation, simulation - a management laboratory, advantages & limitations of system simulation, continuous and discrete systems.
2. **Simulation of Continuous Systems:** characteristics of a continuous system, comparison of numerical integration with continuous simulation system. Simulation of an integration formula.

UNIT-II

3. **Simulation of Discrete System:** Time flow mechanisms, Discrete and continuous probability density functions. Generation of random numbers, testing of random numbers for randomness

and for auto correlation, generation of random variates for discrete distribution, generation of random variates for continuous probability distributions-binomial, normal, exponential and beta distributions; combination of discrete event and continuous models.

4. **Simulation of Queuing Systems:** Concept of queuing theory, characteristic of queues, stationary and time dependent queues, queue discipline, time series analysis, measure of system performance, Kendall's notation, auto covariance and auto correlation function, auto correlation effects in queuing systems, simulation of single server queues, multi-server queues, queues involving complex arrivals and service times with blanking and reneging.

UNIT-III

5. **Simulation of Inventory Systems:** Rudiments of inventory theory, MRP, in-process inventory. Necessity of simulation in inventory problems, forecasting and regression analysis, forecasting through simulation, generation of Poisson and Erlang variates, simulation of complex inventory situations.
6. **Design of Simulation Experiments:** Length of run, elimination of initial bias, Variance, Variance reduction techniques, stratified sampling, antipathetic sampling, common random numbers, time series analysis, spectral analysis, model validation, optimization procedures, search methods, single variable deterministic case search, single variable non-deterministic case search, regenerative technique.

UNIT-IV

7. **Simulation of PERT:** Simulation of - maintenance and replacement problems, capacity planning, production systems, reliability problems, computer time sharing problem, the elevator system.
8. **Simulation Languages:** Continuous and discrete simulation languages, block structured continuous languages, special purpose simulation languages, SIMSCRIPT, GPSS SIMULA importance and limitations of special purpose languages.

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Recommended Books

1. Loffick, 'Simulation and Modelling', Tata McGraw Hill.
2. Deo Narsingh, 'System Simulation with Digital Computer', Prentice Hall.
3. D.S. Hira, 'System Simulation', S. Chand & Co.
4. Meelamkavil, 'Computer Simulation and Modelling', John Willey.
5. Gerden, 'System Simulation', Prentice Hall.

MATERIALS TECHNOLOGY

Subject Code: PE-517	L T P C 4 0 0 4	Duration: 45 Hrs.

UNIT-I

Material science fundamentals. Properties of single and multiphase. Materials. Fatigue, creep and fracture process. Ferrous materials and alloying properties. Engineering properties of non-ferrous and refractory materials-ceramics, plastics, fibre reinforced and composite materials. Environmental degradation of materials and surface modification techniques. Non-Destructive testing.

Recommended Books

1. R.E. Reed Hill, 'Physical Metallurgy Principles', Van Nostrand.
2. Y.U. Lakhtin, 'Engineering Physical Metallurgy & Heat Treatment', Mir Publishers.

3. D.S. Clark & W.R. Varney 'Physical Metallurgy for Engineers', CBS.
4. R.A. Higgins, 'Engineering Physical Metallurgy', Part – I.
5. V. Raghavan, 'Solid State Transformation', Prentice Hall.
6. A.K. Jena & M.C. Chaturvedi, 'Phase Transformations in Materials', Prentice Hall.
7. A. Cottrell, 'An Introduction to Metallurgy', ELBS.
8. V. Raghavan, 'Material Science & Engineering'.
9. James F. Shackelford, 'Introduction to Material Science for Engineers', Macmillan Publishing co. New York.
10. Shirvastav, 'Non-Destructive Testing Techniques'.
11. 'Non-Destructive Testing', Hand Books of American Society of Non-Destructive Testing.

LAB.-I

Subject Code: PE-518 **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.

MECHATRONICS

Subject Code: PE-619 **L T P C** **Duration: 45 Hrs.**
4 0 0 4

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UNIT-I

Control Engineering: Open loop and closed loop control system, system components, hydraulic, thermal, pneumatic processes and their electrical analogies.

UNIT-II

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

Sensors and Signal Conditioners: Transducers for Industrial processes, signal conditioning, output devices and displays.

UNIT-IV

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.

ROBOTICS AND INDUSTRIAL AUTOMATION

Subject Code: PE-620 **L T P C** **Duration: 45 Hrs.**
4 0 0 4

UNIT-I

Introduction to Robot Technology: Robot Physical configuration, basic Robot motions.
Types of Manipulators: Constructional features, advantages and disadvantages of various kinematic structures, servo and Non- servo manipulator. Actuators and Transmission System: Pneumatic, Hydraulic and Electrical actuators and their characteristics and control systems.

UNIT-II

Feed Back Systems and Sensors: Encoders and other feedback systems, vision, ranging systems, textile sensors.
Programming Languages: Description of VAN, RAII and other Languages.
Artificial Intelligence: Logged Locomotion, Export system.

UNIT-III

Concept of Spatial Description and Transformations: Manipulator Kinematics; Inverse manipulator, Kinematics Jacobians; velocities and static forces; manipulator dynamics, position control of manipulators, force control of manipulators, robot programming languages and systems. Concept of automation in Industry, mechanization and automation classification of automation systems.
Air Cylinders: Their design and mountings, pneumatic and hydraulic valves, flow control valves metering valves, direction control valves, hydraulic servo systems, pneumatic safety and remote control circuits.

UNIT-IV

Basis of Automated Work Piece Handling: Working principles and techniques, job orienting and feeding devices. Transfer mechanisms automated feed out of components, performance analysis. Assembly automation, automatic packaging and automatic Inspection.

Recommended Books

1. Groover and Elimmers (Jr.), 'CAD/CAM'.
2. 'CAD/CAM Handbook', Bed Ford Masschusettes.
3. 'Automation Production Systems & Computer Aided Manufacturing'.
4. Royen, 'Robotics for Engineers', MIT Press.
5. Paul, 'Robot Manipulators', MIT Press.
6. Hall & Hall, 'Robotics'.
7. Brady, 'Robot Motion', MIT Press.
8. Press man and Elimmers, 'Numerical Controlled Computer Aided Manufacturing', John Wiley & Sons. New York.

METROLOGY & INDUSTRIAL INSPECTION

Subject Code: PE-621 **L T P C** **Duration: 45 Hrs.**
4 0 0 4

UNIT-I

Standards of Measurement: Line, End and Wavelength standards. Primary secondary and working standards. Limits, Fits & tolerances, Interchangeability, design & manufacture of

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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

Instruments for Measuring Surface finish & Roughness: Classes of instruments, the Taylor-Hobson tele surf, plastic replica techniques, numerical assessment of roundness.

Calibration of Working Standards by Interferometry: Application of interferometry, calibration of gauges by interference, by interference method, the gauge length interferometer, obliquity correction the absolute length gauge interferometer.

UNIT-III

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

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, thread gauge measurement, measurement, measuring equipment, application of thread gauges.

Management of Inspection and Quality Control: Communication of specifications, the nature of dimensions, selection of gauging equipment, kind of inspection, quality control Management

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Recommended Books

1. Taher, ‘Metrology and Measuring Instruments’.
2. Miller, ‘Dimensional Metrology’.
3. Khare & Vajpayee, ‘Dimensional Metrology’.
4. R.K. Jain, ‘Engineering Metrology’.
5. I.C. Gupta, ‘Engineering Metrology’.
6. Michelon, ‘Industrial Inspection Methods’, Leno C. Harper & Brothers, NY, **1950**.
7. ‘The Science of Precision Measurement’, The DoALL Co, Des Plaines Illinois.
8. ‘Inspection & Gauging’, The Industrial Press, New York, **1951**.

COMPUTER AIDED PROCESS PLANNING

Subject Code: PE-622	**L T P C** **4 0 0 4**	**Duration: 45 Hrs.**

UNIT-I

Introduction: Traditional process planning, process planning elements, product design evaluation; selection of tooling and process parameters; operation sequence evaluation.

UNIT-II

Group Technology: Production, advantages; part families; classification and coding systems, production analysis. Design of machine cells.

UNIT-III

Production Systems at Operation Level: Manufacturing support systems and concepts at the level of production processes; computer generated time standards; machinability data system; cutting condition optimization.

Production Systems at Plant Level: Communication oriented production information and control system (COPICS); material requirements planning_ capacity planning; shop floor control and operation scheduling.

UNIT-IV

Automated Process Planning: Advantages of automated process planning; Standardization of manufacturing process plans; variant process planning_ its features_ and different stages; different variant systems; advantages and limitations of variant process planning; generative process planning; its features; design strategies; planning; modeling and coding scheme; decision mechanism for software; decision trees for process; process, information; artificial intelligence; overview & application; search strategies for AI production systems; resolution and reduction systems; knowledge acquisition; machine selection; cutting tool selection; software; various generative process planning systems; advantages of generative process planning systems; case studies.

Recommended Books

1. Chand & Wysk, 'An Introduction to the Automated Process Planning', Prentice Hall.
2. Groover & Zimmers, 'Computer Aided Design & Manufacturing', Prentice Hall.
3. Gallagher & Knight Ellis Hosewood, 'Group Technology; Prod. Method in Manufacturing'.
4. 'Principle of Artificial Intelligence', Verlag.
5. 'Automation; Pro6uction System & Computer Integrated Manufacturing', Prentice Hall.

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METHODS ENGINEERING AND ERGONOMICS

Subject Code: PE-623 **L T P C** **Duration: 45 Hrs.**
4 0 0 4

UNIT-I

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).

Introduction of Ergonomics: Man/machine/environment systems concept. Development of ergonomics.

UNIT-II

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

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.

UNIT-IV

Climates:

a) **Heat Humidity:** Body heat balance, effective temperature scales, zones of discomfort, effect of heat on body and work performance.
b) **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.
c) **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**.
5. Lyle, F. Yerges, 'Sound, Noise and Vibration Control', Van Nostrand, **1978**.

PRODUCT DESIGN AND DEVELOPMENT

Subject Code: PE-624 | **L T P C** **4 0 0 4** | **Duration: 45 Hrs.**

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UNIT-I

Importance of product design in industry. Principal requirements of good product design. Factors and considerations affecting product design. Ergonomic factor in product design.

UNIT-II

Product design methodology and techniques. Basic elements and concepts of visual design.

UNIT-III

Materials, forms, function and color relationships. Product graphics, product development and testing. Packaging materials their characteristics and applications. Packaging design considerations.

UNIT-IV

Value engineering, concept, advantage and applications. Value, types of values. Analysis of function, using and evaluating functions. Value engineering techniques. Value control.

Recommended Books

1. Mayall, 'Industrial Design', McGraw Hill.
2. Niebel & Draper, 'Product Design & Process Engineering', McGraw Hill.
3. Asimov, 'Introduction to Design', Prentice Hall.
4. Mudge, 'Value Engineering', McGraw Hill.

ENTREPRENEURSHIP

Subject Code: PE-625 **L T P C** **Duration: 45 Hrs.**
4 0 0 4

UNIT-I

Introduction: Factors leading to Industrial Development Entrepreneur definition and various concepts, self-awareness. Motivational aspects, attitude development, creativity, copying with uncertainties, resilience.

UNIT-II

Information: Industrial potential, environmental scanning, Identification of opportunities, dynamics of an opportunity, business opportunities recognition. Government policy for Industrial development. Choice of Technology Research for patents, product development.

UNIT-III

Planning: Planning of an Industrial unit, project planning, identification of market and demand for product, role of significant variables, execution of projects legal aspects, financial aspects and labour laws, feasibility studies, sectoral, Industrial and unit level feasibility, exposure to past, present and future.

UNIT-IV

Entrepreneurial Management: Business finance Management through elementary concept break even, working capital knowledge of various institutions and their mode of assistance. Elements of Production processes, quality control, Inspection methods. Production planning group dynamics.

Recommended Books

1. V.G. Patel, 'Entrepreneurship Development Programme in India and its Relevance to Developing Countries', EDI, Ahmedabad, India, **1987.**
2. 'Developing of New Entrepreneurship', EDI, Ahmedabad, India, **1987.**
3. G.R. Jain and M.A. Ansari, 'Self –made Impact making Entrepreneurship', EDI, Ahmedabad, India, **1988.**

STATISTICS AND RELIABILITY ENGINEERING

Subject Code: PE-626 **L T P C** **Duration: 45 Hrs.**
4 0 0 4

UNIT-I

Statistics: Introduction; Principal uses of Statistics, Sampling, Frequency Distributions; Normal Distribution; Logarithmic normal distribution; Poisson distribution; correlations; Probability, Tests of significance; the Chi-Square tests; Differences in means of large samples; Differences in means of small samples; The t-test; Confidence limits; Analysis of Variances; Time Series, Monte-Carlo Method.

UNIT-II

Reliability: Introduction, Reliability concepts and patterns of failure; Reliability Management; Reliability for system effectiveness.

Reliability and Hazard Rates: Failure data; Reliability function; Failure rate and hazard rate; Common distributions in failure Mechanisms-Exponential, Weibull, Gamma, Lognormal Extreme Value; Model selection for component failures; Failure analysis.

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UNIT-III

Reliability Prediction and Analysis: Reliability prediction based on Exponential Distribution; System Reliability analysis- Block diagram method, fault tree and sconces tree methods, event tree method, failure mode, failure mechanisms.

UNIT-IV

Reliability Design: Design for Reliability, Design process, assessment methodology, Reliability allocation, Reliability improvements, Selection of Components to improve system Reliability.

Recommended Books

1. A.K. Gupta, ‘Reliability Engg. & Terotechnology’, Macmillan India Ltd., Delhi, **1996.**
2. E.E. Levis, ‘Introduction to Reliability Engg.’, Wiley & Sons, New York.
3. L.S. Shrinath, ‘Reliability Engg.’ Affiliated East West Press.
4. R.A. Johnson, ‘Probality and Statisties for Engineers’, Prentice Hall of India Pvt. Ltd., New Delhi, **1995.**

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MRSPTU POST GRADUATE OPEN ELECTIVES-I 2016 BATCH ONWARDS (UPDATED ON 22.4.2018)

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	
MMEE0-F94	Industrial Automation & Robotics	
MCIE0-F91	Environment Management	M.Tech. Civil Engg., M.Tech. CE (Infrastructural Engg.), M.Tech. CE (Geotechnical Engg.), M.Tech. (Structural & Foundation Engg.),

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		M.Tech. CE (Construction 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	
MBAD0-FX0	Managing Supply Chain	---
MMAT0-F94	Design of Experiments	M.Sc. Mathematics
	Enterprise Resource Planning (ERP)	
	Relational Database Management System (RDBMS)	
MFOT0-F91	Basics of Nutrition and Health	M.Sc. Food Technology

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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 COURSE.

CO4: Able to design feedback Artificial Neural Networks (ANN) and implement various methods of unsupervised COURSE

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. COURSE rules and equations: Perceptron, Hebb's, Delta, winner take all and out-star COURSE rules. Supervised COURSE Network: Perceptron Networks, Adaptive Linear Neuron, Multiple Adaptive Linear Neuron, Back Propagation Network, Associative memory networks, Unsupervised COURSE 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 COURSE, **2008**.

BIG DATA ANALYTICS AND CONCEPTS

Subject Code: MCSE0-F92 **L T P C** **Duration: 45 Hrs.**
3 0 0 3

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

COURSE 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.

COURSE 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

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.**

ADVANCED DATA STRUCTURES AND ALGORITHMS

Subject Code-MCSE0-F94	**L T P C** **3 0 0 3**	**Duration – 45 Hrs.**

COURSE 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.

COURSE 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 (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.

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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 Ed., PHI, **2009**.
3. Adam Drozdex, 'Data Structures and algorithms in C++', 2nd Ed., Thomson COURSE – 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 3 0 0 3**	**Duration: 40 Hrs.**

Course 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.
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

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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.

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.

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HUMAN RESOURCE MANAGEMENT

Subject Code: MBAD0-F93 **L T P C** **Duration: 45 Hrs.**
3 0 0 3

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, 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.

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 COURSE.
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.

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MARKETING MANAGEMENT

Subject Code: MBAD1-F94 **L T P C** **Duration: 40 Hrs.**
3 0 0 3

COURSE 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

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 COURSE.
5. Kotler & Armstrong, 'Principles of Marketing', Prentice Hall.
6. Biplab S. Bose, 'Marketing Management', Himalaya Publications.
7. Subhash c. Jain, 'Marketing Management', Cengage COURSE.
8. Rajan Saxena, 'Marketing Management', Tata McGraw Hill.

PROJECT MANAGEMENT

Subject Code: MBAD0- F95 **L T P C** **Duration: 40 Hrs.**
3 0 0 3

MRSPTU

COURSE 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 COURSEs.
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.

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.**

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.

COURSE 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 COURSE.
4. Joseph Brady & Ellen F Monk, 'Problem Solving Cases in Microsoft, Excel Thomson COURSE'.
5. K. Saini & Pradeep Kumar, 'Computer Applications in Management', Anmol Publications.
6. Deepak Bharihoke, 'Fundamentals of Information Technology', Excel Books.

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PHYSICS OF MATERIALS

Subject Code: MPHY0-F91 **LT P C** **Contact Hrs.-48**
3 0 0 3

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.

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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 **L T P C** **Contact Hrs.-36**
3 0 0 3

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.

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** **Contact Hrs.-45**
3 0 0 3

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.

MRSPTU

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.

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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'.

SUPPLY CHAIN MANAGEMENT

Course Code: MMEE0-F92	**L T P C** **3 0 0 3**	**Contact Hrs. 42**

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.

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.

Recommended Books:

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', 2nd Edn., Belmont CA: West/ Wadsworth-An International Thomson Publishing Company, **1988**.

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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', 17^{th} 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, 6^{th} 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', 2^{nd} Edn., **1988**.

COMPUTER NETWORKS

Subject Code: MECE0-F91 **L T P C** **Duration: 48 Hrs.**
3 0 0 3

COURSE Objectives

This Course provides an In-depth knowledge on computer networks and provides a good background for advanced studies in communication networks.

COURSE 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.

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.

MRSPTU

DIGITAL SIGNAL PROCESSING

Subject Code: MECE0-F92 **L T P C** **Duration: 48 Hrs.**
3 0 0 3

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.

SENSORS AND TRANSDUCERS

Subject Code: MECE0-F93 **L T P C** **Duration: 48 Hrs.**
3 0 0 3

Course 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.

Course 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.

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.

DIGITAL CIRCUITS AND LOGIC DESIGN

Subject Code: MECE0-F95 | **L T P C 3 0 0 3** | **Duration: 48 Hrs.**

Course 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.

Course 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**.

MRSPTU

ADVANCED ELECTRICAL MACHINES

Subject Code: MELE0-F91 **L T P C**
3 0 0 3

Course Objectives:

1. To give a systematic approach for modeling and analysis of all rotating machines under both transient and steady state conditions.

Course Outcomes:

1. The students will be able to model all types of rotation machines including special machines.
2. 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.**

MRSPTU

LOAD FORECASTING AND LOAD MANAGEMENT

Subject Code: MELE0-F92 **L T P C**
3 0 0 3

Course Objectives:

1. To give a systematic approach for load management and forecasting.
2. To analysis of all trend coming related to recent case studies conditions.

Course Outcomes:

1. The students will acquire skills of load related energy management and tariff structure.
2. 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.

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

MRSPTU

Course Objectives:

1. To apply artificial neural networks in various electrical and electronics engineering applications.
2. To expose students to fuzzy methods of analyzing 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.

Course 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

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

COURSE Processes: Memory Based COURSE Hebbian COURSE, Competitive COURSE, Boltzmann COURSE, COURSE with a teacher, COURSE 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

Course 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.

Course Outcomes:

- After COURSE 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.

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.

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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.

DESIGN OF EXPERIMENTS

Subject Code: MMAT0-F94 **L T P C**
3 0 0 3

Course Objectives

To impart knowledge of statistical tools, designing of experiments, etc.

UNIT-I

General introduction about various statistical tools and their usefulness. Objectives and principles of experimental design. Experimental design terminology. Increasing accuracy on experiments.

UNIT-II

Completely randomized designs. Blocking designs. Latin square designs. Analysis of variance (ANOVA). Correlation and regression. Principles of experimental design. Typical application of experimental design. Simple comparative experiments. Experiment with single factor.

UNIT-III

Introduction to factorial designs. Concept of fractional factorial design. Two level design. Three level design, Response surface designs. Central composite and Box-Behnken designs. Concept of Split-plot design.

UNIT-IV

Fitting regression models. Multiple regression and correlation analysis, Partial correlation. Test of significance and model lack of fit. Use of replicates. Orthogonal design and Taguchi Approach. Use of computers and software packages.

Recommended Books

1. W.G. Cochran and G.M. Cox, 'Experimental Design', John Wiley and Sons, Inc.
2. D.C. Montgomery, 'Design and Analysis of Experiments', John Wiley and Sons.
3. G.A.V. Leaf, 'Practical Statistics for the Textile Industry', Part-I, II, The Textile Institute, UK.
4. A.I. Khuri and J. Cornell, 'Response Surface: Design and Analyisi', Marcel Dekker, New York.
5. Diamond William J., 'Practical Experiment Designs', 1st Indian Edn., CBS Publishers and Distributors, New Delhi.
6. D.C. Montgomery, E.A. Peck, G.G. Vinning, 'Introduction to Linear Regression Analysis', John Willey and Sons, Inc.

MANAGING SUPPLY CHAIN

Subject Code: MBAD0-X0 **L T P C**
3 0 0 3

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Course Objectives

To impart knowledge of statistical tools, designing of experiments, etc.

Unit-1

Supply Chain, Supply Chain Concepts: flow of materials, Wastes in the pipeline, flow of Information, Supply Chain Drivers, Supply chain Management: Concept, frame work and need for study.

Unit-2

Planning & Managing Inventories in a Supply Chain: Safety Inventory, Benchmarking the supply chain. Quick Response, Vendor Managed Inventory (VMI), Postponement, Just in Time & QR Logistics, Introduction to Apparel/Textile Supply Chain, Distribution & Procurement and various Procurement Channels in Supply Chain.

Unit-3

Reverse supply chain(RSC), difference with forward supply chain, cost considerations involved, industries participation, factors leading to application of concept of RSC in specific industries and its restricted application, benefits, cost effectiveness of RSC.

Unit-4

Supply chain in apparels, Introduction to sampling, understanding quality procedures in sampling and sample development, different stages of samples and their requirements from Proto to Shipment sample Proto, fit, Size set, Pre production, TOP, Sealer, important Industry Inputs

Recommended Books

1. Martin Christopher, ‘Logistics & Supply Chain Management: Strategies for Reducing Cost and Improving Service’.
2. Sunil Chopra, ‘Supply Chain Management: Strategy, Planning and Operation’.
3. Douglas Macbeth, ‘Partnership Sourcing: An Integrated Supply Chain Management Approach’.

MRSPTU

BASICS OF NUTRITION AND HEALTH

Subject Code: MFOT0-F91 **L T P C** **Duration: 36 Hrs.**

3 0 0 3

Unit-I (9 Hrs.)

Food and Nutrients: Basic definitions, changing concepts of nutrition.

Energy requirements of individuals and groups. Control of food intake and weight.

Unit-II (9 Hrs.)

Obesity and its causes, Body composition, Body Mass Index (B.M.I).

Basal metabolic rate (B.M.R.), Factors affecting B.M.R.

Unit-III (9 Hrs.)

Cardio vascular diseases, Diabetics, Hypertension, Inflammatory bowel disorder (IBD): causes, precaution and preventive measures.

Functional Foods, role in controlling various diseases.

Unit-IV (9 Hrs.)

Diet planning for specific age groups.

Diet planning for diabetic patients.

Preparation of food charts.

Recommended Books

1. P. Insel, R.E Turner and D. Ross 'Discovering Nutrition', ADA, Jones and Bartlett Publishers Inc., USA.
2. S.R. Williams. 'Essentials of Nutrition and Diet Therapy', Times Mirror/Mosby College Publication.
3. V. Hegarty, 'Nutrition Food and the Environment,' Eagen Press.
4. A.F. Brian, and G. Allen, 'Food Science, Nutrition & Health.,' Edward Arnold, A Member of Hodder Headline Group London, Sydney, Auckland.
5. S.R. Mudambi and M.V. Rajagopal, 'Fundamentals of Food & Nutrition,' New Age International (P) Ltd., Publishers, New Delhi.
6. ICMR, 'Nutrient Requirement and RDA', ICMR, New Delhi.
7. M.J. Gibney, M. Elia, O. Ljungqvist, and J. Dowsett, 'Clinical Nutrition', The Nutrition Society Textbook Series, Blackwell Publications.

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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	
MBAD0-FX1	Intellectual Property Rights	---
MMAT0-F95	Operation Research and Statistics	---

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MFOT0-F92	Food Adulteration and Safety	M.Sc. Food Technology

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NETWORK SECURITY AND ETHICAL HACKING

Course Code: MITE0-F92 **L T P C**
3 0 0 3

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 Course, **2009**.
5. Eric Core, 'Hackers Beware', EC-Council Press, **2003.**

ADVANCED OPERATING SYSTEM

Subject Code-MCSE0-F95 **L T P C** **Duration – 45 Hrs.**
3 0 0 3

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

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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

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**.

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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

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**.

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ADVANCED COMPUTER NETWORKS

Subject Code-MCSE0-F97	L T P C 3 0 0 3	Duration – 45 Hrs.

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.

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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', 5^{th} Edn., Tata McGraw Hill, **2013**.
2. A.S. Tanenbaum, 'Computer Networks', 4^{th} Edn., Pearson Education, **2002.**
3. William Stallings, 'Network Security and Cryptography', 6^{th} Edn., Prentice Hall of India, **2013**.
4. Theodore S. Rappaport, 'Wireless Communication: Principles and Practices', 2^{nd} 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** **3 0 0 3** **Contact Hrs. 45**

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.

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,

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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, Course, 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**.

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DATABASE MANAGEMENT SYSTEMS

Subject Code-MCSE0-F99 **L T P C** **Duration – 36 Hrs.**
3 0 0 3

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

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.

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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 3 0 0 3	Duration – 40 Hrs.

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 Course.
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**

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BUSINESS ETHICS

Subject Code: MBAD0- F97 | **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.

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.

Recommended Books

1. R.C. Shekhar, 'Ethical Choices in Business', Response Book, New Delhi.
2. S.C. Chakraborty, 'Managerial Transformations 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

Course 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.

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DYES, SOAP AND DETERGENTS

Subject Code: MCHM0-F92 **L T P C** **Contact Hrs.**

UNIT–I (12 Hrs.)

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 (8 Hrs.)

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 (saponifiable, 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

Recommended Books

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'.

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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.

MRSPTU

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 (11 Hrs.)

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.

MRSPTU

ELECTRONIC INSTRUMENTATION

Subject Code: MECE0-F97 **L T P C** **Duration: 45 Hrs.**
3 0 0 3

Course 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 (11 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(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.

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RELIABILITY ENGINEERING

Subject Code: MECE0-F98 **L T P C 3 0 0 3** **Duration: 45 Hrs.**

Course 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.

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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

Course 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.

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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 **L T 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 **L T 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

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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', 4^{th} Edn,, New Age International Publishers, New Delhi, **2003.**
2. S.S. Sastry, 'Introductory Methods of Numerical Analysis', 5^{th} 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.

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ELECTRIC TRACTION SYSTEM

Subject Code: MELE0-F96 **L T P C** **Contact Hrs.-36**
3 0 0 3

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**
3 0 0 3

Course 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

Course 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 MOSFET and 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

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INTELLECTUAL PROPERTY RIGHTS

Subject Code: MBAD0-FX1 **L T P C** **Contact Hrs.-36**
3 0 0 3

Course Objectives

To impart knowledge of designing concepts of fabric and apparels, etc.

Unit-I

Intellectual property rights and its importance. Overview of world intellectual property organization (WIPO) and their role. IPR in perspective of India. Introduction to copyright, patent, industrial designs and trade. Concept of IPR in textile and fashion industries.

Unit-II

Copy Right: definition, types of works that are covered by copyright, rights protected by copy rights-economic rights, moral rights. Right of reproduction: right of public performance, broadcasting and communication to the public. Right of translation and adaptation. Step to get copy right, limitation and general duration of copy right. International agreements concerning copyright.

Related Rights: right of performers, broadcasting organization.

Unit-III

Trademarks: introduction, signs that may serve as trademarks, Madrid agreement, procedure for getting trademark register, geographic indications. Appellation of origin.
Industrial design: introduction, different between industrial design, trademark and patent. Procedure for protection of Industrial design, general duration of Industrial design.

Unit-IV

Patents: purpose, need of patent, required condition for patentability. Procedure for filing the patent application. Limitation and advantages of patenting. Issue of enforcement and licensing, patent cooperation treaty.
Unfair Competition: introduction, acts of unfair competition and protection.
Applications of IPR in textile and fashion industries.

OPERATION RESEARCH AND STATISTICS OF ENGG.

Subject Code: MMAT0-F95 **L T P C** **Contact Hrs.-36**
3 0 0 3

Course Objectives
To impart knowledge of statistical tools, designing of experiments, etc.

Unit-I

Linear Optimization Models: Formulation of linear – programming problems.
Graphical solution. Simplex algorithms: Prig M method, two phase Method, Dual Simplex algorithm (Numericals based on these methods). Transportation problems (including time minimizing transportation problems). Assignment problems including traveling salesman and airline crew problems. Degeneracy in Transportation problems.

Unit-II

Introduction to Sequencing Models: Problems based on n jobs 2 machines, 4 jobs in machines. Gantt chart.
Introduction to Networking Planning: CPM: Concept, difference from PERT. Critical path. Floats PERT. Concept, critical path finding, problems involving probability of project completion/

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Unit-III

Concept of probability. Additive and multiplicative laws of probability. Random variables. Mathematical expectation. Discrete and continuous probability distributions (Definitions, and problems only). Binomial, Poisson and normal distributing (properties and applications). Concept of sampling. Techniques of sampling. Sampling distribution. Test of hypothesis. Type I and Type II errors. Level of significance and P-value approach.

Unit-IV

Test of significance for large and small samples. χ^2 test for goodness of fit. t-test. F-test. Analysis of variance (one way and two way classifications).
Introduction to MATLAB and its applications.

Recommended Books

1. C.K. Mustafi, ‘Operations Research Methods and Practices’.
2. Kantiswarup, P.K. Gupta, Manmohan, ‘Operations Research’.
3. Gupta and S.D. Sharma, ‘Operations Research’.
4. Gupta and Gupta, ‘Business Statistics’.
5. Gupta and Kapur, ‘Mathematical Statistics’.

6. M.P. Spiegel, 'Theory and Problems of Probability and Statistics'.

FOOD ADULTERATION AND SAFETY

Subject Code: MFOT0-F92 | **L T P C 3 0 0 3** | **Duration: 36 Hrs.**

Unit-I (8 Hrs.)

Introduction and Concept: Food Adulteration – Definition, concept, classification of adulterants, food contaminants, difference between adulterants and contaminants, list of foods commonly adulterated, harmful effects of adulterants.

Unit-II (10 Hrs.)

Adulteration in Milk and Milk Products: Common adulterants in milk and milk products. Household and laboratory scale methods to detect the adulterants in milk and milk products

Adulteration in Spices and Additives: Common adulterants in spices and food additive. Household and laboratory scale methods to detect the adulterants in these commodities.

Unit-III (8 Hrs.)

Food Laws and standards for adulteration: National and international Laws and regulations to minimize adulteration in food commodities.

Unit-IV (10 Hrs.)

Public Health Hazards and Food Safety: Food borne illness, food poisoning, types of food poisonings, bacterial agents of food borne illness, food poisoning by clostridium, salmonella, E. coli, bacillus, staphylococcus etc.

Recommended Books

1. N.S. Manay and M. Shadaksharaswamy, 'Food Facts and Principles', New Age International Publisher, New Delhi.
2. F.W. Traphagen, 'Food Adulteration', Nabu Press.
3. E.M. Bruce, E.M. Bruce, 'Detection of the Common Food Adulterants', Forgotten Books.
4. S.N. Jha, 'Rapid Detection of Food Adulterants and Contaminants', Academic Publication Ltd.
5. J.M. Jay, 'Modern Food Microbiology', CBS Publishers, New Delhi.

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1st Semester		Contact Hrs.			Marks			Credits
Code	**Course**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
MELEE1-101	Power System Analysis	3	0	0	40	60	100	3
MELEE1-102	Power System Dynamics-I	3	0	0	40	60	100	3
MRMIP-101	Research Methodology and IPR	2	0	0	40	60	100	2
MELEE1-103	Power System (Power System Steady State Analysis) Lab-I.	0	0	4	60	40	100	2
MELEE1-104	Power System (Renewable Energy) Lab-II.	0	0	4	60	40	100	2
Departmental Elective-I		3	0	0	40	60	100	3
MELEE1-156	Renewable Energy System and Distributed Generation							
MELEE1-157	Smart Grids							
MELEE1-158	High Power Converters							
MELEE1-159	Wind and Solar Systems							
Departmental Elective-II		3	0	0	40	60	100	3
MELEE1-160	Electrical Power Distribution System							
MELEE1-161	Optimization Techniques for Power Engineering							
MELEE1-162	Pulse Width Modulation for PE Converters							
MELEE1-163	Electric and Hybrid Vehicles							
Audit Course (Choose any one)		2	0	0	100	0	100	0
MHUMA0-101	English For Research Paper Writing							
MCIVE0-101	Disaster Management							
MHUMA0-102	Sanskrit for Technical Knowledge							
MHUMA0-103	Value Education							
MHUMA0-104	Constitution of India							
MHUMA0-105	Pedagogy Studies							
MHUMA0-106	Stress Management by Yoga							
MHUMA0-107	Personality Development through Life Enlightenment Skills							
Total		**16**	**0**	**8**	**420**	**380**	**800**	**18**

Programme Outcomes of Power Systems Stream:

PO1: Ability to apply the enhanced knowledge in advanced technologies for modeling, analyzing and solving contemporary issues in power sector with a global perspective.
PO2: Ability to critically analyze and carry out detailed investigation on multifaceted complex Problems in area of Power Systems and envisage advanced research in thrust areas.
PO3: Ability to identify, analyze and solve real-life engineering problems in the area of Power Systems and provide strategic solutions satisfying the safety, cultural, societal and environmental aspects/ needs.
PO4: Ability for continued pursuance of research and to design, develop and propose theoretical and practical methodologies towards research and development support for the Power System infrastructure.
PO5: Ability to develop and utilize modern tools for modeling, analyzing and solving various Engineering problems related to Power Systems.
PO6: Willingness and ability to work in a team of engineers/ researchers with mutual understandings to take unsophisticated challenges, in the field of Power Systems, lead and motivate the group to inculcate multi-disciplinary and collaborative approach.PO7 Willingness and ability to take up administrative challenges including the management of various projects of interdisciplinary nature and carry out the same in an efficient manner giving due consideration to societal, environmental, economic and financial factors.
PO8: Ability to express ideas clearly and communicate orally as well as in writing with others in an effective manner, adhering to various national and international standards and practices for the documentation and presentation of the contents.

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POWER SYSTEM ANALYSIS

Subject Code: MELEE1-101 **L T P C** **Duration: 40 Hrs.**
3 0 0 3

Course Objectives: Students will be able to:
1. Study various methods of load flow and their advantages and disadvantages.
2. Understand how to analyze various types of faults in power system.
3. Understand power system security concepts and study the methods to rank the contingencies.
4. Understand need of state estimation and study simple algorithms for state estimation.
5. Study voltage instability phenomenon.

UNIT-I (8 Hrs.)

Load Flow: Overview of Newton-Raphson, Gauss-Siedel, Fast decoupled methods, convergence properties, sparsity techniques, handling Q- max violations in constant matrix, inclusion of frequency effects. AVR in load flow, handling of discrete variables in load flow.

UNIT-II (8 Hrs.)

Fault Analysis: Simultaneous faults, open conductor faults. Generalized method of fault analysis.

UNIT-III (8 Hrs.)

Security Analysis: Security state diagram, contingency analysis, generator shift distribution factors, line outage distribution factor, multiple line outages, Overload index ranking.

UNIT-IV (8 Hrs.)

State Estimation: Sources of errors in measurement, Virtual and pseudo measurement, Observability, Tracking state estimation. WSL method, bad data correction.

UNIT-V (8 Hrs.)

Voltage Stability: Voltage collapse, P-V curve, optimal power flow solution, continuation power flow, voltage collapse proximity indices.

Recommended Books:
1. J.J. Grainger and W.D. Stevenson, 'Power System Analysis', McGraw Hill, **2003**.
2. R. Bergen and Vijay Vittal, 'Power System Analysis', Pearson, **2000**.
3. L.P. Singh, 'Advanced Power System Analysis and Dynamics', New Age International, **2006**.
4. G.L. Kusic, 'Computer aided Power System Analysis', Prentice Hall India, **1986**.
5. A.J. Wood, 'Power Generation, Operation and Control', John Wiley, **1994.**
6. P.M. Anderson, 'Faulted Power System Analysis', IEEE Press, **1995**.

Course Outcomes: Students will be able to:
1. Able to calculate voltage phasor at all buses, given the data using various methods of load flow.
2. Able to calculate fault currents in each phase.
3. Rank various contingencies according to their severity.
4. Estimate the bus voltage phasor given various quantities viz. power flow, voltages, taps, CB status etc.
5. Estimate closeness to voltage collapse and calculate PV curves using continuation power flow.

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POWER SYSTEM DYNAMICS-I

Subject Code: MELEE1-102 **L T P C** **Duration: 40 Hrs.**
3 0 0 3

Course Objectives: Students will be able to:
1. Study of system dynamics and its physical interpretation.
2. Development of mathematical models for synchronous machine.
3. Modelling of induction motor.

UNIT-I (10 Hrs.)

Synchronous Machines: Per unit systems, Park's Transformation (modified), Flux-linkage equations, power angle characteristics during steady state and transient state, Significance of SCR.

UNIT-II (8 Hrs.)

Voltage and current equations, torque equation, Formulation of State-space equations, Equivalent circuit.

UNIT-III (8 Hrs.)

Sub-transient and transient inductance and Time constants, Simplified models of synchronous machines, synchronous machine dynamics (Electromechanical transients).

UNIT-IV (8 Hrs.)

Small Signal Model: Introduction to frequency model, Excitation systems and Philips-Heffron model, Power System Stabilizer Load modeling.

UNIT-V (6 Hrs.)

Modeling of Induction Motors: Prime mover controllers, Induction motor dynamics during starting and breaking.

Recommended Books:

1. P.M. Anderson & A.A. Fouad, 'Power System Control and Stability', Galgotia, New Delhi, **1981.**
2. J. Machowski, J. Bialek and J.R.W. Bumby, 'Power System Dynamics and Stability', John Wiley & Sons, **1997.**
3. P. Kundur, 'Power System Stability and Control', McGraw Hill Inc.,**1994**.
4. E.W. Kimbark, 'Power System Stability', Vol.-I & III, John Wiley & Sons, New York, **2002**.

Course Outcomes: Students will be able to:
1. Understand the modeling of synchronous machine in details.
2. Carry out simulation studies of power system dynamics using MATLAB-SIMULINK, MI POWER.
3. Carry out stability analysis with and without power system stabilizer (PSS).
4. Understand the load modelling in power system.

RESEARCH METHODOLOGY AND IPR

Subject Code: MRMIP0-101 **L T P C** **Duration: 28 Hrs.**
2 0 0 2

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: At the end of this course, students will be able to:

CO1: Understand research problem formulation, analyze research related information, Follow research ethics

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CO2: Understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity.
CO3: Understanding that when IPR would take such important place in growth of individuals & nation, it is needless to emphasis the need of information about Intellectual Property Right to be promoted among students in general & engineering in particular.
CO4: Understand that IPR protection provides an incentive to inventors for further research work and investment in R & D, which leads to creation of new and better products, and in turn brings about, economic growth and social benefits.

UNIT-I (7 Hrs.)

Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations.

UNIT-II (7 Hrs.)

Effective literature studies approaches, analysis Plagiarism, Research ethics, Effective technical writing, how to write report, Paper Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee.

UNIT-III (7 Hrs.)

Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. Introduction to international Scenario on Intellectual Property, Procedure for grants of patents, Patenting under PCT.

UNIT-IV (7 Hrs.)

Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases.
New Developments in IPR: Administration of Patent System. New developments in IPR: introduction to IPR of Biological Systems, Computer Software etc. Traditional Knowledge Case Studies, IPR or IITs

Recommended Books:

1. Stuart Melville and Wayne Goddard, 'Research methodology: An Introduction for Science & Engineering Students'.
2. Wayne Goddard and Stuart Melville, 'Research Methodology: An Introduction'.
3. Ranjit Kumar, 2nd Edn., 'Research Methodology: A Step by Step Guide for Beginners'.
4. Halbert, 'Resisting Intellectual Property', Taylor & Francis Ltd., **2007**.
5. Mayall , 'Industrial Design', McGraw Hill, **1992**.
6. Niebel , 'Product Design', McGraw Hill, **1974**.
7. Asimov, 'Introduction to Design', Prentice Hall, **1962**.
8. Robert P. Merges, Peter S. Menell, Mark A. Lemley, 'Intellectual Property in New Technological Age', **2016**.
9. T. Ramappa, 'Intellectual Property Rights Under WTO', S. Chand, **2008.**

POWER SYSTEM (POWER SYSTEM STEADY STATE ANALYSIS) LAB-I.

Subject Code: MELEE1-103 **L T P C**
0 0 4 2

LIST OF EXPERIMENTS

1. Simulation of IGBT Inverters.
2. Simulation of Thyristor Converters.
3. Transient Stability Studies.
4. Short Circuit Studies.

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5. Load Flow and optimal load flow Studies.
6. Load Flow and optimal load flow Studies.
7. Simulation of automatic generation control.

POWER SYSTEM (RENEWABLE ENERGY) LAB-II.

Subject Code: MELEE1-104 **L T P C**
0 0 4 2

LIST OF EXPERIMENTS

1. Power Curves.
2. Build a Wind Farm.
3. Test the Capabilities of the Hydrogen Fuel Cells and Capacitors.
4. Effect of Temperature on Solar Panel Output.
5. Variables Affecting Solar Panel Output.
6. Effect of Load on Solar Panel Output.
7. Wind Turbine Output: The Effect of Load.
8. Test the Capabilities of Solar Panels and Wind Turbines.

RENEWABLE ENERGY SYSTEM & DISTRIBUTED GENERATION

Subject Code: MELEE1-156 **L T P C** **Duration: 40 Hrs.**
3 0 0 3

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Course Objectives: Students will be able to:
1. To learn various renewable energy sources.
2. To gain understanding of integrated operation of renewable energy sources.
3. To understand Power Electronics Interface with the Grid.
4. To understand about Distributed Generation.

UNIT-I (8 Hrs.)

Introduction to Renewable Energy Resources: Types, Advantages, Limitations & scope of renewable energy resources.
Solar Energy: Basic principles and energy conversion schemes.
Wind Energy: Introduction, Basic principles & energy conversion schemes, Major components, Electrical wind generators and their analysis.

UNIT-II (4 Hrs.)

Hydro Energy: Site selection, Types of power stations, Major components & their working.
Biomass Energy: Biogas generation, Types of biogas plants.

UNIT-III (8 Hrs.)

Tidal Energy: Basic principles of tidal energy, Tidal power generation systems.
Wave Energy: Wave energy conversion devices, Advantages and Disadvantages of wave energy.
Geothermal Energy: Origin and nature of geothermal energy; Classification of geothermal resources; Schematic of geothermal power plants.
Fuel Cells: Schematic of fuel cell, Characteristics, Working of different types of fuel cells.

UNIT-IV (10 Hrs.)

Distributed Generation: Introduction, Distributed v/s central station generation, Technologies of distributed generation as sources of energy such as Micro-turbines, Micro combined heat power, Rooftop solar PV, Solar and wind hybrid system, Impact of distributed generation on power grid reliability.

UNIT-V (10 Hrs.)

Distributed Generators: Introduction, Various types of distributed generators, such as, Permanent magnet generator, Self-excited Induction generators, Power Electronic Interface of distributed Generators with the Grid, Analysis of Effect of Distributed Generation on Transmission System Operation, Protection of Distributed Generators, Economics Issues of Distributed Generation, Case Studies on distributed generations for electric vehicle and energy storage integration.

Recommended Books:

1. D.P. Kothari, K.C. Singal and Ranjan Rakesh, 'Renewable Energy Sources and Emerging Technologies', 2nd Edn., Prentice Hall of India, **2011**.
2. Math H. Bollen, Fainan Hassan, 'Integration of Distributed Generation in the Power System', Wiley-IEEE Press, **2011**.
3. Loi Lei Lai, Tze Fun Chan, 'Distributed Generation: Induction and Permanent Magnet Generators', Wiley-IEEE Press, **2007**.
4. A. Roger, Messenger and Jerry Ventre, 'Photovoltaic System Engineering', 3rd Edn., **2010.**
5. James F. Manwell, Jon G. McGowan and Anthony L. Rogers, 'Wind Energy Explained: Theory Design and Application', 2nd Edn., John Wiley and Sons **2010**.

Course Outcomes: Students will be able to:

1. Know about various renewable energy sources.
2. Understand the working of distributed generation system in autonomous/grid connected modes.
3. Know the Impact of Distributed Generation on Power System.

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SMART GRIDS

Subject Code: MELEE1-157 | **L T P C** **3 0 0 3** | **Duration: 40 Hrs.**

Course Objectives: Students will be able to:

1. Understand concept of Smart Grid and its Advantages over Conventional Grid.
2. Know Smart Metering Techniques.
3. Learn wide area measurement techniques.
4. Understanding the problems associated with integration of distributed generation & its solution through smart grid.

UNIT-I (7 Hrs.)

Introduction to Smart Grid: Evolution of Electric Grid, Concept of Smart Grid, Definitions and Necessity of Smart Grid, Concept of Robust & Self-Healing Grid, Present Development & International Policies in Smart Grid.

UNIT-II (7 Hrs.)

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, Smart Substations, Substation Automation, Feeder Automation.

UNIT-III (7 Hrs.)

Smart Grid Technologies: Geographic Information System(GIS), Intelligent Electronic Devices(IED) & their application for monitoring & protection, Smart storage like Battery, Superconducting Magnetic Energy Storage (SMES), Pumped Hydro, Compressed Air Energy Storage (CAES), Wide Area Measurement System(WAMS), Phase Measurement Unit (PMU).

UNIT-IV (7 Hrs.)

Micro-Grid: Concept, Necessity & Applications of Micro-Grid, Formation of Micro-Grid, Issues of Interconnection, Operation, Control & Protection 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-V (6 Hrs.)

Power Quality: Electromagnetic Compatibility (EMC) of 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.

UNIT-VI (6 Hrs.)

Communications in Smart Grid: Advanced Metering Infrastructure (AMI), Home Area Network (HAN), Neighborhood Area Network, Communication through GPRS and Power Line Carrier Communication, Internet of Things (IoT) based Protocols.

Recommended Books:

1. Ali Keyhani, 'Design of Smart Power Grid Renewable Energy Systems', 2nd Edn., Wiley IEEE Press.
2. Clark W. Gellings, 'The Smart Grid: Enabling Energy Efficiency and Demand Response', CRC Press, **2009**.
3. Janaka Ekanayake, Kithsiri Liyanage, Jianzhong Wu and Nick Jenkins, 'Smart Grid: Technology and Applications', Wiley Online Library, **2012**.
4. Stuart Borlase, 'Smart Grid: Infrastructure, Technology and solutions', CRC Press.

Course Outcomes:

Students will be able to:

1. Appreciate the difference between Smart grid & Conventional grid.
2. Apply smart metering concepts to industrial and Commercial Installations.
3. Formulate solutions in the areas of smart substations, distributed generation and wide area measurements.
4. Come up with smart grid solutions using modern communication technologies.

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HIGH POWER CONVERTERS

Subject Code: MELEE1-158 | **L T P C 3 0 0 3** | **Duration: 40 Hrs.**

Course Objectives: Students will be able to:

1. Understand the requirements of high power rated converters.
2. Understand the different topologies involved for these converters.
3. Able to understand the design of protection circuits for these converters.

UNIT-I (8 Hrs.)

Power Electronic Systems: Power semiconductors devices and circuits, Characteristics and specification of switches, Phase shifting transformer.

Multi-Pulse Diode Rectifier: Multiphase star rectifier, three phase bridge rectifier, three phase bridge rectifier with RL load, three phase rectifier with a highly inductive load, Rectifier circuit design, output voltage with LC filter.

UNIT-II (6 Hrs.)

Multi-Pulse SCR Rectifier: Three-phase full converters with *RL* load, Twelve –pulse converters, Effect of load and source inductance.

UNIT-III (8 Hrs.)

Multilevel Inverters: Introduction, Multilevel concept, Types of multilevel inverters such as: diode clamped multilevel inverter, Flying-Capacitor multilevel inverter, Cascaded multilevel inverter, Applications, PWM current source inverters.

UNIT-IV (4 Hrs.)

DC-DC Converter: Introduction, performance parameter of DC-DC converters, Switching mode regulators such as: Buck, Boost and Buck-Boost regulators.

UNIT-V (8 Hrs.)

AC Voltage Controllers: Introduction, performance parameters of AC voltage controllers, single phase full wave controller with resistive loads and inductive loads, three phase full wave controllers, three phase full wave delta connected controllers, Single phase and three phase Cyclo-converters, Matrix converter.

Un-interruptible Power Supply (UPS): Switched mode DC and AC power supplies.

UNIT-VI (6 Hrs.)

Protection of Devices and Circuits: Introduction, Cooling and heat sinks, Thermal modeling of power switching devices, Snubber circuit, Reverse recovery transients, supply and load side transients, Voltage protection by selenium diodes and metal oxide varistors, Current protections, fusing, fault current with AC & DC source.

Recommended Books:

1. N. Mohan, T.M. Undeland and W.P. Robbins, 'Power Electronics: Converter, Applications and Design', John Wiley and Sons, **1989.**
2. P.S. Bhimbra, 'Power Electronics', Khanna Publishers, **2012.**
3. M.H. Rashid, 'Power Electronics', Pearson/Prentice Hall, **2004.**
4. B.K. Bose, 'Power Electronics and A.C. Drives', Prentice Hall, **1986.**
5. Bin Wu, 'High Power Converters and Drives', IEEE Press, Wiley Interscience.

Course Outcomes: Students will be able to:

1. Learn the characteristics of PSDs such as SCRs, GTOs, IGBTs and use them in practical systems.
2. Knowledge of working of multi-level VSIs, DC-DC switched mode converters, Cyclo-converters and PWM techniques and the ability to use them properly.
3. Acquire knowledge of power conditioners and their applications.
4. Ability to design power circuit and protection circuit of PSDs and converters.

MRSPTU

WIND AND SOLAR SYSTEMS

Subject Code: MELEE1-159 **L T P C** **Duration: 40 Hrs.**
3 0 0 3

Course Objectives: Students will be able to:

1. To get exposure to wind and solar systems.
2. To understand the factors involved in installation and commissioning of a Solar or Wind plant.
3. Learning the dynamics involved when interconnected with power system grid.

UNIT-I (7 Hrs.)

Historical development and current status, characteristics of wind power generation, network integration issues.

UNIT-II (7 Hrs.)

Generators and power electronics for wind turbines, power quality standards for wind turbines, Technical regulations for interconnections of wind farm with power systems.

UNIT-III (7 Hrs.)

Isolated wind systems, reactive power and voltage control, Economic aspects.

UNIT-IV (7 Hrs.)

Impacts on power system dynamics, power system interconnection.

UNIT-V (6 Hrs.)

Introduction of solar systems, Merits and demerits, concentrators, various applications.

UNIT-VI (6 Hrs.)

Solar thermal power generation, PV power generation, Energy Storage device, Designing the solar system for small installations.

Recommended Books:

1. Thomas Ackermann, Editor, 'Wind Power in Power Systems', John Willy and Sons Ltd, , **2005**.
2. Siegfried Heier, 'Grid Integration of Wind Energy Conversion Systems', John Willy and Sons Ltd., **2006**.
3. K. Sukhatme and S.P. Sukhatme, 'Solar Energy', Tata McGraw Hill, 2nd Edn., **1996.**

Course Outcomes: Students will be able to:

1. Appreciate the importance of energy growth of the power generation from the renewable energy sources and participate in solving these problems.
2. Demonstrate the knowledge of the physics of wind power and solar power generation and all associated issues so as to solve practical problems.
3. Demonstrate the knowledge of physics of solar power generation and the associated issues Identify, formulate and solve the problems of energy crises using wind and solar energy.

ELECTRIC POWER DISTRIBUTION SYSTEM

Subject Code: MELEE1-160 **L T P C** **Duration: 40 Hrs.**
3 0 0 3

Course Objectives: Students will be able to:

1. Learning about power distribution system.
2. Learning of SCADA System.
3. Understanding Distribution Automation.

UNIT-I (8 Hrs.)

Distribution of Power, Management, Power Loads, Load Forecasting Short-term & Long-term, Power system loading, Technological forecasting.

UNIT-II (8 Hrs.)

Advantages of Distribution Management System (D.M.S.) Distribution Automation: Definition, Restoration/Reconfiguration of Distribution Network, Different Methods and Constraints, Power Factor Correction.

UNIT-III (8 Hrs.)

Interconnection of Distribution, Control & Communication Systems, Remote Metering, Smart meter and Automatic Meter Reading and its implementation.

UNIT-IV (8 Hrs.)

Calculation of Optimum Number of Switches, Capacitors, Optimum Switching Device Placement in Radial Distribution Systems, Sectionalizing Switches – Types, Benefits, Bellman's Optimality Principle, Remote Terminal Units, Energy efficiency in electrical distribution & Monitoring.

UNIT-V (8 Hrs.)

Maintenance of Automated Distribution Systems: Difficulties in Implementing Distribution, Automation in Actual Practice, Urban/Rural Distribution, Energy Management, introduction to AI techniques applied to Distribution Automation.

Recommended Books:

1. A.S. Pabla, 'Electric Power Distribution', 4th Edn., Tata McGraw Hill Publishing Co. Ltd.
2. M.K. Khedkar, G.M. Dhole, 'A Text Book of Electrical Power Distribution Automation', University Science Press, New Delhi.
3. Anthony J. Panseni, 'Electrical Distribution Engineering', CRC Press.
4. James Momoh, 'Electric Power Distribution, Automation, Protection & Control', CRC Press.

Course Outcomes: Students will be able to:

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1. Understand of power distribution system.
2. Study of Distribution automation and its application in practice.
3. To learn SCADA system.

OPTIMIZATION TECHNIQUES FOR POWER ENGINEERING

Subject Code: MELEE1-161 **L T P C** **Duration: 40 Hrs.**
3 0 0 3

Course Objectives: -Students will be able to:
1. To understand the relevance of mathematical methods to solve engineering problems.
2. To understand how to apply these methods for a given engineering problem.

UNIT-I (4 Hrs.)

Introduction to Optimization: Statement of an optimization problem, Classification of optimization problems, Optimization techniques, Engineering applications of optimization, Single variable optimization, Multivariable optimization with no constraints.

UNIT-II (6 Hrs.)

Linear Programming: Standard form of linear programming, Simplex method, Computer implementation of the Simplex method, Duality theory.
Transportation Problem: North-West Corner rule, least cost method, Vogel approximation method, testing for optimality.

UNIT-III (7 Hrs.)

Non-Linear Programming: One–Dimensional Minimization Methods: Unimodal function, Dichotomous search, Fibonacci search, Golden Section, Cubic interpolation method, Direct root, Newton Raphson Method.

UNIT-IV (7 Hrs.)

Unconstrained Multivariable Optimization Techniques: Random search method, Steepest descent method, Conjugate gradient method, Newton Raphson Method, Evolutionary search, Hooke-Jeeves Method, Simplex search Method.

UNIT-V (8 Hrs.)

Constrained Optimization Techniques: Interior Penalty function method, Exterior penalty function method, Method of Multipliers, KKT Conditions.

UNIT-VI (8 Hrs.)

Further Topics in Optimization: Critical path method (CPM), Program evaluation and review technique (PERT). Multi-objective Optimization Techniques, Weighting method, ε-constraint method. Simulated annealing method, Genetic Algorithm, Particle swarm optimization.

Recommended Books:
1. S.S. Rao, 'Optimization: Theory and Application', Wiley Eastern Press, 2nd Edn., **1984**.
2. Deb Kalyanmoy, ‘Optimisation for Engineering Design - Algorithms and Examples’, Prentice Hall India, **1998.**
3. H.A. Taha, ‘Operations Research - An Introduction’, Prentice Hall of India, **2003**.
4. R.L. Fox, 'Optimization Methods for Engineering Design', Addition Welsey, **1971**.
5. A. Ravindran, K.M. Ragsdell and G.V. Reklaitis, ‘Engineering Optimization: Methods and Applications’, Wiley, **2008**.
6. Godfrey C. Onwubolu, B.V. Babu, ‘New Optimization Techniques in Engineering’, Springer, **2004**.
7. D.P. Kothari & J.S. Dhillon, ‘Power System Optimization’, Prentice-Hall of India, **2010**.

Course Outcomes: Students will be able to:
1. Knowledge about vector spaces, linear transformation, Eigen values and Eigen vectors of linear operators.

2. To learn about linear programming problems and understanding the simple method for solving linear programming problems in various fields of science and technology.
3. Acquire knowledge about nonlinear programming and various techniques used for solving constrained and unconstrained nonlinear programming problems.
4. Understanding the concept of random variables, functions of random variable and their probability distribution.
5. Understand stochastic processes and their classification.

PULSE WIDTH MODULATION FOR POWER ELECTRONICS CONVERTERS

Subject Code: MELEE1-162 **L T P C** **Duration: 40 Hrs.**
3 0 0 3

Course Objectives: Students will be able to:
1. To understand Necessity and Importance of PWM techniques.
2. Implementation of PWM controllers.

UNIT-I (8 Hrs.)

Introduction to Power Electronics Converters:

Modulation of One Inverter Phase Leg: Fundamental concepts of PWM, Evaluation of PWM schemes, Naturally sampled PWM, PWM analysis by duty cycle variation, Regular sampled PWM, Direct modulation.

Modulation of Single-phase Voltage Source Inverter: Topology of a single phase inverter, Three level modulation of a single phase inverter, Harmonic losses.

Modulation of Three-phase Voltage Source Inverter: Topology of three phase inverter (VSI), Three phase modulation with sinusoidal references, harmonic losses, discontinues modulation.

UNIT-II (8 Hrs.)

Zero Space Vector Placement Modulation Strategies: Space vector modulation, Harmonic losses for SVM, Placement of the Zero space vector, Discontinuous modulation (120,60,30 degree), Harmonic losses for discontinuous PWM.

Modulation of Current Source Inverter: Three phase modulators as state machines, Naturally sampled CSI space vector modulator.

UNIT-III (8 Hrs.)

Over modulation of an Inverter: The over modulation region, naturally sampled and regularly sampled over modulation of one phase leg of an inverter, naturally sampled over modulation of single-phase and three-phase inverters.

Programmed Modulation Strategies: optimized space vector modulation, harmonic elimination PWM, Performance Index for optimality, Optimum PWM, Minimum loss PWM.

UNIT-IV (6 Hrs.)

Pulse Width Modulation for Multilevel Inverters: PWM of cascaded single phase H-bridges, Over modulation of cascaded H bridges, PWM alternatives for diode-clamped multilevel inverters, three level naturally sampled PD PWM, Over modulation of three level inverters, five level PWM for diode clamped inverters. PWM of higher level inverters.

UNIT-V (4 Hrs.)

Implementation of Modulation Controller: Overview of a power electronic conversion system, Elements of a PWM converter system, Hardware implementation of the PWM process, PWM software implementation.

UNIT-VI (6 Hrs.)

Continuing Developments in Modulation: Random PWM, PWM Rectifier with Voltage unbalance, Effect of minimum pulse width, PWM Dead-Time compensation.

Introduction to Hybrid Electric Vehicles: History of hybrid and electric vehicles, social and environmental importance of hybrid and electric vehicles, impact of modern drive-trains on energy supplies.

Recommended Books:

1. D. Grahame Holmes, Thomas A. Lipo, 'Pulse width modulation of Power Converter: Principles and Practice', John Wiley & Sons, **2003.**
2. Bin Vew, 'High Power Converter', Wiley Publication.
3. Marian K. Kazimicrczuk, 'Pulse Width modulated dc-dc Power Converter', Wiley Publication.

Course Outcomes: Students will be able to:

1. Appreciate importance of PWM techniques.
2. Implement PWM using different strategies.
3. Control CSI and VSI using PWM.
4. Compare performance of converter for different PWM techniques.

ELECTRIC AND HYBRID VECHILES

Subject Code: MELEE1-163 **L T P C** **Duration: 40 Hrs.**
3 0 0 3

UNIT-I (7 Hrs.)

Conventional Vehicles: Basics of vehicle performance, vehicle power source characterization, transmission characteristics, Mathematical models to describe vehicle performance.

UNIT-II (7 Hrs.)

Hybrid Electric Drive-Trains: Basic concept of hybrid traction, introduction to various hybrid drive-train topologies, power flow control in hybrid drive-train topologies, fuel efficiency analysis.

Electric Drive-Trains: Basic concept of electric traction, introduction to various electric drive-train topologies, power flow control in electric drive-train topologies, fuel efficiency analysis.

UNIT-III (7 Hrs.)

Electric Propulsion Unit: Introduction to electric components used in hybrid and electric vehicles, Configuration and control of DC Motor drives, Configuration and control of Induction Motor drives.

UNIT-IV (6 Hrs.)

Energy Storage: Introduction to Energy Storage Requirements in Hybrid and Electric Vehicles, Battery based energy storage and its analysis, Fuel Cell based energy storage and its analysis, Hybridization of different energy storage devices.

UNIT-V (6 Hrs.)

Sizing the Drive System: Matching the electric machine and the internal combustion engine (ICE), Sizing the propulsion motor, sizing the power electronics, selecting the energy storage technology.

UNIT-VI (7 Hrs.)

Energy Management Strategies: Introduction to energy management strategies used in hybrid and electric vehicles, classification of different energy management strategies, comparison of different energy management strategies.

Recommended Books:

1. Sira -Ramirez, R. Silva Ortigoza, 'Control Design Techniques in Power Electronics Devices', Springer.
2. Siew-Chong Tan, Yuk-Ming Lai, Chi Kong Tse, 'Sliding Mode Control of Switching Power Converters'.

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Course Outcomes: Students will be able to:

1. Acquire knowledge about fundamental concepts, principles, analysis and design of hybrid and electric vehicles.
2. To learn electric drive in vehicles/traction.

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