Maharaja Ranjit Singh Punjab Technical University, Bathinda-151001

AGENDA

FOR THE 7TH MEETING OF FACULTY OF ENGINEERING AND TECHNOLOGY TO BE HELD ON 15.05.2023

MAHARAJA RANJIT SINGH PUNJAB TECHNICAL UNIVERSITY
DABWALI ROAD, BATHINDA-151001
(Estb. by Govt. of Punjab Act 5(2015) & Approved u/s 2(f) & 12(b) of UGC Act, 1956)

www.mrsptu.ac.in

Ref. No.: DC/2023/15 Date: 8/5/23

SUBJECT: INVITATION FOR 7TH MEETING OF FACULTY OF ENGINEERING & TECHNOLOGY TO BE HELD ON 15.05.2023

To

1. **Dr. SUNDAR SINGH** — **Chairperson**
   Former Professor, Civil
   Thapar IET, Patiala
   (98761-78224) sundarsingh453@gmail.com
2. **Dr. MANINDER SINGH** — **Chairperson**
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31. **Dr Kanwal Jit Singh** — **Member**
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36. **Dr Dhirendra Singhal** — **Member**
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38. **Dr T K Jindal** — **Member**
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39. **Dr Ajay Bansal** — **Member**
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40. **Dr Sandeep Mann** — **Member**
Principal Scientist (APE) & HOD Transfer
of Technology Division, lCAR-Central Institute of Post-Harvest Engg. & Tech. Ministry of Agriculture and
Farmer's Welfare, Govt. of India.

P.O. P.A.U. Ludhiana
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Sir/Madam,

It is to inform you that 7th offline Meeting of Faculty of Engineering & Technology of Maharaja Ranjit Singh Punjab Technical University has been scheduled on 15/05/2023 at 11:00 A.M.in the Committee Room of GZSCCET, MRSPTU Bathinda. You are requested to make it convenient to attend this meeting.

Further, you are requested to confirm your availability to attend this meeting. The agenda of the meeting is being forwarded shortly.

Member Secretary,
Faculty of Engg. & Tech.,
MRSPTU, Bathinda

Copy to:

1. PA to Vice Chancellor, MRSPTU, Bathinda for information to Vice Chancellor please.
2. Registrar, MRSPTU, Bathinda
3. Campus Director, GZSCCET, MRSPTU Bathinda
4. Professor I/C, Finance, MRSPTU, Bathinda
5. Dean Academic Affairs, MRSPTU, Bathinda

ITEM NO. 07.01 CONFIRMATION OF THE MINUTES OF 6TH MEETING OF FACULTY OF ENGG. & TECH. OF MRSPTU BATHINDA HELD ON 14/07/2022 ANNEXURE-I (Page 1-4)

Put up before Faculty of Engineering & Technology for confirmation please.

ITEM NO. 07.02 TO APPROVE THE MINUTES OF MEETING of BOS of Computer Science and Engineering held on 28/04/2023 - as per following details and are attached herewith as **ANNEXURE - II**.

S. No.	ITEM	Annexure - II
		Page No.
07.02.01	Minutes of Meeting of BOS of Computer Science and Engineering held on 28/04/2023	05

Put up before Faculty of Engineering & Technology for deliberations and approval for further recommending it to Academic Council please.

ITEM NO. 07.03 APPROVAL OF SYLLABI OF PG-ENGG. PROGRAMMES

The Scheme and Syllabi of M.Tech. Regular and M.Tech. Part-time has been prepared and approved by the concerned BOS as per following details:

S. No.	ITEM	Annexure - III
		Page Nos.
07.03.01	Complete Scheme and Syllabus of **M.Tech. (Textile Engineering)** Regular and Part-time mode for Batch 2022 onwards	06-35
07.03.02	Complete Scheme and Syllabus of **M.Tech. Electrical Engineering (Power System)** Regular and Part-time mode for Batch 2022 onwards	36-85
07.03.03	Complete Scheme and First Semester Syllabus of **M.Tech. (Electronics and Communication Engineering)** Regular and Part-time mode for Batch 2022 onwards	86-102

Put up before Faculty of Engineering & Technology for deliberations and approval for further recommending it to Academic Council please.

ITEM NO. 07.04 APPROVAL OF SYLLABI OF UG-ENGG. PROGRAMMES

The Scheme and Syllabi of B.Tech. Regular has been prepared and approved by the concerned BOS as per following details:

S. No.	ITEM	Annexure - IV
		Page Nos.
07.04.01	Scheme and Syllabus of B.Tech. Computer Science and Engineering (Artificial Intelligence and Machine Learning) (3rd – 4th Sem.) for Batch 2K22 onwards	103-120

Put up before Faculty of Engineering & Technology for deliberations and approval for further recommending it to Academic Council please.

ITEM NO. 07.05 TO APPROVE THE SYLLABUS OF OPEN ONLINE COURSES STARTING FROM 2K22.

Scheme and syllabi of following online courses were approved by respective Board of Studies **ANNEXURE-V (Page 121-141)**

S.No.	ITEM
1.	AWS Cloud Practitioner
2.	Basics of C#
3.	Cyber Security and Ethical Hacking
4.	Database Management System
5.	Fundamental of Java
6.	Introduction to Cloud Computing
7.	Office Automation
8.	Operating System
9.	PHP
10.	Python for Data Science

Put up before Faculty of Engineering & Technology for deliberations and approval for further recommending it to Academic Council please.

ITEM NO. 07.06 TO APPROVE THE CO-PO OF M.TECH. CSE AND B.TECH. CSE.

The revised CO-PO of M.Tech. CSE and B.Tech. CSE has been received from the concerned BoS attached as **ANNEXURE-VI (Page 142-172)**

ITEM NO. 07.07 Any other agenda Item/Items with the permission of the chair.

Ref. No.: HEED/8698 Date: 15/07/2022

MINUTES OF 6th MEETING OF FACULTY OF ENGG. & TECH. HELD ON 14.07.2022

A pre-scheduled 6th Meeting of Faculty of Engineering & Technology of Maharaja Ranjit Singh Punjab Technical University, Bathinda was held on 14.07.2022 at 11:00 AM onwards in online mode (Google meet code: iby spyz hqc). The following members were present:

1. Dr. Sundar Singh — Chairperson
   Former Professor, Civil
   Thapar IET, Patiala
   (98761-78224) sundersingh453@gmail.com
2. Dr. Sarbjeet Kaur Bath — Member Secretary
   Head, Department of Electrical Engg
   GZSCCET, MRSPTU Bathinda
   (94638-36070) sjkbath77@gmail.com
3. Er. J.S. Tiwana — Member
   Department of Mechanical Engg.
   GZSCCET, MRSPTU Bathinda,
   (94631-35222) rg91@rediffmail.com
4. Dr. Rajeev Varshney — Member
   Head, Department of Textile Engg
   GZSCCET, MRSPTU Bathinda
   (87250-72426) textilegzscetbti@gmail.com
5. Dr. Gurpreet Singh Bath — Member
   For Head, Department of Civil Engg
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6. Dr. Neeraj Gill — Member
   Head, Deptt of Electronics & Comm Engg
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   (94646-62132) neeraj.ece@mrsptu.ac.in
7. Er. Jyoti Rani — Member
   Head, Department of Computer Sc & Engg
   GZSCCET, MRSPTU Bathinda
   (94174-60026) cse.gzscet@gmail.com
8. Dr. Sarbjeet Kaur Bath — Member
   Department of Electrical Engg
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9. Dr. Balwinder Singh Sidhu — Member
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16. Dr. Devanand Uttam — Member
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17. Dr. Harish Garg — Member
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21. Dr. Anil Jindal — Member
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22. Dr. Rakesh Kumar — Member
Professor, Deptt of Aerospace Engg
Punjab Engineering College, Chandigarh
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At the outset, after verifying the quorum of the meeting, the Chairperson welcomed all the members attending 6th Meeting of Faculty of Engg. & Tech. at Bathinda in online mode. Thereafter he asked Member Secretary to take up agenda items one by one for discussion. After detailed deliberations, the following unanimous decisions were arrived at:

ITEM 6.01	**CONFIRMATION OF THE MINUTES OF 5TH MEETING OF FACULTY OF ENGG. & TECH. OF MRSPTU BATHINDA HELD ON 20/06/2022. (ANNEXURE-I)**
DECISION	❖ Confirmed
ITEM 6.02	**TO APPROVE THE MINUTES OF 8th MEETING of BOS of Aeronautical and Aerospace Engineering held on 10/06/2022 - as per following details and are attached herewith as ANNEXURE - II.**
06.02.01	Minutes of 8th Meeting of BOS of Aeronautical and Aerospace Engineering held on 10/06/2022
DECISION	❖ Approved after incorporating the correction suggested by some faculty members.
ITEM 6.03	**APPROVAL OF SYLLABI OF UG-ENGG. PROGRAMMES**
06.03.01	Scheme and Syllabus of B. Tech. (Aerospace Engineering) 7th – 8th Sem. for Batches 2018 onwards
DECISION	❖ Approved after incorporating the change suggested by Dr. Rakesh Kumar, Prof. Department of Aerospace Engg., PEC Chandigarh.

ITEM 06.04	**ANY OTHER AGENDA ITEM/ITEMS WITH THE PERMISSION OF CHAIR.**
DECISION	❖ No other agenda item

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

15/7/2022

Member Secretary
(Dr. Sarbjeet Kaur Bath)

For Approval please
CHAIRPERSON
(Dr. Sundar Singh)
(Meeting attended in on-line mode)
(through Google Meet) (Meet code: iby spyz hqc)
(Approval from Dean got through email)
(Copy of email attached)

Giani Zail Singh Campus College of Engineering &Technology
Maharaja Ranjit Singh Punjab Technical University
DABWALI ROAD, BATHINDA-151001
ਮਹਾਰਾਜਾ ਰਣਜੀਤ ਸਿੰਘ ਪੰਜਾਬ ਤਕਨੀਕੀ ਯੂਨੀਵਰਸਿਟੀ,
ਡੱਬਵਾਲੀ ਰੋਡ, ਬਠਿੰਡਾ - 151001
[A State University Estb. by Govt. of Punjab Act No. 5(2015) u/s 2(f) & Approved u/s 12B of UGC Act, 1956]
Department of Computer Science & Engineering

Ref No: HCSD / 3491 Dated: 04/5/2023

MINUTES OF MEETING

Sub: Minutes of Meeting Board of Studies (BOS), Deptt. of Computer Science & Engg., GZSCCET, Bathinda held on 28.04.2023 (Friday).

The Board of Studies (BOS) meeting of Deptt. of Computer Science & Engg. was held on 28.04.2023 (Friday) at 3:30 PM in the office of Head, Deptt. of CSE, GZSCCET MRSPTU, Bathinda.

The following were present in the meeting:

01	Er. Jyoti Rani	Head, Deptt. of CSE (Chairperson)
02	Dr. Paramjeet Singh	Professor, Deptt. of CSE (Member)
03	Dr. Shaveta Rani	Professor, Deptt. of CSE (Member)
04	Dr. Naresh Kumar Garg	Professor, Deptt. of CSE (Member)
05	Dr. Dinesh Kumar	Professor, Deptt. of CSE (Member)
06	Dr. Abhilahsa	Associate Professor, Deptt. of CSE (Member)
07	Er. Rahul Garg	Programmer, MRSPTU (Member)
08	Dr. Swati	Academic Incharge
09	Er. Simardeep Kaur	Academic Incharge

Following points were discussed in the meeting:

1. The Syllabus & Study Scheme of B. Tech CSE **(Artificial Intelligence and Machine Learning)** and start of new course B. Tech CSE **(Internet Of Things And Cyber Security Including Block Chain Technology)** at MRSPTU, Bathinda was deliberated.
2. Revised COs and POs of B.Tech and M. Tech CSE at GZSCCET, Bathinda were finalized.
3. The matter regarding internship of 8th semester was deliberated.

04/5/23

Chairperson
Board of Studies (BOS)

DAA, MRSPTU

Maharaja Ranjit Singh Punjab Technical University
Bathinda-151001

FACULTY OF ENGINEERING AND TECHNOLOGY

SYLLABUS

M.Tech. (Textile Engineering)

2022 BATCH ONWARDS

(For Full-Time and Part-Time Modes)

Mission and Vision of the Department

Vision

To strive to become a premier department in the field of Textile Engineering by providing quality technical education to the students to serve the needs of society.

Mission

The department is committed to nurture the students with best quality technical education in textile engineering and develop research aptitude.
To improve skill and knowledge through effective and participative teaching – learning process using latest educational techniques.
To boost up industry-institute interaction/ collaboration through MoUs, Internships and participative curriculum developments.
To enhance students exposure in multidisciplinary & interdisciplinary domain and professional ethics through collaborative case study/ project and related activities.

Programme Outcomes

Critical Thinking: Ability to analyse complex engineering problems and apply acquired knowledge in an innovative manner to provide societal acceptable solutions.
Research Skills:Creating a research temperament for achieving meaningful and long-lasting solutions in-line with the changing needs of the society.
Use of Modern Tools:Ability to develop appropriate models/simulated solutions by using available state-of-the-art tools and techniques.
Collaborate Multidisciplinary Work: Ability to achieve the laid objectives by maximizing the potential of co-team members and collaborating with other stakeholders.
Project Management and Finance:Ability to formulate economically viable solutions using acquired technical and allied knowledge base.
Research Ethics and Life Long Learning:Ability to exercise research ethics and enforce professional conduct in research, publications and life-long learning.
Effective Communication:Abilityto acquireeffective listening, oral and writing skillsfor executive presentations making complete use of available ICT platforms.
Environment and Sustainability:Analysethe impact of engineering solutions in societal and environmental contexts to address the needs for sustainable development.

Programme Specific Outcomes (PSOs)

Ability to evaluate the complex textile engineering problems and design optimal solutions and implement the same using cutting edge technologies.
Ability to develop research skill to explore new facts and dimensions which can help develop solutions which are sustainable and beneficial to the society.

Programme Educational Objectives (PEO) for M. Tech.(Textile Engineering)

Post graduates will be recognized by contribution in the workplace that involves creative and critical thinking in engineering challenges.
Teaming skill and effective communication in a professional environment.
Continuous learning through developmental opportunities by adapting to changing social, economic and technological environments.

Study Scheme for M.Tech Regular Programme

1st SEMESTER		Contact Hours			Marks			Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Internal**	**External**	**Total**	
MTEXS1-101	Advances in Yarn Production Technologies	4	0	0	40	60	100	4
MTEXS1-102	Advances in Fabric Production Technologies	4	0	0	40	60	100	4
MTEXS1-103	Apparel Technology	4	0	0	40	60	100	4
	DE- 1	4	0	0	40	60	100	4
MTEXD1-111	Process Control in Spinning and Weaving							
MTEXD1-112	Production Management in Textiles							
MTEXD1-113	Total Quality Management							
	DE- 2	4	0	0	40	60	100	4
MTEXD1-121	Textile Product Design							
MTEXD1-122	Physical Properties of Fibres							
MTEXD1-123	Coloration and finishing Technology							
MTEXS1-104	Advanced Mechanical Processing Laboratories	0	0	4	60	40	100	2
Total:		**20**	**0**	**4**	**260**	**340**	**600**	**22**

2nd SEMESTER		Contact Hours			Marks			Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Internal**	**External**	**Total**	
MTEXS1-201	Advances in Fibre Production Technologies	4	0	0	40	60	100	4
MTEXS1-202	Structural Mechanics of Yarns	4	0	0	40	60	100	4
MTEXS1-203	Structural Mechanics of fabrics	4	0	0	40	60	100	4
	DE- 3	4	0	0	40	60	100	4
MTEXD1-211	Knitting and Non-Woven Technology							
MTEXD1-212	Post Spinning Operation							
MTEXD1-213	Environmental Practices in Textiles							
	DE- 4	4	0	0	40	60	100	4
MTEXD1-221	High Performance Fibres and Composites							
MTEXD1-222	Advanced Garments Manufacturing Technology							
MTEXD1-223	Technical Textiles							
MTEXS1-204	Advanced Textile Testing Lab	0	0	4	60	40	100	2
Total:		**20**	**0**	**4**	**260**	**340**	**600**	**22**

3rd SEMESTER		Contact Hours			Marks			Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Internal**	**External**	**Total**	
XXXX	Open Elective- 1	3	0	0	40	60	100	3
MREMI0-101	RM & IPR	4	0	0	40	60	100	4
MTEXS1-302	Project	0	0	-	60	40	100	6
MTEXS1-303	Seminar	0	0	2	100	--	100	1
Total:		**7**	**0**	**2**	**240**	**160**	**400**	**14**

4th SEMESTER		Contact Hours			Marks		
Subject Code	**Subject Name**	**L**	**T**	**P**	**Internal**	**External**	**Total**
MTEXS1-401	Dissertation	--	--	--	**Satisfactory / Not Satisfactory as per CBCS-2016**		
Total:		--	--	--	--		

Study Scheme for M.Tech Part-Time Programme

SEMESTER-1		Contact Hours			Marks			Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Internal**	**External**	**Total**	
MTEXS1-101	Advances in Yarn Production Technologies	4	0	0	40	60	100	4
MTEXS1-102	Advances in Fabric Production Technologies	4	0	0	40	60	100	4
Department Elective- 1		4	0	0	40	60	100	4
MTEXD1-111	Process Control in Spinning and Weaving							
MTEXD1-112	Production Management in Textile							
MTEXD1-113	Total Quality Management							
Total:		**12**	**0**	**0**	**120**	**180**	**300**	**12**

SEMESTER-2		Contact Hours			Marks			Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Internal**	**External**	**Total**	
MTEXS1-103	Apparel Technology	4	0	0	40	60	100	4
Department Elective- 2		4	0	0	40	60	100	4
MTEXD1-121	Textile Product Design							
MTEXD1-122	Physical Properties of Fibres							
MTEXD1-123	Coloration and finishing Technology							
MTEXS1-104	Advanced Mechanical Processing Laboratories	0	0	4	60	40	100	2
Total:		**8**	**0**	**4**	**140**	**160**	**300**	**10**

SEMESTER-3		Contact Hours			Marks			Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Internal**	**External**	**Total**	
MTEXS1-201	Advances in Fibre Production Technologies	4	0	0	40	60	100	4
MTEXS1-202	Structural Mechanics of Yarn	4	0	0	40	60	100	4
Department Elective- 3		4	0	0	40	60	100	4
MTEXD1-211	Knitting and Non-Woven Technology							
MTEXD1-212	Post Spinning Operations							
MTEXD1-213	Environmental Practices in Textiles							
Total:		**12**	**0**	**0**	**120**	**180**	**300**	**12**

SEMESTER-4		Contact Hours			Marks			Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Internal**	**External**	**Total**	
MTEXS1-203	Structural Mechanics of fabrics	4	0	0	40	60	100	4
Department Elective- 4		4	0	0	40	60	100	4
MTEXD1-221	High Performance Fibres and Composites							
MTEXD1-222	Advanced Garments Manufacturing Technology							
MTEXD1-223	Technical Textiles							
MTEXS1-204	Advanced Textile Testing Lab	0	0	4	60	40	100	2
Total:		**8**	**0**	**4**	**140**	**160**	**300**	**10**

SEMESTER-5		Contact Hours			Marks			Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Internal**	**External**	**Total**	
XXXXX	Open Elective- 1	3	0	0	40	60	100	3
MREMI0-101	Research Methodology and IPR	4	0	0	40	60	100	4
MTEXS1-302	Project	0	0	-	60	40	100	6
MTEXS1-303	Seminar	0	0	2	100	--	100	1
Total:		**7**	**0**	**2**	**240**	**160**	**400**	**14**

SEMESTER-6		Contact Hours			Marks		
Subject Code	**Subject Name**	**L**	**T**	**P**	**Internal**	**External**	**Total**
MTEXS1-401	Dissertation	-	-	-	**Satisfactory / Not Satisfactory as per CBCS-2016**		
Total:		-	-	-	--		

ADVANCES IN YARN PRODUCTION TECHNOLOGIES

Subject Code: MTEXS1-101 **LTPC** **Duration-60hrs**
4 0 0 4

Course Outcomes

CO1: To analyse the basics of fiber Quality Requirements, and Various spinning systems.
CO2: To understand and analyse the theory of textile machines and modern developments.
CO3: To understand the various new spinning methods.
CO4: Evaluate the structure, properties of spun yarn and various quality parameters.

UNIT – I (15 Hrs)

Fiber Quality Requirements for Different Spinning Technologies, Systems of Yarn Manufacture in Cotton, Worsted, Woolen and Semi Worsted System, Comparative Study of New Spinning Technologies, Concept of Opening and Cleaning

UNIT-II (15 Hrs)

Aerodynamics and its Role in Blowroom, Theories of Cardin, Drafting Theories, Developments in Comber, Quality Aspects of Roving, Balloon Theory in Spinning, Significance of Modern Developments in Spinning Process, Modern High Speed Draft Spinning Systems

UNIT-III (15Hrs)

Machine and Process Variables Affecting The Structure and Properties of Spun Yarns, Introduction to Core Spinning, Cover Spinning, Siro-Spinning and Compact Spinning.

UNIT-IV (15 Hrs)

Processing of Wool and Man Made Fibres in New Spinning Systems, Non-Conventional Methods of Yarn Manufacture, Air-Vortex Yarn, Quality Standards of Different Yarns with Emphasis on USTER Standard

Recommended Books

1. P. Grosberg and C. Iype, “Yarn Production-Theoretical Aspects”, 1st edition, The Textile Institute, UK, 1999.
2. R. Chattopadhyay, “Advances in Technology of Yarn Production”, 1st Edn., NCUTE, NewDelhi, 2002.
3. M.V.S. and A.B. Talele, “A Guide to Crimping / Texturing Technology”, 1st Edn., Nasnal Printers and its Associates, Surat,1992.
4. Klein W, “Manual of Textile Technology-New Spinning Systems”, Vol.5, 1st Edn., TheTextile Institute, UK, 1993.

ADVANCES IN FABRIC PRODUCTION TECHNOLOGIES

Subject Code: MTEXS1- 102 **LTPC** **Duration -60hrs**
4 0 0 4

Course Outcomes

CO1 To Understand science based manufacturing of Weaving.
CO2 Able to Learn mathematic Modelling of weaving process.
CO3 To understand and analyse the theory of textile Knitting machines.
CO4 Learn modelling of Non-woven manufacturing process and identifying the parameters in non woven production.

UNIT-I (15 Hrs)

Development Trends in Winding, Warping and Sizing Machines for Improving Quality of Preparation and Cost Reduction, Loom Development Trends and Objectives, Kinematics of Sley and Heald Motion with Reference to Shuttle Loom, Mechanics of Shuttle Checking, Analysis of Warp Tension during Weaving, Cloth Fell Position, Beat Up Force and Pick Spacing

UNIT-II (15Hrs)

Theoretical Analysis of Weft Insertion in Shuttleless Loom, Electronic Control of Different Motions of Loom, Techno-Economics of Different Methods of Fabric Production

UNIT-III (15 Hrs)

Weft Knitted Fabric Manufacturing by Circular Knitting and Flat Bed Knitting Machine, Warp Knitting Manufacturing

UNIT-IV (15 Hrs)

Classification and Areas of Application of Nonwoven Fabrics, Different Methods of Production of Nonwoven Fabrics, Effect of Machines, Fibre and Process Variables on Properties of Nonwoven Fabrics, Failure Mechanism of Nonwoven Fabrics. Prediction Of Needle Punched Nonwoven Fabric Behavior. Designing of Nonwoven For Engineering Applications. Developments In Nonwoven Machineries.

Recommended Books

1. R. Marks and A.T.C. Robinson, “Principles of Weaving”, Textile Institute, UK, 1986.
A. Ormerod, “Modern Preparation and Weaving Machinery”, Buttersworth & Co., UK,
2. 1983.
3. O. Talavasek and V. Svaty, “Shuttleless Weaving Machine”, Elsevier ScientificPublishing Co. Amsterdam, 1981.
4. J. Lunenschloss and W. Albrecht, “Nonwoven Bonded Fabrics”, Ellis and Harwood Ltd.UK, 1985.
5. W. Albrecht, H. Fuchs and Kittelmann, “Nonwoven Fabrics”, Wiley – VCH Weinheim.
6. 2003.
7. V. Mrstina and F. Fejgal, “Needle Punching Textile Technology”, ElsevierScientific Publishing Co. Amsterdam, 1990.
8. M.L. Gulrajani, “Book of Papers of International Conference on Nonwoven”, The Textile Institute, UK, 1992.
9. D.J. Spencer, “Knitting Technology”, 2nd Edn.,, Pergamon Press, 1989.

APPAREL TECHNOLOGY

Subject Code: MTEXS1-103 **LTPC** **Duration-60hrs**
4 0 0 4

Course Outcomes

CO1 Understanding different manufacturing processes of apparel such as pattern making, lay plan, spreading , cuttings bundling and ticketing
CO2 Understanding of detail of sewing room processes
CO3 Understanding of finishing processes of apparel.
CO4 Knowledge of production, planning and control in apparel production.
Understanding of the property of the fabric with comfort to the clothing wearer

UNIT-I (10 Hrs)

Introduction:- Introduction to garment manufacturing and Indian apparel industry. Latest developments in apparel manufacturing and machinery.
Pattern Formation and Cutting - Pattern making – Draft construction – marker planning – fabric spreading - laying methods - fabric cutting. Advanced Pattern making, Spreading & cutting – Factors affecting spreading – Automatic systems - Marker planning - 3D body scanner for measurements.
Computerized cutting machines – easymatch system - automatic ticketing and bundling Automatic pattern notcher.

UNIT-II (20 Hrs)

Sewing Machine Mechanisms & Accessories – Introduction to sewing m/c and its parts and working details, types of sewing m/c, Attachment of sewing m/c, Automation in industrial sewing machines, automatic placket feeder, Automatic pocket maker, auto button sewer, Electronic Sewing machines Application of robotics in sewing, LAN in Sewing machines, high speed stitching. Preparation of seamless garments and its applications, sewing room planning.
Sewing Needles and Threads - Needle – functions, special needles, Needle size, Needle points, sewing thread – construction, material, thread size and packages.
Seams & Stitches – Seams, Different types, Superimposed, lapped, bound, flat, decorative, edge neatening, addition to Garment edges, single piece addition, Stitches – lock stitch, chain stitch, hand stitch type, multi-thread chain stitch, over edge chain stitch and covering chain stitches.
Stitch formation Mechanics: - Mechanism of lock stitch formation, Factors affecting yarn tension and stitch length of a seam during stitching, Mathematical model of lock stitch,
Development of yarn tension during lock stitching, Modeling of take-up arm displacement

UNIT-III (10 Hrs)

Components and Trims - Labels – linings, interlinings, wadding, lace, braid, elastic, hock and loop fastening shoulder pads, eyelets and laces, Zip fasteners and buttons.
Garment finishing & Packing machines - CNC pressing machines, Quality control in apparel production.

UNIT-IV (20 Hrs)

Apparel Production parameters – control parameters, Product Development, Time management. Breakdown of operation sequence, Development of Flow process, Grid chart for operation sequence.

Manufacturing systems & Planning – Lay out planning, Bundling and ticketing, Evaluation of production systems Capacity planning & line balancing, Capacity calculation for cutting, sewing & finishing, Machine requirements – Line Balancing techniques. Work study method, motion & time study - computer Integrated production planning & management systems.

Recommended Books:

1. Jackb Solinger, "Apparel Manufacturing Handbook", Van Nostrand Reinhold company" 1980
2. Cooklin. G. "Introduction to clothing manufactures" Blackwell science . 1995.
3. Harold Carr & B. Latham, "The Technology of clothing manufacture - Blackwell sciences 1998
4. Churter. A.J, "Introduction to clothing production management", Oseney Mead.1995.
5. Mehta P V and Bhardwaj S K " Managing Quality in Apparel Industry", New Age International (P) Ltd., Delhi-2002
6. "Garment Technology NCUTE Series", Ed. Bhattacharya A, NCUTE- IIT, Delhi,2003.
7. Aldrich W, " Metric pattern cutting", Om Book Service, Delhi-1998.

PROCESS CONTROL IN SPINNING & WEAVING

Subject Code: MTEXD1-111 **LTPC** **Duration -60 hrs**
4 0 0 4

Course Outcomes

CO1: Optimisation of quality and cost of fibres though mixing/blending.
CO2: Able to apply process and quality control tools in yarn production.
CO3: Apply modern process and quality control parameters of yarns and fabrics in production.
CO4: Able to evaluate various process and quality parameters for fabric production.

UNIT - I (15 Hrs)

Process Control in Spinning: Optimum Fibre-Mix for Various End Use Requirements, Yarn Realization, Waste Control in Blow room and Card for All Types of Fibres Spun on Cotton System, Minimizing Lea Count Variation, Controlling Yarn Irregularity, Imperfections and Faults, Yarn Tenacity and Elongation, Hairiness. Production of High Quality Export Yarns

UNIT - II (15 Hrs)

Machinery Audit, Work Load, Life of Accessories, Work Load, Indices of Productivity, Temperature and Humidity Control & Its Effect on Performance.

UNIT - III (15 Hrs)

Process Control in Weaving: Principles for Control of Productivity in Different Sections, Contribution of Control in Yarn Winding, Warping, Sizing & Weaving to The Cost of Production in Fabric Manufacture, Splicing, Machine Allocation and Load Distribution, Control of Migration in Sizing, Size Droppings, Sizing Materials, Loom Allocation, Evaluation & Grading of Fabric Defects, Control of Loom Accessories, Control of Loss of Efficiency by Snap Study.

UNIT - IV (15 Hrs)

Process Control in Special Conditions: Controls in the Process of High Twist Yarns, Blended Yarns, Filament Yarns in Warp and Weft, Controls in The Winding for Processing Yarns for Dyeing & Knitting, Controlling Sloughing Off During Winding, Warping & Weaving, On-Line Data System and Its Use In Controls.

Recommended Books

1. ATIRA, “Process Control in Spinning”.
2. ATIRA, “Process Control in Weaving”.
3. R. Chattopadhyay, “Process Control in Spinning”, IIT, NCUTE, Delhi.
4. SITRA, “Quality Control in Spinning”.

PRODUCTION MANAGEMENT IN TEXTILE

Subject Code - MTEXD1-112 **L T P C** **Duration – 60 Hrs**
4 0 0 4

Course Outcomes

CO1 Know and examine the concepts of operation management and operations planning control.

CO2 Analyse the various aspects of plant location and layout.

CO3 Evaluate critically the concepts of Material Management, objectives, planning, MRP calculation and material handling.

CO4 Judge the role and solutions of issues like Job Evaluation and Waste Management and different types of pollution.

UNIT – I (15Hrs)

Operation Management: Operations Management in Corporate Profitability and Competitiveness, Types and Characteristics of Manufacturing and Service Systems, Operations Planning Control: Planning Production in Aggregate Terms, Quality Assurance

UNIT – II (15Hrs)

Plant Location and Layout: Plant Layout: Features, Basic Principles, Types of Layout, Merits And Demerits, Optimization Of A Product/Line Layout And Process Layout. Location of Facilities: Nature of Location Decision, Situations That Influence Location Decision, Backward Areas And Industrial Policy, Behavioral Aspects In Location Planning

UNIT – III (15 Hrs)

Material Management: Purchasing, Objectives, Value Engineering, Vendor Relations, Selection of Vendors, Material Requirement Planning, MRP Calculations, Material Handling

UNIT - IV (15Hrs)

Job Evaluation and Waste Management: Job Evaluation, Incentive Schemes, Job Redesign, Work Measurement Techniques, Different Types of Pollution: Water, Air, Solid Waste, Soil, Noise, Odours etc. Pollution Caused by Textile Industries, Waste Definition, Characteristics and Perspectives, Different Types of Waste

Recommended Books

M.R. Raymond, "Production and operations management", Mcgraw-Hill international Edition, New York, 1993.

S.E. Buffa and R. Sarin, "Modern Production/Operations Management", John Willey and Sons, Delhi, 1995.

R. Collard, "Total quality", Jaico Publishing House, Mumbai, 1988.

S.K., Sharma, Sand Sharma T, "Industrial Engineering and Operations Management", S.K. Kataria and Sons, Delhi, 1996.

S. Asolekar, "Environmental Problems in Chemical Processing of Textiles"1st Edn., NCUTE, Department of Textile Technology, IIT-Delhi, 2000.

TOTAL QUALITY MANAGEMENT

Subject Code: MTEXD1-113 **LTPC** **Duration -60hrs**
4 0 0 4

Course Outcomes

CO1 Recognise importance and framework of TQM
CO2 Appreciate and analyze TQM principles
CO3 Comprehend and appraise Tools and Techniques of TQM
CO4 Demonstrate the understanding about implementation of Quality Management System

UNIT -I(15hrs)

Introduction - Need for quality - Evolution of quality - Definitions of quality - Dimensions of product and service quality - Basic concepts of TQM - TQM Framework - Contributions of Deming, Juran and Crosby - Barriers to TQM - Customer focus - Customer orientation, Customer satisfaction, Customer complaints, Customer retention.

UNIT II(15hrs)

Leadership - Quality Statements, Strategic quality planning, Quality Councils - Employee involvement - Motivation, Empowerment, Team and Teamwork, Recognition and Reward, Performance appraisal - Continuous process improvement - PDCA cycle, 5S, Kaizen - Supplier partnership - Partnering, Supplier selection, Supplier Rating.

UNIT III(15hrs)

The seven traditional tools of quality - New management tools - Six sigma: Concepts, Methodology, applications to manufacturing, service sector including IT - Bench marking - Reason to bench mark, Bench marking process - FMEA - Stages, Types. Quality Circles - Cost of Quality - Quality Function Deployment (QFD) - Taguchi quality loss function - TPM - Concepts, improvement needs - Performance measures.

UNIT IV(15hrs)

Introduction—Benefits of ISO Registration—ISO 9000 Series of Standards—Sector-Specific Standards—AS 9100, TS16949 and TL 9000-- ISO 9001 Requirements—Implementation—Documentation—Internal Audits—Registration--ENVIRONMENTAL MANAGEMENT SYSTEM: Introduction—ISO 14000 Series Standards—Concepts of ISO 14001—Requirements of ISO 14001— Benefits of EMS.

Books recommended:

1. Dale H.Besterfiled, Carol B.Michna,Glen H. Besterfield,Mary B.Sacre,Hemant Urdhwareshe and Rashmi Urdhwareshe, “Total Quality Management”, Pearson Education Asia, Revised Third Edition, Indian Reprint, Sixth Impression, 2013.
2. Ross E, “Total Quality Management”, Kogan Page USA, 1989.
3. Raju S S M, “Total Quality Management”,Tata Mcgraw Hill Publishing Co., 1985.
4. FiegenbaumV A, “Total Quality Management”, Mcgraw Hill International, 1990.
5. Tenner R A and Detoro JI,“Total Quality Management”, Addison–Wesley Publishing Co., 1986.

TEXTILE PRODUCT DESIGN

Subject Code: MTEXD1-121 **L T P C** **Duration - 60 Hrs**
4 0 0 4

Course Outcomes

CO1 Conceptualise process of Product development & Design
CO2 Evaluate the role of Research in Product development and Its business aspects
CO3 Organise the ideas related to Design Conceptualization and Design analysis
CO4 Execute Design optimization

UNIT-I (15 Hrs)

Concepts of Engineering, Product Development and Design, Characteristics of Successful Product Design, Product Development Process Tools, Product Architecture. Evolution of Engineering, Engineering Attributes and Concepts

UNIT-II (15Hrs)

Basic Concepts and Critical Factors for Product Development, Simplified View of Product Development, The Product Development Cycle, Business and Marketing Aspects Related To Product Development Product-Focus Versus User-Focus Product, Development Role Of Research in Product Development, The Core Task in Product Development

UNIT-III (15 Hrs)

The Product Design Cycle, Design Conceptualization Design Analysis, Basic Differences between Design Conceptualization and Design Analysis, General Guidelines for Design Conceptualization Basic Tools of Design Conceptualization

UNIT-IV (15 Hrs)

Purpose of Design Analysis, Optimization Analysis: Linear programming, Product Design Economics.

Recommended Books

1. Kevin Otto, & Kristin Wood, "Product Design Techniques in Reverse Engineering andNew Product Development", Pearson Education Publication, 1st Edn., 2006.
2. K.T. Ulrich, "Product Design and Development", Tata McGraw Hill, 3rd Edn., 2004.

PHYSICAL PROPERTIES OF FIBRES

Subject Code: MTEXD1-122 **L T P C** **Duration – 60 Hrs**
4 0 0 4

Course Outcomes

CO1 Analyze the mechanism of moisture absorption and its influence on fibre properties
CO2 Appreciate the fibre mechanical properties under different test conditions, their analysis and applications
CO3 Apply the knowledge about the properties like thermal, electrical, frictional properties of fibre
CO4 Distinguish the structural features of fibres and application of structure analysis

UNIT – I (15 Hrs)

Moisture Absorption and Desorption of Fibres, Sorption Isotherms, Heat of Sorption and Theory of Sorption, Swelling of Fibres.

UNIT - II (15 Hrs)

Mechanism of Deformation of Fibres, Principles of Elasticity and Visco-Elasticity, Stress-Strain Behaviour of Textile Fibres, Creep and Stress Relaxation. Dynamic Mechanical Properties of Fiber, Model Theory, Time Temperature Superposition Principle, Thermodynamic Analysis of Deformation.

UNIT - III (15 Hrs)

Fiber Friction, Its Nature, Theory, Application and Measurement, Unibirefringence and Its Measurement, Thermal Transition and Its Importance

UNIT – IV (15 Hrs)

Dielectric Properties of Fiber, Static Electricity and Measurement of Static Charge in Fibres, Fiber Micro Structure, X-Ray Analysis, IR Spectroscopy and SEM

Recommended Books

1. R. Meredith, 'The Mechanical Properties of Textile Fibres', North HollandPublishing Co; Amsterdam, 1959.
2. W.E. Morton and J.W.S. Hearle,"Physical Properties of Textile Fibres", 1st reprint, TheTextile Institute, Manchester, 1986.
3. V.B. Gupta and V.K. Kothari, "Manufactured Fibre Technology"1st Edn., Chapman andHall, London, 1997.
4. J.W.1.S. Hearle, Polymers and their Properties, Vol. I, John Wiley and Sons, NY, 1982.

COLORATION AND FINISHING TECHNOLOGY

Subject Code: MTEXD1-123 **L T P C** **Duration: 60 hrs**
4 0 0 4

Course Outcomes

CO1 Understand technology behind preparatory processes for manmade textiles and their blends
CO2 learn modern approaches for dyeing and printing of manmade fibres and blends
CO3 Grasp the latest techniques of finishing processes and garment processing
CO4 Appreciate energy management and effluent treatment techniques in textile industries

UNIT- I (15hrs)

Preparatory processes for synthetic textiles and their blends. Heat setting - Mechanism and effect on properties of textiles.

UNIT II(15hrs)

Developments in dyeing of synthetic textiles and their blends. Dyeing of micro-fibres. Mass coloration of synthetic textiles. Printing of synthetic/blended textiles in direct, resist and discharge styles. Transfer printing of polyester, cotton, wool and their blends.

UNIT -III(15hrs)

Anti-crease finishes and latest development in it. Controlled application techniques. Anti-stat, soil release and flame- retardant finishes. Garment processing. Quality control in chemical processing.

UNIT- IV (15hrs)

Energy conservation, minimization of wastage of energy during chemical processing of textiles, low temperature processing of textiles. Waste water load in various areas of chemical processing and ways to reduce it.

Recommended Books:

1. Peters R H, *"Textile chemistry",* Vol. – II and III, Elsevier Publishing Company, London, 1967.
2. Nunn D M, *"The dyeing of synthetic polymer and acetate fibres",* Dyers Company Publication Trust, London, 1979.
3. Miles L W C, *"Textile printing",* Dyers Company Publication Trust, Bradford, England, 1981.
4. Hall A J, *"Textile finishing",* Haywood Books, London, 1996.
5. Bird C L and Boston W S, "The theory of coloration of textiles", Dyers Company Publication Trust, Bradford, England, 1975.
6. Smethwurst G, " Basic water treatment", IBT Publications, Delhi, 1989.

ADVANCED MECHANICAL PROCESSING LABORATORIES

Subject Code: MTEXS1-104 **L T P C** **Duration: 60 Hrs**
0 0 4 2

Course Outcomes

CO1 To study and analyse the various machines.
CO2 Able to develop new products through process optimization.
CO3 Acquire the presentation skill
CO4 Develop an idea to analyse and correct the machine faults.

List of Experiments

Exploration of product development possibilities in Spinning laboratories.
Exploration of product development possibilities in weaving laboratories
Measurement of properties of the Ring spun yarns.
Measurement of properties of the Rotor, spun yarns.
Measurement of properties of the Friction spun yarns.
Measurement of properties of the Airjet yarns.
Preparation of Fabric Samples in knitting machines and measurement of Fabric properties.
Preparation of Fabric Samples in Weaving machines and measurement of Fabric properties.

Note: A minimum 6 Experiments should be performed by the student from the above given list of experiments or experiments relevant to syllabus.

ADVANCES IN FIBER PRODUCTION TECHNOLOGIES

Subject Code: MTEXS1-201 **L T P C** **Duration - 60 Hrs**
4 0 0 4

Course Outcomes

CO1 Create the concept of man-made fibre production, principles and factors affecting.
CO2 Understand the raw materials, monomers, equipment, mechanism used in manmade fibre spinning.
CO3 Apply the basic principles in important manmade fibres production methods, polymerization and new developments.
CO4 Analyze the effect of variables on melt spinning and study high speed spinning, micro-fibre production, solution spinning and heat setting.

UNIT – I (15 Hrs)

General Definition of Man Made or Manufactured Fibres, Introduction to General Principles of Spinning and Spinning Processes, Basic Principles of Fluid Flow during Fiber Spinning, Factors Affecting Shear Viscosity. Elongational Flow, Spinnability and Flow Instabilities

UNIT - II (15 Hrs)

Extruder Design, Spin Head, Spinneret, Quench Chamber, Spin Finish Application, Wind Up Mechanism, Manufacture and Specifications of Raw Materials and Monomers.

UNIT - III (15Hrs)

Types, Methods of Manufacture, Mechanism of Polymerisation and Production Techniques of Viscose, Nylon 6 And 66, PET, PAN And PP, Introduction to New Developments, other Fibres including PU, PVA, PE, PVC and Polyvinylidene Chloride.

UNIT-IV (15 Hrs)

Primary and Secondary Variables and Their Effect on Melt Spinning, High Speed Spinning, Spinning of Microfibre, Solution Spinning Process: Dry and Wet Spinning, Heat-Setting of Fibres

Recommended Books

1. A.A. Vaidya, “Production of Synthetic Fibres”, 1st Edn., Prentice Hall of India, New Delhi, 1988.
2. V.B. Gupta and V.K. Kothari, “Manufactured Fibre Technology”, 1st Edn., Chapman andHall, London, 1997.
3. H.F. Mark, S.M. Atlas and E. Cernia, “Man Made Fibre Science and Technology”, Vol. 1,2, 3, 1st Edn., Willey Inter Science Publishers, New York, 1967.
4. J.E. Macintyre, “Synthetic Fibres”, Woodhead Fibre Science Series, UK, 2003.
5. F. Fourne, “Synthetic Fibres: Machines and Equipment, Manufacture, Properties”, HanserPublisher, Munich, 1999.

STRUCTURAL MECHANICS OF YARN

Subject Code: MTEXS1-202 **LTPC** **Duration-60hrs**
4 0 0 4

Course Outcomes

CO1: To understand and analyse the yarn structure and measurements of various parameters pertaining to yarn structure.
CO2: Able to apply applications of theoretical aspects in problem solving.
CO3: Analysis of yarn structure and relation with properties.
CO4: Able to acquire presentation skill.

UNIT-I (15 Hrs)

Elements of Yarn Geometry, Geometry of Helix and Its Application to Yarn Structure, Geometry of Folded Yarn, Yarn Diameter and Density

UNIT-II (15 Hrs)

Theoretical Analysis of Effect of Fiber Properties and Their Geometrical Configuration on the Tensile and Bending Properties of Yarn, Theories and Analysis of Yarn Strength and Irregularity

UNIT-III (15 Hrs)

Fiber Migration Characteristics of Continuous Filament and Spun Yarns, Breakage of Continuous Filament and Spun Yarns, Effect of Properties of Constituent Fibres and Blend Composition on Behavior of Composite Yarn.

UNIT-IV (15 Hrs)

Effect of Yarn Structure on Different Properties of Yarns, Structure and Property Relationship of Ring, Rotor, Air-Jet and Friction Spun Yarns

Recommended Books

1. J.W.S. Hearle, P. Grosberg and S. Backer, “Structural Mechanics of Fibres Yarns and Fabrics”,
2. Wiley Interscience, New York, 1969.
3. B.C. Goswami, J.G. Martindale and F. Scardino, “structure and applications”, Wiley Interscience Publisher, New York, 1995.
4. J.W.S. Hearle, J.J. Thwaites and J. Amirbayat, “Mechanics of Flexible Fibre Assemblies”, Sijthff and Noordhoff International Publishers BV, Alphen aan den Rijn, Netherlands, 1980.

STRUCTURAL MECHANICS OF FABRICS

Subject Code: MTEXS1-203 **LTPC** **Duration-60 hrs**
4 0 0 4

Course Outcomes

CO1 Develop the concept of Mechanics applicable to Textiles.
CO2 Understand the anatomy of woven structure.
CO3 Analyse relation with property and structure of woven and knitted fabric.
CO4 Understand the mechanics of non-woven and woven fabric.

UNIT-1 (15Hrs)

Fabric Cover Factor and Its Significance, Engineering Approach for Fabric Formation, Pierce's Cloth Geometry, Practical Aspect of Cloth Geometry, Graphical Relationship in Cloth Geometry for Plain, Twill and Sateen Weaves

UNIT-II (15 Hrs)

Concept of Jammed Structure, Analysis of Racetrack Section of Yarn in Cloth Geometry, Theoretical Investigation of Weavability Limit of Yarns, Elastic Thread Model for Fabric

UNIT-III (15 Hrs)

Concept of Fabric Relaxation for Knitted Fabrics, Geometry and Properties of Weft Knitted Fabrics – Importance of Doyle's and Munden's Research, K-Values and Pierce's Geometry of Knitted Fabrics

UNIT-IV (15 Hrs)

Tensile and tearing Behaviour of Fabric, Bending Deformation of Fabric, Bending Hysteresis of Woven Fabric, Buckling, Shear And Drape Behaviour of Woven Fabric, Mechanical Properties of Nonwoven Needle Punch and Stitch Bonded Fabric, Brief Study of Formability, Tailorability and Hand of Apparel Fabric.

Recommended Books

1. J.W.S. Hearle, P. Grosberg and S. Backer, "Structural Mechanics of Fibres Yarns andFabrics", Wiley Interscience, New York, 1969.
2. F.T. Peirce and J.R. Womersley, "Cloth Geometry", The Textile Institute, Manchester,
3. 1978.
4. J.W.S. Hearle, J.J. Thwaites and J. Amirbayat, "Mechanics of Flexible Fibre Assemblies",Sijthff and Noordhoff International Publishers BV, Alphen aan den Rijn, Netherlands, 1980.
5. J. Hu, "Structural Mechanics of Fabrics", Woodhead Publishing Co., Cambridge, UK, 2006.

KNITTING AND NONWOVEN TECHNOLOGY

Subject Code: MTEXD1-211 **LTPC** **Duration 60 hrs**
4 0 0 4

Course Outcomes

CO1 Understand the dynamics of knitting process and mechanics of loop formation.
CO2 Understand the design and performance of high speed knitting cam.
CO3 Analyse the geometry and properties of knitted fabrics.
CO4 Understand effect of machine, fibre and process variables on properties of non-woven fabrics .

UNIT-I (15hrs)

Concepts of loop formation in weft and warp knitting. Different forces acting on the needle butt and mechanics of loop formation. Study of dynamics of knitting process. Study of different machines, process and yarn parameters affecting the yarn tension in knitting zone and loop length.

UNIT-II(15hrs)

Concept of Robbing Back of yarn in loop. Study of design and performance of high speed knitting cam and increase in machine production. Yarn feeding devices on circular knitting machines.

UNIT-III(15hrs)

Geometry and properties of weft knitted fabrics –k-values and Pierce‘s geometry. Outlines of process control in knitting. Use of electronics and computers and other developments in knitting. Features of warp knitted fabrics and their usesd friction spun yarns, Strength-length relation in yarn

UNIT IV(15hrs)

Different advanced methods of production of nonwoven fabrics. Effect of machines, fibre and process variables on properties of nonwoven fabrics. Designing of nonwoven for engineering applications. Development in nonwoven machineries. Developments in various nonwoven manufacturing techniques.

Recommended Books:

1. Spencer D J, “Knitting Technology” , 2nd Ed., Pergamon Press, 1989.
2. Russell, S J, “Handbook of Nonwovens”, Woodhead Publishing Limited, Cambridge, UK, 2007
3. Lunenschloss J and Albrecht W, “Non-Woven Bonded Fabric”, Ellis and Horwood Ltd., UK, 1985
4. Albrecht W, Fuchs H and Kittelmann, “Nonwoven Fabrics”, Wiley-VCH Weinheim, 2003.
5. Journals: Textile Research Journal, Princeton, USA and Journal of Textile Institute, Manchester, UK.

POST SPINNING OPERATIONS

Subject Code: MTEXD1-212 **L T P C** **Duration – 60Hrs**
4 0 0 4

Course Outcomes

CO1 Create the concept of drawing process and its influence on structure and properties of filament.
CO2 Evaluate the texturing process for fibres; material and process variables and their influence.
CO3 Analyze the heat setting process, parameters, equipment and degree of set.
CO4 Understand about the sewing threads, properties and post spinning operations

UNIT-I (15 Hrs)

Drawing: Drawing Process, Neck Drawing, Initiation and Propagation of Neck, Neck Stabilization. Natural Draw Ratio, Effect of Temperature and Strain Rate on Neck Drawing, Prediction of Neck Formation, Influence of Drawing on Structure and Properties of Filament, Spin - Draw process.

UNIT-II (15 Hrs)

Texturing: Texturing and Warping Process, Material and Process Variables in Texturing and Their Influence on Yarn Quality, Recent Advances in Texturing, Testing and Evaluation of Textured Yarn Properties of Fabrics Made from Textured Yarn.

UNIT-III (15Hrs)

Heat Setting: Heat Setting Process, Parameters for Heat Setting, Equipment for Heat Setting and Evaluation of Degree of Set.

UNIT-IV (15 Hrs)

Multifilament Sewing Threads: Post Spinning Operation on Multifilament Sewing Threads

Recommended Books

1. V.B. Gupta and V.K. Kothari, “Manufactured Fibre Technology”, 1st Edn., Chapman andHall, London, 1997.
2. H.F. Mark, S.M. Atlas, E. Cernia, “Man Made fibre Science and Technology”, 1st Edn.,Vol. I, II, III, Willey Interscience Publishers, NewYork, 1967.
3. Macintyre J E, “Synthetic Fibres”, Woodhead Fibre Science Series, UK, 2003
4. F. Fourne, “Synthetic Fibres: Machines and Equipment, Manufacture, Properties”, HanserPublisher, Munich, 1999.

ENVIRONMENTAL PRACTICES IN TEXTILES

Subject Code: MTEXD1-213 **L T P C** **Duration – 60 Hrs**
4 0 0 4

Course Outcomes

CO1 Understand and Define the contribution of an engineer towards Environment Quality
CO2 Get Acquainted with the types of pollution caused by Textile Industry
CO3 Understand the types of textile wastes and their disposal.
CO4 Appreciate the Textile Effluent treatment techniques

UNIT – I (15 Hrs)

Introduction to Environment, The Impact of Human upon the Environment, Improvement of Environment Quality, Role of Environmental Engineer.

UNIT - II (15 Hrs)

Different Types of Pollution: Water, Air, Solid Waste, Soil, Noise, Odours etc. Pollution Caused by Textile Industries.

UNIT – III (15 Hrs)

Waste: Definition, Characteristics and Perspectives, Different Types of Waste. Waste Water Collection, Treatment and Disposal, Solid Waste Generation, Collection and Disposal.

UNIT-IV (15 Hrs)

The Textile Effluents, Textile Waste Characteristics, Textile Waste Water Problems, Chemicals Used in Textile Industry, Treatment of Textile Effluents and its Testing.

Recommended Books

1. S. Asolekar, "Environmental Problems in Chemical Processing of Textiles",1st Edn., NCUTE, Department of Textile Technology, IIT-Delhi, 2000.
2. V. Padma, "Textile Effluents" 1st Edn.,. NCUTE, Department of Textile Technology, IIT-Delhi, 2002.
3. B. Edmund, "The Treatment of Industrial Wastes" 2nd Edn., Tata McGraw-Hill, New Delhi, 1976.
4. M.N. Rao, "Environmental Engineering" 2nd Edn., Tata McGraw-Hill, New Delhi,
5. 1993.

HIGH PERFORMANCE FIBRES AND COMPOSITES

Subject Code: MTEXD1-221 **L T P C** **Duration - 60 Hrs**
4 0 0 4

Course Outcomes

CO1 Understand the various techniques for development/fabrication of composite structure
CO2 Learn the details about the fibres used for composite
CO3 Gain Knowledge about Carbon based composites
CO4 Understand the properties and applications of composite and Nano Composites

UNIT– I (15 Hrs)

Definition of Composite, General Introduction to Fibres and Resins for Composites, Composite Fabrication Techniques, Matrices and Inter phase.

UNIT– II (15 Hrs)

Polyamide Fibres: Aliphatic Polyamide (N6 and 66) and Their Application in Rubber Tyre. Fully Aromatic Polyamides or Aramid Fibres (Nomex And Kevlar), Their Manufacture, Structure, Properties and Applications

UNIT-III (15 Hrs)

Carbon Fibres: Different Precursors, Preoxidation, Carbonization, Graphitization, Structure and Properties. Application in Composite. Flexible Chain High Performance Fibres, Manufacture and Application in Composite. Glass fiber, Manufacture, Properties and Applications in Composite.

UNIT-IV (15 Hrs)

Nanocomposite: Introduction, Advantages and Different Nano-materials Commonly Used as Fillers Carbon Nanotubes, Carbon Nano-fibres and Nano Clay.

Recommended Books

1. N.G. Mc Crum, C.P. Buckley and C.B. Bucknall, "Principle of Polymer Engineering", Oxford University Press, New York, 1990.
2. Ed. J.W. Stteare, "High Performance Fibres", Woodhead Publishing Co., England, 2001.
3. D. Hull, "An Introduction to Composite Materials",Cambridge University Press,UK, 1981.
4. H. Broody, "Synthetic Fiber Materials", Longman Scientific and Technical, UK,
5. 1994.

ADVANCED GARMENTS MANUFACTURING TECHNOLOGY

Subject Code: MTEXD1-222 **LTPC** **Duration- 60 Hrs**
4 0 0 4

Course Outcomes

CO1 Acquire details about basic designing and pattern making, Discuss the process and machineries for the marker planning, spreading and lay planning automation in sewing machine.
CO2 To understand and analyse the importance of automation in apparel finishing
CO3 To understand and analyse the importance of automation in Material handling.
CO4 To understand and analyse the importance of robotics in apparel Industruy.

UNIT-I(20hrs)

AUTOMATION IN APPAREL DESIGNING AND FIT ANALYSIS
Automated elements in clothing production - cutting of fabric - cutting by water jet, laser, plasma - automated sewing machines - Types of driving mechanism of sewing machines – single needle lock stitch machine, over lock and flat lock machine. Automation in special machines – bar tack, pocket making and patterning machines, button holing and sewing machines.

UNIT-II (10hrs)

AUTOMATION IN APPAREL FINISHING:
Automation in fusing, pressing and folding machines. Automation in apparel packing equipments.

UNIT-III(15hrs)

AUTOMATION IN MATERIAL HANDLING
Types of equipment- Automated storage and retrieval systems- Overview of conceptions of "Work Robots" and "Manipulators". Conveyor systems – UNIT production systems. Ply separation; Transportation - position and orientation, pick and place – clamping grippers and pinch grippers.

UNIT-IV(15hrs)

ROBOTICS IN APPAREL INDUSTRY
Robotics in spreading and cutting; Robotics in sewing – double lock stitching, one side stitching, Tufting; Robotics for material handling; Robots as 2D and 3D folding machines.

Recommended Books:

1. Cooklin Gerry, "Garment Technology for fashion Designers", Om Book Service Delhi,1997.
2. Carr Harold and Barbara, "The Technology of clothing Manufacture",Om Book Service,Delhi,1998
3. Mehta P V and Bhardwaj S K " Managing Quality in Apparel Industry", New Age International (P) Ltd., Delhi-2002
4. "Garment Technology NCUTE Series", Ed.Bhattacharye A, NCUTE- IIT, Delhi,2003.
5. Aldrich W, " Metric pattern cutting", Om Book Service, Delhi-1998.
6. Wilson J, " Hand book of Textile Design", Woodhead publishing Ltd., UK, 2002.

TECHNICAL TEXTILES

Subject Code: MTEXD1-223 **LTPC** **Duration- 60 Hrs**
4 0 04

Course Outcomes

CO1 To analyse the role of technical textiles in modern are
CO2 To apply Technical Textiles in diversified fields.
CO3 Ability to design a product as per the specific requirements for end uses.
CO4 Characterization of products and their performance

UNIT-I(15hrs)

Definition and Scope for Technical Textiles, Brief Idea about Technical Fibres, Role of Yarn and Fabric Construction. Filtration Textiles: Definition of Filtration Parameters, Filtration Requirements

UNIT-II(15hrs)

Geotextiles: Brief Idea about Geosynthtics and Their Uses, Essential Properties of Geotextiles, Geotextiles Testing and Evaluation, Application Examples of Geotextiles. Medical Textiles: Classification of Medical Textiles, Description of Different Medical Textiles.

UNIT-III(15hrs)

Protective Clothing: Brief Idea about Different Type of Protective Clothing, Functional Requirement of Textiles in Defence including Ballistic Protection Materials and Parachute Cloth, Flame Retardant Clothing, Chemical Protective Clothing, Sports Textiles, functional requirement of sports textiles.

UNIT-IV(15hrs)

General Technical Textile: Textiles in Agriculture, Electronics, Power Transmission Belting, Hoses, Canvas Covers and Tarpaulins.

Recommended Books:

1. "Handbook of Technical Textiles", Ed. A R Horrocks and S C Anand, Woodhead Publication Ltd., Cambridge, 2000.
2. "Wellington Sears Handbook of Industrial Textiles", Ed. Sabit Adanaur, Technimic Publishing Company, Inc., Pennsylavania, USA, 1995.
3. Shukla S K, Yin Jian-hua, Fundamentals of Geosynthetic Engineering, Taylor & Francis, 2006, UK.
4. "Modern Textile Characterization Methods", Ed. M Raheel, Marcel Dekker, Inc., 1996.
5. Nonwoven Fabrics; Ed. W. Albrecht, H. Fuchs, and W. Kittelmann, WLLEY VCH Publication, 2003, UK.

ADVANCED TEXTILE TESTING LAB

Subject Code: MTEXS1-204 **LPTC** **Duration-60 hrs**
0 0 4 2

Course Outcomes

CO1: To evaluate various aspects of quality parameters and its role in modern era.
CO2: To access fibre and yarn quality by modern instruments for domestic and international market.
CO3: To estimate various fabrics quality parameters by modern instruments.
CO4: Able to implement various quality control tools.

No. of Experiments

Evaluation of tensile and compressional characteristics of different woven fabric.
Evaluation of tensile and compressional characteristics of different nonwoven fabric.
Assessment of yarn diameter, yarn structure using image analysis method.
Evaluation and analysis of HVI data for differently graded cotton material.
Evaluation and analysis of tearing strength of fabric using universal tester
Evaluation and analysis of tearing strength of fabric using Elmendrof tear tester.
Evaluation and analysis of AFIS data for differently graded cotton material
Evaluation and analysis of Classimate data for differently graded cotton material

Note: A minimum 6 Experiments should be performed by the student from the above given list of experiments or experiments relevant to syllabus.

RESEARCH METHODOLOGY AND IPR

Subject Code - MREMI0-101 **LTPC** **Duration-60 hrs**
4 0 0 4

Course Objectives: To make the students to:

1. Understand that how to formulate a research problem, analyze research related information, follow research ethics, and to design experiments.
2. To learn to collect or sample data, process it and validate results etc.
3. Do effective literature studies and develop a research proposal.
4. Understand the need of information about Intellectual Property Right (IPR) in general & engineering in particular.
5. Understand that IPR protection provides an incentive to inventors for further research work and investment in R & D.

Course Outcomes: At the end of this course, students will be able to:

1. Formulate a research problem, analyze research related information, and follow research ethics and design experiments.
2. Collect, sample, scale, validate and process data.
3. To do literature survey effectively and develop a good research proposal.
4. Motivated to do research work and invest in R & D to create new and better products for economic growth and social benefits.

UNIT-I (15 Hrs.)

Research Problem: 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 problems, Data collection, Analysis, Interpretation, Necessary instrumentation.
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 (15 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.
Data Process Operations: Editing, Sorting, Coding, Classification and Tabulation.

UNIT-III (10 Hrs.)

Literature Survey: Importance of literature survey - Sources of information - Assessment of quality of journals and articles - Information through internet. Literature Review: Need of review - Guidelines for review - Record of research review.
Effective Literature Studies Approaches: Analysis Plagiarism, Research ethics, Effective technical writing, Essentials of report writing, Report Format, Paper Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee.

UNIT-IV (20 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.
Patent Rights: Scope of Patent Rights, Licensing and transfer of technology, Patent information and databases, Introduction to patent searching and World Intellectual Property Organization (WIPO).
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', Juta & Co. Ltd., 1996.
2. Ranjit Kumar, 2nd Edn., 'Research Methodology: A Step by Step Guide for Beginners'.
3. C.R Kothari, "Research Methodology, Methods & Techniques", New Age International Publishers, New Delhi, 2004.
4. R. Ganesan, 'Research Methodology for Engineers', MJP Publishers, Chennai, 2011.
5. Ratan Khananabis and Suvasis Saha, "Research Methodology", Universities Press, Hyderabad, 2015.
6. Vijay Upagade and Aravind Shende, 'Research Methodology', S. Chand & Company Ltd., New Delhi, 2009.
7. G. Nageswara Rao, 'Research Methodology and Quantitative methods', BS Publications, Hyderabad, 2012.
8. Debora J. Halbert, 'Resisting Intellectual Property', Taylor & Francis Ltd., 2005, DOI https://doi.org/10.4324/9780203799512.
9. Robert P. Merges, Peter S. Menell, Mark A. Lemley, 'Intellectual Property in New Technological Age', 2016.
10. T. Ramappa, 'Intellectual Property Rights Under WTO', S. Chand, 2008.

PROJECT

Subject Code: MTEXS1-302

L	T	P	C
0	0	-	6

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. Execute a meaningful research project that demonstrates spatial thinking and uses the knowledge and skills.
2. Able to learn effectively record data and experiments so that others can understand them.
3. 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 Textile Engineering including interdisciplinary fields in the final semester of M. Tech Course.

SEMINAR

Subject Code: MTEXS1-303

L	T	P	C
0	0	2	1

Course Outcomes

Student should undertake in depth independent study of a topic. The study should be carried out under the guidance of a faculty member. The subject area chosen by the student should be sufficiently different from the area of project being pursued by the student. The evaluation will be based on the report, seminar and viva- voce.

Maharaja Ranjit Singh Punjab Technical University
Bathinda-151001

FACULTY OF ENGINEERING AND TECHNOLOGY

SYLLABUS

FOR

M.TECH. ELECTRICAL ENGINEERING (POWER SYSTEM)
2022 BATCH ONWARDS

(For Full-Time and Part-Time Modes)

Study Scheme for M.Tech Regular Programme

1st Semester		Contact Hrs.			Marks			Credits
Subject Code	**Course**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
MELES2-101	Advanced Power System Analysis	4	0	0	40	60	100	4
MELES2-102	Electrical Power Distribution System	4	0	0	40	60	100	4
MELES2-103	Electric and Hybrid Vehicles	4	0	0	40	60	100	4
MELES2-104	Power System Lab - I	0	0	4	60	40	100	2
Departmental Elective-I		4	0	0	40	60	100	4
MELED2-111	Restructured Power Systems							
MELED2-112	Energy Management and Energy Auditing							
MELED2-113	Artificial Intelligence Techniques							
Departmental Elective-II		4	0	0	40	60	100	4
MELED2-121	Industrial Load Modeling and Control							
MELED2-122	Advanced AC/DC LV/MV Drive Systems							
MELED2-123	Power System Transients							
Total		**20**	**0**	**4**	**260**	**340**	**600**	**22**

2nd Semester		Contact Hrs.			Marks			Credits
Code	**Course**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
MELES2-201	Advanced Protection of Power System	4	0	0	40	60	100	4
MELES2-202	Power System Dynamics & Stability	4	0	0	40	60	100	4
MELES2-203	Smart Grids	4	0	0	40	60	100	4
MELES2-204	Power System Lab-II	0	0	4	60	40	100	2
Departmental Elective-III		4	0	0	40	60	100	4
MELED2-211	Power Quality							
MELED2-212	FACTS and Custom Power Devices							
MELED2-213	Digital Transformation in Industry							
Departmental Elective-IV		4	0	0	40	60	100	4
MELED2-221	Renewable Energy System and Distributed Generation							
MELED2-222	SCADA System and Applications							
MELED2-223	Optimization Techniques for Power Engineering							
Total		**20**	**0**	**4**	**260**	**340**	**600**	22

3rd Semester		Contact Hrs.			Marks			Credits
Code	**Course**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
MELES2-301	Project	0	0	--	60	40	100	6
MELES2-302	Seminar	0	0	2	100	--	100	1
MREMI0-101	Research Methodology & IPR	4	0	0	40	60	100	4
XXXXXX	Open Elective – (To be selected from the list of PG open electives from emerging technical areas and not from Humanities and Social Sciences)	3	0	0	40	60	100	3
Total		**7**	**0**	**2**	**240**	**160**	**400**	14

4th Semester		Contact Hrs.			Marks		
Code	**Course**	**L**	**T**	**P**	**Int.**	**Ext**	**Total**
MELES2-401	Dissertation	--	--	--	**Satisfactory / Not Satisfactory as per CBCS-2016**		
Total		**--**	**--**	**--**	**--**		

Study Scheme for M.Tech. Part-Time Programme

1st Semester		Contact Hrs.			Marks			Credits
Subject Code	**Course**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
MELES2-102	Electrical Power Distribution System	4	0	0	40	60	100	4
MELES2-103	Electric and Hybrid Vehicles	4	0	0	40	60	100	4
Departmental Elective-I		4	0	0	40	60	100	4
MELED2-111	Restructured Power Systems							
MELED2-112	Energy Management & Energy Auditing							
MELED2-113	Artificial Intelligence Techniques							
Total		**12**	**0**	**0**	**120**	**180**	**300**	**12**

2nd Semester		Contact Hrs.			Marks			Credits
Subject Code	**Course**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
MELES2-101	Advanced Power System Analysis	4	0	0	40	60	100	4
MELES2-104	Power System Lab - I	0	0	4	60	40	100	2
Departmental Elective-II		4	0	0	40	60	100	4
MELED2-121	Industrial Load Modeling and Control							
MELED2-122	Advanced AC/DC LV/MV Drive Systems							
MELED2-123	Power System Transients							
Total		**8**	**0**	**4**	**140**	**160**	**300**	10

3rd Semester		Contact Hrs.			Marks			Credits
Subject Code	**Course**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
MELES2-201	Advanced Protection of Power System	4	0	0	40	60	100	4
MELES2-203	Smart Grids	4	0	0	40	60	100	4
Departmental Elective-III		4	0	0	40	60	100	4
MELED2-211	Power Quality							
MELED2-212	FACTS and Custom Power Devices							
MELED2-213	Digital Transformation in Industry							
Total		**12**	**0**	**0**	**120**	**180**	**300**	**12**

4th Semester		Contact Hrs.			Marks			Credits
Code	**Course**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
MELES2-202	Power System Dynamics & Stability	4	0	0	40	60	100	4
MELES2-204	Power System Lab-II	0	0	4	60	40	100	2
Departmental Elective-IV		4	0	0	40	60	100	4
MELED2-221	Renewable Energy System & Distributed Generation							
MELED2-222	SCADA System & Applications							
MELED2-223	Optimization Techniques for Power Engineering							
Total		**8**	**0**	**4**	**140**	**160**	**300**	**10**

5th Semester		Contact Hrs.			Marks			Credits
Code	**Course**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
MELES2-301	Project	0	0	--	60	40	100	6
MELES2-302	Seminar	0	0	2	100	--	100	1
MREMI0-101	Research Methodology & IPR	4	0	0	40	60	100	4
XXXXXX	Open Elective – (To be selected from the list of PG open electives from emerging technical areas and not from Humanities and Social Sciences)	3	0	0	40	60	100	3
Total		**7**	**0**	**2**	**240**	**160**	**400**	**14**

6th Semester		Contact Hrs.			Marks		
Code	**Course**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**
MELES2-401	Dissertation	--	--	--	**Satisfactory / Not Satisfactory as per CBCS-2016**		
Total		**--**	**--**	**--**	**--**		

ADVANCED POWER SYSTEM ANALYSIS

Subject Code: MELES2-101 **L T P C** **Duration: 60 Hrs.**
4 0 0 4

Course Objectives: Students will be able to:
Study various methods of load flow and their advantages and disadvantages.
Understand how to analyze various types of faults in power system.
Understand power system security concepts and study the methods to rank the contingencies.
Understand need of state estimation and study simple algorithms for state estimation.
Study voltage instability phenomenon.
Course Outcomes: Students will be able:
To do load flow analysis using various methods and economic operation of power system.
To calculate fault currents.
To know about automatic generation and voltage control.
To rank various contingencies according to their severity for security analysis.
To estimate state of power system by various methods.

UNIT-I (15 Hrs.)

Load Flow: Network modeling, Overview of Newton-Raphson, Gauss-Siedel, Decoupled and Fast decoupled methods, convergence properties, three-phase load flow, AVR in load flow.
Economic operation of Power System:
Economic dispatch including transmission losses using lambda iteration method, Solution of Coordination Equations, Formulation of optimal power flow-solution by Gradient Method, Newton's method.
Unit Commitment: Constraints in unit commitment (UC), Methods for UC; Priority list method and Dynamic programming.

UNIT-II (15 Hrs.)

Fault Analysis: Analysis of balanced and unbalanced three phase faults, Fault calculations, Short circuit faults, Open circuit faults, Generalized method of fault analysis.
Digital Techniques in Fault Calculations: Algorithm for formulation of bus impedance matrix, Equations and Flow chart for short circuit studies, Calculation of line currents, mutually coupled branches in Z_{BUS}.

UNIT-III (15 Hrs.)

Automatic generation control: Introduction, Load frequency control (single area and Two area) and economic dispatch control, Optimal load frequency control, Load frequency control with generation rate constraints,
Voltage Control: Effect of reactive power transmission on voltage, Surge impedance loading and voltage stability limit, P-V curve and V-Q curve, Voltage collapse, Prevention of voltage collapse, Voltage collapse proximity indices, Automatic voltage control of alternator.

UNIT- IV (15 Hrs.)

Security Analysis: Factors affecting power system security, Security state diagram, Contingency analysis, Sensitivity factors; generator shift distribution factors, line outage distribution factors, multiple line outages, Overload performance index ranking.
State Estimation: Introduction to power system state estimation, Weighted least squares estimation, State estimation of an AC network, State estimation by orthogonal decomposition and its algorithm, Detection and identification of bad measurements, Virtual and pseudo measurements, network observability and Pseudo-measurements, Application of power systems state estimation.

Recommended Books:

1. A.J. Wood, Bruce F. Wollenberg, 'Power Generation, Operation and Control', John Wiley, **2009.**
2. D.P. Kothari & I.J. Nagrath, Modern Power System Analysis, Tata McGraw Hill, 2012.
3. J.J. Grainger and W.D. Stevenson, 'Power System Analysis', McGraw Hill, **2003**.
4. R. Bergen and Vijay Vittal, 'Power System Analysis', Pearson, **2000**.
5. L.P. Singh, 'Advanced Power System Analysis and Dynamics', New Age International, 2006.
6. G.L. Kusic, 'Computer aided Power System Analysis', Prentice Hall India, **1986**.
7. P.M. Anderson, 'Faulted Power System Analysis', IEEE Press, **1995**.
8. J. Arrillaga and C.P. Arnold, 'Computer Analysis of Power Systems', John Wiley and Sons, NewYork, 1997.
9. M.A. Pai, 'Computer Techniques in Power System Analysis', Tata McGraw hill, New Delhi, 2006.
10. Dr. B.R. Gupta, Power System Analysis and Design, S. Chand & Company, 2014.

ELECTRICAL POWER DISTRIBUTION SYSTEM

Subject Code: MELES2-102 **L T P C** **Duration: 60 Hrs.**
4 0 0 4

Course Objectives: Students will be able to:
Learning about power distribution system.
Learning of SCADA System.
Understanding Distribution Automation.
Course Outcomes: Students will be able to:
Understand of power distribution system.
Study of Distribution automation and its application in practice.
To learn SCADA system.

UNIT-I (15 Hrs.)

System Planning: Introduction, Distribution system planning, Factors affecting system planning, present planning techniques, planning models, Introduction to optimum line network, future trends in planning, systems approach, distribution automation.
Load Characteristics: Basic definitions, Relation between load and loss factors, Maximum diversified demand, Distribution of Power, Management, Power Loads, Load Forecasting Short-term & Long- term, Power system loading, Technological forecasting.

UNIT-II (15 Hrs.)

System Design and Operation: Criteria, system developers, dispersed generation, distribution systems, economics and finance, mapping, Design of substation and feeder, Operation criteria voltage measurements, harmonics, load variations, system losses, Introduction to energy management.
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-III (20 Hrs.)

Distribution Automation: Advantages of Distribution Management System (D.M.S.) Definition, Restoration/Reconfiguration of Distribution Network, Different Methods and Constraints, Power Factor Correction.
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.
Voltage Regulation and Automation: Quality of Service and Voltage Standards, Voltage Control, Line Drop Compensation, Distribution capacitor automation, Voltage fluctuations,
SCADA and Communication with Load Dispatch Centers: Interconnection of Distribution, Control & Communication Systems, Remote Metering, Smart meter and Automatic Meter Reading and its implementation.

UNIT-IV (10 Hrs.)

Distribution System Protection: Objective of distribution system protection, high impedance faults coordination of protective devices: fuse to fuse co-ordination, re-closer to re-closer coordination, re-closer to fuse coordination, re-closer to substation transformer high side fuse coordination, fuse to circuit breaker coordination, re-closer to circuit breaker coordination, Lightning protection.

Recommended Books:

1. A.S. Pabla, 'Electric Power Distribution', 6th Edn., Tata McGraw Hill Publishing Co. Ltd., 2011
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.
5. Gonen, Turan, 'Electric Power Distribution System Engineering', CRC PRESS, Third Indian Reprint, **2012**.
6. Thomas Allen Short , 'Electric Power Distribution Handbook'**.**

ELECTRIC AND HYBRID VECHILES

Subject Code: MELES2-103 **L T P C** **Duration: 60 Hrs.**
4 0 0 4

Course Objectives: Students will be:
Introduced to conventional and hybrid electric vehicles.
Introduced to the Electric Propulsion unit and DC/AC drives.
Made familiar with electric and hybrid drive trains and sizing of the drive system.
Able to learn about energy storage in Hybrid and Electric Vehicles.
Course Outcomes: Students will be able to:
Acquire knowledge about conventional and hybrid electric vehicles.
Acquire knowledge about Electric Propulsion unit and DC/AC drives.
Match the electric machine and the internal combustion engine.
Estimate about energy storage requirements in Hybrid and Electric Vehicles.

UNIT-I (10 Hrs.)

Conventional Vehicles: Basics of vehicle performance, vehicle power source characterization, transmission characteristics, Mathematical models to describe vehicle performance.
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.

UNIT-II (20 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.
Introduction to DC Motor Drives: Review of Four quadrant operation of a DC machine; Steady-state operation of multi-quadrant chopper fed DC drive, regenerative braking, Introduction to various PM motors, BLDC and PMSM drive configurations and their speed and torque control.
Introduction to AC Motor Drives: Voltage fed inverter control-V/f control, Vector control, direct torque and flux control (DTC) of induction machines, Open loop v/f control, vector control, direct torque control of synchronous motor drives.

UNIT-III (15 Hrs.)

Electric Drive-Trains: Basic concept of electric traction, Various electric drive-train topologies, Power flow control in electric drive-train topologies, Fuel efficiency analysis.
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.
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-IV (15 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.
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. Iqbal Hussain, 'Electric and Hybrid Vehicles', CRC Press, 2nd Eddition, 2010.
2. A.K. Babu, 'Electric and Hybrid Vehicles', Khanna Publishers, 2019.
3. Sira -Ramirez, R. Silva Ortigoza, 'Control Design Techniques in Power Electronics Devices', Springer.
4. Siew-Chong Tan, Yuk-Ming Lai, Chi Kong Tse, 'Sliding Mode Control of Switching Power Converters'.

POWER SYSTEM LAB-I

Subject Code: MELES2-104 **L T P C** **Duration: 60 Hrs.**
0 0 4 2

Course Objectives: To make the students able:
To do the load flow analysis using various methods.
To plan the economic operation of power systems by finding optimum loading schedule of the generators and to optimally commit the generating units.
To calculate fault currents.
To evaluate transient stability of single/ multi-machines connected to infinite bus.
To simulate automatic generation and voltage control and load frequency control.
Course Outcomes: Students will be able to use the relevant software for programming:
To do the load flow analysis using various methods.
To plan the economic operation of power systems by finding optimum loading schedule of the generators and optimal unit commitment.
To calculate fault currents. Also, to evaluate transient stability of machines connected to infinite bus.
To simulate automatic generation control and load frequency control.

LIST OF EXPERIMENTS
NOTE: Students should be made familiar with one or more available programming language/software like MATLAB, ETAP, GAMS, Power System Toolbox, Power world Simulator, Network Simulator, LABVIEW, etc. so as to develop programs using one or more of these for:

1. Review of basics of the available programming language.
2. Load flow analysis by using Gauss Seidel (G-S) method.
3. Load flow analysis by using Newton-Raphson (N-R) method.
4. Load flow analysis by using decoupled and fast decoupled N-R method.
5. Short circuit Fault analysis.
6. Economic dispatch of power generation.
7. To find optimum loading of generators neglecting transmission losses.
8. To find optimum loading of generators with penalty factors.
9. Optimal unit commitment.
10. Simulink model of single area load frequency control with and without PI controller.
11. Simulink model for two area load frequency control.
12. Simulink model for evaluating transient stability of single/multi machine connected to infinite bus.
13. Simulation of automatic generation control.

RESTRUCTURED POWER SYSTEM

Subject Code: MELED2 – 111 **L T P C** **Duration: 60 Hours**
4 0 0 4

Course Objectives: To make the students to:
To introduce the concept of restructuring of the electricity market and its components
To make the students familiar about the deregulation of the electricity market
To introduce the concept of the Competitive Wholesale Electricity Markets
To make the students familiar about Transmission Open Access in electricity markets
Course Outcomes: Students will be able to:
To describe the process of restructuring of the electricity market
To understand the process of deregulation of the electricity market
To understand concept, types and challenges in Competitive Wholesale Electricity Markets
To understand the concept of Transmission Open Access in electricity markets

UNIT-I (15 Hrs.)

Components of Restructured Power System
Introduction, The Traditional Power Industry, Motivations for Restructuring the Power Industry, Unbundling Generation, Transmission and Distribution, Components of Restructured Power System (BOT Plant Operators & Contracted IPPs, Discos & Retailers, Transmission Owners (TOs), Independent System Operator (ISO), Power Exchange (PX), Scheduling Coordinators (SCs), PX Functions and Responsibilities, California Power Exchange, ISO Functions and Responsibilities, Classification of ISO types.

UNIT-II (15 Hrs.)

Deregulation of Electric Utilities
Introduction of Deregulation, Traditional Central Utility Model, Reform Motivations, Separation of Ownership and Operation, Central Dispatch Versus Market Solution, Competition and Direct Access in the Electricity Market (Energy Market and Auction Mechanisms), Direct Access/Wheeling, Independent System Operator (Pricing and Market Clearing, Risk Taking), Retail Electric Providers, Different Experiences of deregulation of England & Wales, Norway, California, Scotland, The European Union and Germany and New Zealand.

UNIT-III (15 Hrs.)

Competitive Wholesale Electricity Markets:
Introduction, Wholesale Electricity Market Characteristics (Small Test System, Central Auction, Bidding, Market Clearing and Pricing, Market Timing, Sequential and Simultaneous Markets, Bilateral Trading, Scheduling, Gaming, Ancillary Services, Physical and Financial Markets), Market models (Maximalist ISO, Minimalist ISO Model), Challenges (Market Power Evaluation and Mitigation, System Capacity, Reliability, Technical Issues).

UNIT-IV (15 Hrs.)

Transmission Open Access
Introduction, Trading Arrangements (The Pool, Pool and Bilateral Trades, Multilateral Trades) Transmission Pricing in Open-access Systems (Introduction, Rolled-in Pricing Methods. Incremental/ Marginal Pricing Methods, Embedded Cost Recovery, Transmission Pricing Method in the NGC & UK), Open Transmission System Operation, Dispatch, Transmission Loss Compensation (System Control, Ancillary Service Provision), Congestion Management in Open-access Transmission Systems (Normal Operation, Integrated Transmission Dispatch Strategy, Illustration Using a Small Power System), Open Access Coordination Strategies (Price Elasticity, ISO Executed Price Signalling, Coordination between Transactions, Illustration of Transaction Procedure and Integrated Coordination Procedure)

Recommended Books:

1. Loi Lei Lai, 'Power System Restructuring and Deregulation', John Wiley & Sons Ltd., 2002.
2. Lorrin Philipson, H. Lee Willis, 'Understanding Electric Utilities and De-regulation', Marcel Dekker, 1998.
3. **Gan Donghan Feng; Jun Xie, 'Electricity Markets And Power System Economics by; T&F India.**
4. Kankar Bhattacharya, Jaap E. Daadler, Math H.J. Boolen, 'Operation of Restructured Power Systems', Kluwer Academic Pub.,2001.
5. Mohammad Shahidehpour, Muwaffaq Alomoush, 'Restructured Electrical Power Systems: Operation, Trading and Volatility', Marcel Dekker.

ENERGY MANAGEMENT AND ENERGY AUDITING

Subject Code: MELED2 – 112 **L T P C** **Duration: 60 Hours**
4 0 0 4

Course Objectives: Students will be able to:
To understand the need for energy auditing
Understanding of various loads involved based on power consumption for auditing
To know about different audit instruments used in practice.
Course Outcomes: Students will be able:
To acquire the skills and techniques required to implement energy management. Able to perform Basic Energy Audit in an Organization.
To calculate different types of losses and hence evaluate and improve the energy efficiency of electric motors and transformers.
To apply Energy Efficient Technologies in Electrical Systems. Energy saving opportunities with energy efficient motors
Identify and quantify the energy intensive business activities in an organization.

UNIT – I (15 Hrs.)

Energy Scenario: Commercial and non-commercial energy, Primary energy resources, Commercial energy production, Final energy consumption, Energy needs of growing economy, Long term energy scenario, Energy pricing, Energy sector reforms, Energy and environment, Energy security, Energy conservation and its importance, Restructuring of the energy supply sector, Energy strategy for the future, Air pollution, Climate change, Energy Conservation Act-2001 and its features.
Energy Management and Audit: Definition, Energy audit, Need, Types of energy audit, Energy management (audit) approach, Energy costs, Bench marking, Energy performance, Matching energy use to requirement, Maximizing system efficiencies, Optimizing the input energy requirements, Fuel & energy substitution, Energy audit instruments, Material and energy balance, Methods for preparing process flow and Material and energy balance diagrams.

UNIT – II (15 Hrs.)

Electric motors: Energy efficient controls and starting efficiency, Motor Efficiency and Load, Analysis Energy efficient /high efficient Motors, Load Matching and selection of motors, Losses in induction motors, Factors affecting motor performance, Rewinding and motor replacement issues, Energy saving opportunities with energy efficient motors
Transformer: Loading/Efficiency analysis, Feeder/cable loss evaluation, case study, Reactive Power management-Capacitor, Sizing-Degree of Compensation-Capacitor losses, Location-Placement, Maintenance, Case study.

UNIT- III (15 Hrs.)

Energy Efficiency in Electrical Systems: Electrical system, Electricity tariffs, Electricity billing, Electrical load management and maximum demand control, Power factor improvement and its benefit, Selection and location of capacitors, Performance assessment of PF capacitors.
Energy Efficient Technologies in Electrical Systems: Maximum demand controllers, Automatic power factor controllers, Energy efficient motors, Soft starters with energy saver, Variable speed drives, Energy efficient transformers, Electronic ballast, Occupancy sensors, Energy efficient lighting controls, Energy saving potential of each technology.

UNIT – IV (15 Hrs.)

Electric loads of Air conditioning &Refrigeration: Energy conservation measures- Cool storage, Types-Optimal operation, case study.
Electric water heating: Geysers-Solar Water Heaters, Power Consumption in Compressors, Energy conservation measures, Electrolytic Process, Computer Controls- software-EMS

Energy Efficiency in Industrial Systems: Types, Performance evaluation, Efficient system operation, Flow control strategies and energy conservation opportunities in Fans and Blowers, Pumps and pumping system, Cooling tower.

Recommended Books:

1. Anthony J. Pansini, Kenneth D. Smalling, .Guide to Electric Load Management., Pennwell Pub; (1998)
2. Howard E. Jordan, .Energy-Efficient Electric Motors and Their Applications., Plenum Pub Corp; 2ndedition (1994)
3. Giovanni Petrecca, .Industrial Energy Management: Principles and Applications., The Kluwerinternational series -207,1999
4. Y P Abbi and Shashank Jain, Handbook on Energy Audit and Environment Management , TERI,2006
5. Albert Thumann, William J. Younger, Terry Niehus, Handbook of Energy Audits 2009

ARTIFICIAL INTELLIGENCE TECHNIQUES

Subject Code: MELED2 – 113 **L T P C** **Duration: 60 Hours**
4 0 0 4

Course Objectives: To make the students to:
To understand basics of AI & Soft computing techniques.
Learn the concepts of biological foundations of artificial neural networks.
Understand Genetic Algorithm and Evolutionary programming.
Understand, fuzzy logic and fuzzy neural networks.
Learn to apply these techniques to practical problems.
Course Outcomes: The students will acquire the skills:
To apply artificial neural networks in various electrical and electronics engineering applications.
To apply Genetic Algorithm and Evolutionary programming to solve engineering problems.
To take up fuzzy systems approach to solve applications in engineering.
Required to innovate and build, smart and intelligent applications in industrial control systems by using all these methods.

UNIT-1 (15 Hrs.)

Artificial Neural Networks: Artificial Neuron models, Types of activation functions, Neural network architectures, Neural Learning: Correlation, Competitive, Feedback based weight adaptation, Evaluation of networks, Generalizability, Computational resources, Supervised learning: Perceptron's, linear separability, Multilayer networks, Back propagation algorithm and its variants, Unsupervised learning, Winner–take all networks, Adaptive resonance theory, Self-organizing maps, Hopfield networks, Typical application in identification, Optimization, and other industrial control methods.

UNIT-II (15 Hrs.)

Fuzzy Logic: Fuzziness vs probability, Crisp logic vs fuzzy logic, Fuzzy sets and systems, Operations on sets, Fuzzy relations, Membership functions, Fuzzy rule generation, Defuzzification, Mamdani and Takagi-Sugeno Model, Fuzzy controllers.
Database – rule base – Inference engine.
Genetic Algorithm (GA): Introduction, Working principle, Coding of variables, Fitness function, Comparison with traditional methods, Constraints and penalty function, GA operators; reproduction, cross over, mutation, Real coded GA, Applications of GA in optimization and to practical problems.

UNIT-III (15 Hrs.)

Evolutionary Computation: Introduction to optimization problem, Constraints, Objective functions, Unimodal / multimodal problems, Classical v/s Evolutionary computational techniques, Genetic Algorithms and its Operators,
Introduction to Advanced AI techniques: Particle Swarm Optimization, Ant Colony Optimization, Differential Evolution Hybrid techniques; Fuzzy Genetic, Genetic-Neural networks etc.

UNIT-IV (15 Hrs.)

Associative Models And Control Schemes In Nn
Auto & hetero associative memory – bi-directional associative memory – Self organizing feature Maps-Hopfield Networks-Neural Networks for non – linear system – Schemes of Neuro control – System identification – forward model and – Inverse model – Case studies.
Applications: Applications of Neural network, Fuzzy system & Genetic algorithms for power systems and power electronics Systems-Designing of controllers using Simulation Software, NN tool box & Fuzzy Logic Toolbox.
Recommended Books:

1. N.P. Padhy, 'Artificial Intelligence and Intelligent Systems', Oxford University Press, 2005.
2. S. Russel and P. Norvig, "Artificial Intelligence – A Modern Approach", Second Edition, Pearson Education.
3. G. Luger, "Artificial Intelligence: Structures and Strategies for complex problem solving", Fourth Edition, Pearson Education.
4. J.M. Zurada, 'An Introduction to ANN', Jaico Publishing House, West, **1992**.
5. Simon Haykins, 'Neural Networks', Pearson Prentice Hall, **2005.**
6. Awrence Fausatt, 'Fundamentals of Neural Networks', Prentice Hall of India, New Delhi, **1994**.
7. Timothy J. Ross, 'Fuzzy Logic with Engineering Applications', McGraw Hill International Edition, USA, **1997**.
8. Driankov, Dimitra, 'An Introduction to Fuzzy Control', Narosa Publication.
9. Davis E. Goldberg, 'Genetic Algorithms in Search, Optimization, and Machine Learning', Adison Willey Publishing Company, **1989**.
10. Siva Nandam, 'Introduction to Fuzzy Logic using MATLAB', Springer Science & Business Media, **2006**.

INDUSTRIAL LOAD MODELING AND CONTROL

Subject Code: MELED2-121 **L T P C** **Duration: 60 Hours**
4 0 0 4

Course Objectives: To acquaint the students with:
The energy demand scenario.
The modeling of load and to study load demand industrially.
To know electricity pricing models.
Study reactive power management in industries.
Course Outcomes: Students will be able to:
Manage load and pricing in industries.
Manage reactive power in industries and apply different energy saving opportunities in cooling and heating loads.
Apply load management to reduce demand of electricity during peak time.
Knowledge about load control techniques in industries and its application.

UNIT-I (15 Hrs.)

Industrial Load Management: Electric Energy Scenario, Demand side management, Load curves, Load Shaping Objectives, Methodologies, Barriers, Classification of industrial loads, Continuous and Batch processes, Load modeling.
Pricing and Control: Electricity pricing, Dynamic and spot pricing Models, Direct load control, Interruptible load control, Bottom up approach, Scheduling, Formulation of load Models, Optimization and control algorithms, Case studies.

UNIT– II (15 Hrs.)

Reactive Power Management in Industries: Power quality problems and Reactive power compensation at distribution level, Controls, Power quality impacts, Choice of filters, Application of filters, Energy saving in industries.
Cooling and Heating Loads: Load profiling, Modeling cool storage, Types, Control strategies, optimal operation, Problem formulation, Case studies.

UNIT-III (10 Hrs.)

Energy banking, industrial cogeneration and Captive power units: Operating and control strategies, Power Pooling, Operation models, Selection of Schemes, Optimal operating strategies, Peak load saving, Constraints problem formulation, Case study

UNIT– IV (20 hrs)

Integrated Load Control for Industries: Design of Multi-loop Controllers: Interactions and decoupling of control loops, Design of cross controllers and selection of loops using Relative Gain Array (RGA).
Advanced Control Schemes: Structure, analysis and application of Cascade control, Selective control, Ratio Control, Design of steady state and dynamic feed forward controller, Feed forward combined with feedback control, Structure, analysis and applications of inferential control, Dead time and inverse response compensators, Concepts and applications of Adaptive control.

Recommended Books:

1. C.O. Bjork, 'Industrial Load Management - Theory, Practice and Simulations', Elsevier, the Netherlands, **1989.**
2. C.W. Gellings and S.N. Talukdar, 'Load Management Concepts', IEEE Press, New York, 1986.
3. Y. Manichaikul and F.C. Schweppe, 'Physically based Industrial load', IEEE Trans. on PAS, April, **1981.**
4. H.G. Stoll, 'Least Cost Electricity Utility Planning', Wiley Interscience Publication, USA,

1989.
5. I.J. Nagarath and D.P. Kothari, Modern Power System Engineering., Tata McGraw Hill publishers, NewDelhi, 1995
6. IEEE Bronze Book- 'Recommended Practice for Energy Conservation and Cost Effective planning in Industrial Facilities', IEEE Inc., USA.

ADVANCED AC/DC LV/MV DRIVE SYSTEMS

Subject Code: MELED2-122 **L T P C** **Duration: 60 Hours**
4 0 0 4

Course Objects: To make the students aware about:
The power electronic converters and their control strategies used for DC and AC motor speed control.
The principles of speed-control of DC motors and to apply these methods for speed control of DC drives.
The principles of speed-control of induction motors and to apply these methods for speed control of AC drives.
The principles of speed-control of Synchronous Motor Drives, Permanent Magnet Motor Drives, Switched Reluctance Motor Drives.
Course Outcomes: students will demonstrate the ability to:
Use the power electronic converters and their control strategies for DC and AC motor speed control.
Understand the principles of speed-control of DC motors and to apply these methods for speed control of DC drives.
Understand the principles of speed-control of induction motors and to apply these methods for speed control of AC drives.
Understand the principles of speed-control of Synchronous Motor Drives, Permanent Magnet Motor Drives, Switched Reluctance Motor Drives.

UNIT – I (15 hours)

Review of DC Motor Characteristics: Review of e.m.f and torque equations, and torque-speed characteristics of separately excited DC motor, Effect of change in armature voltage and load on torque-speed characteristics, Armature voltage control for varying motor speed, flux weakening for high speed operation.
Chopper Fed DC Drives: Review of DC chopper and duty ratio control, Chopper fed DC motor for speed control and its Steady state operation, Armature current waveform and ripple, Calculation of losses in DC motor and chopper, efficiency of DC drive, smooth starting.

UNIT – II (15 hours)

Multi-quadrant DC Drive: Review of motoring and generating modes operation of a separately excited DC machine, Four quadrant operation of DC machine; single-quadrant, two-quadrant and four-quadrant choppers; Steady-state operation of multi-quadrant chopper fed DC drive, regenerative braking.
Closed-loop control of DC Drive: Control structure of DC drive, Inner current loop and outer speed loop, Dynamic model of DC motor – dynamic equations and transfer functions.

UNIT – III (15 hours)

Review of Induction Motor characteristics: Review of induction motor equivalent circuit and torque-speed characteristic, variation of torque-speed curve with (i) applied voltage, (ii) applied frequency and (iii) applied voltage and frequency, Impact of rotor resistance on the torque-speed curve of slip ring induction motor, Power electronic based rotor side control of slip ring motor, Slip power recovery, Operating point, constant flux operation, flux weakening operation.
Induction Motor Drives: Different transformations and reference frame theory, modeling of induction machines, Voltage fed inverter control-V/f control, Vector control, direct torque and flux control (DTC).
Scalar Control or Constant V/f Control of Induction Motor: Review of three-phase voltage source inverter, generation of three-phase PWM signals, sinusoidal modulation, space vector theory, conventional space vector modulation; constant V/f control of induction motor, steady-state performance analysis based on equivalent circuit, speed drop with loading, slip regulation.

UNIT – IV (15 hours)

Synchronous Motor Drives: Modeling of synchronous machines, open loop v/f control, vector control, direct torque control, CSI fed synchronous motor drives.

Permanent Magnet Motor Drives: Introduction to various PM motors, BLDC and PMSM drive configuration, comparison, block diagrams, Speed and torque control in BLDC and PMSM.

Switched Reluctance Motor Drives: Evolution of switched reluctance motors (SRM), various topologies for SRM drives, comparison, Closed loop speed and torque control of SRM.

Recommended Books:

1. G. K. Dubey, "Power Semiconductor Controlled Drives", Prentice Hall, 1989.
2. R. Krishnan, "Electric Motor Drives: Modeling, Analysis and Control", Prentice Hall, 2001.
3. R. Krishnan, " Permanent Magnet Synchronous and Brushless DC motor Drives", CRC Press, 2009.
4. G. K. Dubey, " Fundamentals of Electrical Drives", CRC Press, 2002.
5. W. Leonhard, "Control of Electric Drives", Springer Science & Business Media, 2001.
6. B. K. Bose, "Modern Power Electronics and AC Drives", Pearson Education, Asia, 2003.

POWER SYSTEM TRANSIENTS

Subject Code: MELED2-123 **L T P C** **Duration: 60 Hours**
4 0 0 4

Course Objectives: To make the students aware about:
The occurrence of transients in a power system.
The fundamental circuit analysis of electrical transients to know about change in parameters like voltage and frequency during transients.
The Generation of over-voltages on transmission lines due to lightning and switching phenomenon etc. and protection against these over voltages.
About insulation coordination.
Course Outcomes: Students will be able to:
Knowledge of various transients that could occur in power system.
Model the power system for transient analysis.
To design various protective devices in power system for protecting equipment and personnel against over-voltages.
Coordinating the insulation of various equipment in power system.

UNIT- I (15 Hrs.)

Surge parameters of plant: Equivalent circuit representations, Lumped and distributed circuit transients, Types of system transients, Travelling waves and propagation of surges, Reflection and Refraction of travelling waves, Attenuation and distortion of travelling waves, Traveling waves in distributed parameter multi-conductor lines, parameters as a function of frequency, Determination of system voltages produced by travelling waves.
Line energization and de-energization transients: Earth and earth wire effects, Current chopping in circuit breakers, Short line fault condition and its relation to circuit breaker duty, Trapped charge effects, Effect of source and source representation in short line fault studies, Control of transients.

UNIT- II (15 Hrs.)

Fundamental circuit analysis of electrical transients: Laplace Transform method of solving simple Switching transients, Damping circuits, Abnormal switching transients, Three-phase circuits and transients.
Computation of power system transients: Principle of digital computation, Matrix method of solution, Modal analysis, Z transform- Computation using EMTP (electromagnetic transients program).

UNIT- III (15 Hrs.)

Generation of over-voltages on transmission lines: Lightning, switching and temporary over voltages, Physical phenomena of lightning, Effect of lightning on power transmission system, Influence of tower footing resistance and earth resistance, switching: Short line or kilometric fault, energizing transients - closing and re-closing of lines, line dropping, load rejection, over voltages induced by faults.
Protective devices: Protection of system against over voltages, Surge diverters, Lightning arresters, Neutral grounding, Substation earthing, Simulation of surge diverters in transient analysis.

UNIT- IV (15 Hrs.)

Switching of HVDC line: travelling waves on transmission line, Circuits with distributed parameters wave equation, Reflection, Refraction, Behavior of Travelling waves at the line terminations, Lattice Diagrams – attenuation and distortion, Multi-conductor system and Velocity wave.
Insulation Co-ordination: Over voltage limiting devices, dielectric properties, breakdown of gaseous insulation, tracking and erosion of insulation, high current arcs, and metallic contacts.

Principle of insulation co-ordination in Air Insulated substation (AIS) and Gas Insulated Substation (GIS), Coordination between insulation and protection level, Statistical approach.

Recommended Books:

1. Allan Greenwood, 'Electrical Transients in Power System', Wiley & Sons Inc. New York, 1991.
2. J. Arrillaga and C.P. Arnold, 'Computer Aided Power System', John Wiley and Sons, **1994**.
3. Sunil S. Rao, 'Switch Gear Protection and Power System', Khanna Publishers, **2008.**
4. V.A. Vanikov, 'Transients in Power System', Mir Publications, Moscow.
5. L.V. Bewley, 'Traveling Waves on Transmission Lines', Dover Publications Inc., New York.
6. Ravindera Arora and Mosch Wolfgang, 'High Voltage Insulation Engineering', New AgeInternational Publishers Limited

2nd Semester

ADVANCED PROTECTION OF POWER SYSTEM

Subject Code: MELES2-201 **L T P C** **Duration: 60 Hours**
4 0 0 4

Course Objectives: To make the students familiar to:
Numerical and digital relays.
Mathematical approach towards protection.
The development of algorithms for numerical protection.
The Application of Artificial Intelligence Based technique for digital protection.
Course Outcomes: Students will be able:
To learn the evolution of Digital Relays.
To apply Mathematical approach for numerical protection.
To develop various Protection algorithms for use in digital relays.
Learn to apply Artificial Intelligence Based Numerical Protection.

UNIT-1 (10 Hrs.)

Fundamentals: Classification of protective schemes; Overcurrent, Distance, and Differential protection, Review of basic components of a conventional protection system; Current (CT) and Voltage (VT) transformers, Relays, circuit breakers and trip circuit, Essential qualities of protection, Classification of relays based on their function, Phase and amplitude comparators. Static Comparators.
Evolution of digital relays from electromechanical relays**,** Performance and operational characteristics of digital protection**,** Recent Advances in Digital Protection of Power Systems.

UNIT-II (20 Hrs.)

Numerical Protection: Block diagram of a typical numerical relay, Advantages of numerical relays, Data acquisition system, Mathematical background to protection algorithms; Sample and first derivative (Mann and Morrison) technique, Differential equation based technique,
Discrete Fourier transform (DFT) technique; Fourier series with real and complex coefficients, Discrete Fourier Transform (DFT), Extraction of Fundamental frequency components; Full-cycle window algorithm, Half-cycle window algorithm, Computation of apparent impedance.
Walsh-Hadamard transform technique and its algorithm, Block pulse functions technique, Wavelet transform technique based algorithms**,** Numerical overcurrent protection, Numerical distance protection, and Numerical differential protection.

UNIT-III (20 Hrs.)

Microprocessor Based Numerical Protective Relays: Basic elements of digital protection; IC elements and circuits for interface, A/D converter, Analog multiplexer, Sample and Hold circuit, Their interfacing with microprocessor, Signal conditioning, the sampling theorem, signal aliasing**,** Error, Digital filtering concepts.
Digital relays: Digital relays as a unit consisting of hardware and software, digital Overcurrent relay, digital Impedance relay, digital Directional relay, digital Reactance relay, Generalized mathematical expression for distance relays, Measurement of Resistance (R) and Reactance (X), Digital Mho relay, Quadrilateral relay, Generalized interface for distance relays.

UNIT-IV (10 Hrs.)

Artificial Intelligence Based Numerical Protection: Artificial Neural Network, Fuzzy logic, Application of Artificial Intelligence to power system protection, **Application of ANN and Fuzzy Logic to:** Overcurrent protection, Transmission line protection, Power transformer protection, Generator protection, Directional relay, ANN modular approach for fault detection, classification and location.

Recommended Books:

1. Badri Ram, D N Vishwakarma, 'Power System Protection and Switchgear', Tata McGraw-Hill, 2011.
2. A.G. Phadke and J.S. Thorp, 'Computer Relaying for Power Systems', Wiley/Research Studies Press**, 2009.**
3. A.T. Johns and S.K. Salman, 'Digital Protection of Power Systems', IEEE Press, 1999.
4. Gerhard Zeigler, 'Numerical Distance Protection', Siemens Publicis Corporate Publishing, 2006.
5. S.R. Bhide, 'Digital Power System Protection', PHI Learning Pvt. Ltd., 2014.
6. T.S. Madhava Rao, 'Power System Protection: Static Relays: with Microprocessor Applications', 2017.
7. B. Ravindra Nath M. Chander, 'Power System Protection and Switch Gear', John Wiley Eastern,1989.
8. Sunil S. Rao, 'Power System Protection and Switch Gear', Khanna Publishers, 1989.

POWER SYSTEM DYNAMICS & STABILITY

Subject Code: MELES2-202 **L T P C** **Duration: 60 Hours**
4 0 0 4

Course Objectives: Students will be able to:
Study of system dynamics and its physical interpretation.
Development of mathematical models for synchronous machine and induction machines.
Understand small signal and large signal stability problems, and carry out stability analysis with and without power system stabilizer (PSS).
Analyze the effect of small speed changes in synchronous machines and voltage regulator governor system, and to enhance voltage stability margin of power system.
Course Outcomes: Students will be able to:
Develop mathematical models for synchronous machine.
Develop Models of induction motor.
Understand the system dynamics and analyze the stability of dynamic systems and voltage stability problem.
Implement modern control strategies for improving stability of the power system.

UNIT-I (15 Hrs.)

Modeling of Synchronous Machines: Simplest Model of the Synchronous Machine, Equations in Physical Quantities, Inductance of Synchronous Machine, Park's Transformation to dqO components, Phasor Diagram, Equivalent Circuit and Phasor Diagram, Excitation Systems, Sub-synchronous resonance, Significance of SCR, Synchronous machine dynamics (Electromechanical transients).

UNIT-II (15 Hrs.)

Basic load modeling concepts: Static load models, Dynamic load models.
Modeling of induction motors: Equations of an induction machine, Steady-state characteristics, and Alternative rotor constructions.

UNIT-III (15 Hrs.)

Fundamental Concepts of Stability of Dynamic Systems: Stability definitions, State-space representation, Stability of dynamic system, Analysis of stability, Small signal stability of single machine infinite bus system: Generator represented by the classical model, Effects of synchronous machine field circuit dynamics.
Voltage stability: Basic concepts related to voltage stability, classification of voltage stability, Transmission system characteristics, Generator characteristics, Load characteristics, Characteristics of reactive compensating device, Multi-Machine Stability.
Voltage collapse: Typical scenario of voltage collapse, General characteristics based on actual incidents, Prevention of voltage collapse.

UNIT-IV (15 Hrs.)

Methods of Improving Stability: Automatic voltage regulator, Power system stabilizers, Active power and frequency control: Fundamental of automatic generation control, Implementation of AGC, Under frequency load shedding. Reactive power and voltage control: Production and absorption of reactive power, Method of voltage control, Shunt reactors, shunt capacitors, series capacitors, synchronous condensers, static VAR systems.

Recommended Books:

1. P. Kundur,'Power System Stability and Control'Mc GrawHill, 1994.
2. L. P. Singh, 'Adavanced power systems Analysis and Dynamics', New Age International Publishers.
3. C. W. Taylor, 'Power System Voltage Stability' McGraw Hill.
4. P. M. Anderson and A. A. Fouad,'Power System Control and Stability', IEEE Press.
5. E. Kimbark,'Power System Stability', Vol.I, II & III, IEEEPress, 2002.
6. J. Machowski, J. Bialek and J.R.W. Bumby, 'Power System Dynamics and Stability', John Wiley & Sons, **1997.**
7. L. Leonard Grigsby (Ed.), 'Power System Stability and Control', 2nd Edn., CRC Press, 2007.

SMART GRIDS

Subject Code: MELES2-203 **L T P C** **Duration: 60 Hrs.**
4 0 0 4

Course Objectives: Students will be able to:
To understand concept of Smart Grid and its Advantages and its metering.
To understand Smart Grid technologies.
To understand about Micro grid and power quality.
To understand about communication in smart grid and distribution management system.
Course Outcomes: Students will be able to:
To describe concept of Smart Grid and its Advantages and its metering.
To describe Smart Grid technologies.
To know about Micro grid and power quality.
To describe about communication in smart grid and distribution management system.

UNIT-I (10 Hrs.)

Introduction to Smart Grid: Evolution of Electric Grid, Concept of Smart Grid, Definitions and Necessity of Smart Grid, Today's Grid versus the Smart Grid, Functions of Smart Grid Components, General View of the Smart Grid Market Drive, Concept of Robust & Self-Healing grid, Present Development & International Policies in Smart Grid.

UNIT-II (20 Hrs.)

Introduction to Smart Metering: Evolution of Smart Metering, Key components of Smart metering, 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.
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-III (15 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.
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-IV (15 Hrs.)

Information and Communication Technology for Smart Grid: Advanced Metering Infrastructure (AMI), Home Area Network (HAN), Neighborhood Area Network (NAN), Wide Area Network (WAN), Bluetooth, Zig-Bee, GPS, Wi-Fi, Wi-Max based communication, Wireless Mesh Network, Basics of CLOUD Computing & Cyber Security for Smart Grid, Broadband over Power line (BPL), IP based protocols, Communication through GPRS and Power Line Carrier Communication, Internet of Things (IoT) based Protocols.
Distribution Management System:-Introduction, Substation automation equipment, Faults in distribution system, Fault location & isolation and restoration, Components of fault isolation and restoration, Voltage regulation.

Recommended Books:

1. Janaka Ekanayake, Kithsiri Liyanage, Jianzhong Wu and Nick Jenkins, 'Smart Grid: Technology and Applications', Wiley Online Library, 2012.
2. James A. Momoh, "Smart Grid:-Fundamental of design and Analysis", IEEE Press, Wiley Publication.
3. Lars T.Berger, Krzyszt of, "Smart Grid:- Application, Communication, and Security", Wiley Publication.
4. Ali Keyhani, 'Design of Smart Power Grid Renewable Energy Systems', 2nd Edn., Wiley IEEE Press.
5. Clark W. Gellings, 'The Smart Grid: Enabling Energy Efficiency and Demand Response', CRC Press, **2009**.
6. Stuart Borlase, 'Smart Grid: Infrastructure, Technology and solutions', CRC Press.

POWER SYSTEM LAB-II.

Subject Code: MELES2-204 **L T P C** **Duration: 60 Hrs.**
0 0 4 2

Course Objectives: To make the students aware about:

The various parameters that affect the output of solar panels and wind turbines.
The operation, control and protection aspects of micro-grids and the methods to enhance power quality of power system.
The smart grid technologies, metering and application of real time pricing.
The use of communication technologies for advanced metering Infrastructure.

Course Outcomes: Students will be able:

To know the various parameters affecting the solar panel output and wind turbine output.
To operate, control and protect micro-grids.
To know methods to enhance power quality of power system.
To know about smart grid technologies, metering and to apply real time pricing.
To use communication technologies for advanced metering Infrastructure.

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.
9. Grid integration of solar power output using power electronics interfaces.
10. Application of real time pricing in smart grids.
11. Operation, control and protection of micro-grids.
12. Power quality analysis and enhancement of power system.
13. Use of communication technologies for advanced metering Infrastructure.

POWER QUALITY

Subject Code: MELED2-211 **L T P C** **Duration: 60 Hrs.**
4 0 0 4

Course Objectives: To make the students aware about:
Review definitions and standards of common power quality phenomena.
Understand power quality monitoring and classification techniques.
Investigate different power quality phenomena causes and effects.
Understand different techniques for power quality problems mitigation.
Course Outcomes (COs): The students will be able to:
Acquire knowledge about the parameters of power quality and harmonics in power systems.
Acquire knowledge about the voltage sags and interruptions and their influence on various components.
Be able to model networks and components for power quality analysis and to apply harmonics filtering techniques.
Apply various methods for power quality monitoring.

UNIT-I (10 Hrs.)

Introduction: Definition of Electric Power Quality, Power Quality -- Voltage Quality, Power Quality Evaluation Procedure
Terms & Definitions: General Classes of Power Quality Problems, Transients, Long Duration Voltage Variations, Short-Duration Voltage Variations, Voltage Imbalance, Waveform Distortion, Voltage Fluctuations, Power Frequency Variations, Power Quality Terms.

UNIT-II (20 Hrs.)

Voltage Sags & Interruptions: Sources of Sags and Interruptions, Estimating Voltage Sag Performance: (i) Area of Vulnerability (Weakness, Exposure), (ii) Types of Equipment Sensitivity to Voltage Sags, (iii) Transmission system sag performance evaluation, (iv) Utility distribution system sag performance evaluation, Fundamental Principles of Protection, Solutions at the End-User Level, Voltage Sag Mitigation Technologies, Motor Starting Sags: (i) Motor-starting methods, (ii) Estimating the sag severity during full-voltage starting.

UNIT-III (20 Hrs.)

Transient Over Voltages: Sources of Transient Over Voltages: (i) Capacitor switching, (ii) Magnification of capacitor-switching transients, (iii) Lightning, (iv) Ferroresonance, Principle of Over Voltage Protection, Voltage Swell Mitigation Technologies, Utility Capacitor-Switching Transients, Utility System Lightning Protection, Switching Transient Problems with Loads.
Fundamentals of Harmonics: Harmonic Distortion, Voltage Versus Current Distortion, Harmonics Versus Transients, Power System Quantities under Non-sinusoidal Conditions, Harmonic Indices, Harmonic Sources from Commercial Loads, Locating Harmonic Sources, Effects of Harmonic Distortion, Harmonic Distortion Evaluations, Principles for Controlling Harmonics, Devices for Controlling Harmonic Distortions.

UNIT-IV (10 Hrs.)

Long Duration Voltage Variations: Principles of Regulating the Voltage, Devices for Voltage Regulation, Utility Voltage Regulator Application, Capacitors for Voltage Regulation, End-User Capacitor Application, , Flicker.
Power Quality Monitoring: Monitoring Considerations**,** Power Quality Measurement Equipments, Assessment of Power Quality Measurement Data, Application of Intelligent Systems, Power Quality Monitoring Standards.

Recommended Books:

1. Roger C. Dugan, Surya Santoso, Mark F. McGranaghan, H. Wayne Beaty, 'Electrical Power Systems Quality', McGraw Hill Professional, **2002.**
2. Angelo Baggini, 'Handbook of Power Quality', Wiley, **2008**.
3. G.T. Heydt, 'Electric Power Quality', McGraw Hill Professional, **2007.**
4. Math H. Bollen, 'Understanding Power Quality Problems', IEEE Press, **2000.**
5. J. Arrillaga, 'Power System Quality Assessment', John Wiley, **2000**
6. J. Arrillaga and N. R. Watson, 'Power System Harmonics', Wiley.
7. George J. Wakileh, 'Power Systems Harmonics', Springer.

FACTS AND CUSTOM POWER DEVICES

Subject Code: MELED2-212 **L T P C** **Duration: 60 Hrs.**
4 0 0 4

Course Objectives: To make the students:
To learn the active and reactive power flow control in power system.
To understand the need for static compensators.
To develop the different control strategies used for compensation.
Course Outcomes: Students will be able to:
Acquire knowledge about the fundamentals of Reactive Power Flow Control in Power Systems.
Acquire knowledge about the fundamental principles of passive and active reactive power compensation schemes at transmission and distribution level in power systems.
Learn various Static shunt and series VAR Compensation devices.
To develop analytical modeling skills needed for modeling and analysis of such Static VAR Systems.

UNIT-I (15 Hrs.)

Reactive Power Flow Control in Power Systems: Control of dynamic power unbalances in Power System, Power flow control, Constraints of maximum transmission line loading, Benefits of FACTS Transmission line compensation, Uncompensated line shunt compensation, Series compensation, Phase angle control, Reactive power compensation, Shunt and Series compensation principles, Reactive compensation at transmission and distribution level.

UNIT-II (15 Hrs.)

Static versus passive VAR compensator, Static shunt compensators: Static VAR compensator (SVC) and Static compensator (STATCOM), Operation and control of Thyristor switched capacitor (TSC), Thyristor controlled reactor (TCR) and STATCOM, Compensator control, Comparison between SVC and STATCOM, Multilevel inverter based DSTATCOM (Distributed Static Compensator) and its applications.

UNIT-III (15 Hrs.)

Static Series Compensation: Thyristor switched series capacitor (TSSC), Static synchronous series compensator (SSSC), Static voltage and phase angle regulators, Thyristor controlled voltage regulators (TCVR) and phase angle regulators (TCPAR): Operation and Control, Applications.
Unified power flow controller (UPFC), Circuit arrangement, Operation and control of UPFC, Basic Principle of active power (P) and reactive power (Q) control, Independent real and reactive power flow control- Applications, Comparison of UPFC and UPQC (unified power quality conditioner).

UNIT-IV (15 Hrs.)

Interline power flow controller (IPFC) & FACTS: Introduction to IPFC and FACTS, Modeling and analysis of FACTS controllers, Simulation of FACTS controllers, Power quality problems in distribution systems, Comparison of various custom power devices and their applications.
Recent Trends: Application of basic active filters, multilevel and multi-pulse converters and Z-source inverter in various FACTS and FACDS devices for improving the performances of transmission system network and distribution system network, respectively.

Recommended Books:

1. K.R. Padiyar, 'FACTS Controllers in Power Transmission and Distribution', New Age International Publishers, **2007.**
2. X.P. Zhang, C. Rehtanz, B. Pal, 'Flexible AC Transmission Systems- Modelling and Control', Springer Verlag, Berlin, **2006.**
3. N.G. Hingorani, L. Gyugyi, 'Understanding FACTS: Concepts and Technology of Flexible AC Transmission Systems', IEEE Press Book, Standard Publishers and Distributors, Delhi, **2001**.
4. K.S. Sureshkumar, S. Ashok, 'FACTS Controllers & Applications', e-book Edn., Nalanda Digital Library, NIT Calicut, **2003.**
5. Y.H. Song and A.T. Johns, 'Flexible AC Transmission Systems', IEEE Press, **1999**.
6. R.M. Mathur and R.K. Verma, 'Thyristor based FACTS controllers for Electrical TransmissionSystems', IEEE Press, **2002**.

DIGITAL TRANSFORMATION IN INDUSTRY

Subject Code: MELED2-213 **L T P C** **Duration: 60 Hours**
4 0 0 4

Course Objectives: To make the students to:
To learn about Industry 4.0 and its foundation for the digital transformation term
To understand the concepts of digital supply chains and smart factory.
Learn basics of block chain technology and its application for crypto currency.
To acquire knowledge about real cases from different industries to know that how industries are evolving with the changes and to learn how to overcome the challenges of digital transformation projects.
Course outcomes: The students will be able:
To review the basic concepts about Industry 4.0 and its foundation for the digital transformation term.
To understand digital supply chains and smartly operate a factory.
To understand block chain technology and its application for crypto currency.
To acquire knowledge to learn to overcome the challenges of digital transformation projects.

UNIT-1 (12 Hrs.)

Introduction: Introduction to Industry 4.0, History of Industry 4.0, Industry 4.0 terminologies definition, Industrial Internet, First stages of maturity, The next maturity stages, Society 5.0, Society 5.0: breaking down 5 walls, The Various Industrial Revolutions: Evolution of Industrial Revolutions, INDUSTRY 4.0 - Drivers, Enablers, Challenges and Benefits.

UNIT-II (18 Hrs.)

Smart Factory: Traditional Supply Chains, Digital Supply Chains and Smart Factory, Characteristics of Smart Factory: Connected, Optimized, Transparency, Proactive, Agile
Introduction to Cloud technology, IoT and overview of deployment models (SaaS, PaaS, IaaS), Introduction to Horizontal and Vertical Integration
Digital Twin: Computer Simulation, Introduction to Augmented reality (AR), Virtual reality (VR) and Mixed Reality (MR) and Comparison of AR, VR and MR.
Role of Artificial intelligence & Machine learning in Industry 4.0.

UNIT-III (15 Hrs.)

Block Chain: Overview, Public Ledgers, Bitcoin, Smart Contracts, Block in a Block chain, Transactions, Distributed Consensus, Public v/s Private Block chain, Basic crypto currency, Crypto currency to Block chain, Permissioned Model of Block chain, Overview of Security aspects of Block chain, Basic Crypto Primitives: Cryptographic Hash Function and its Properties, Hash pointer and Merkle tree, Digital Signature, Public Key Cryptography.
Understanding Crypto Currency with Block Chain: Bitcoin and Block chain: Creation of coins, Payments and double spending, Bitcoin Scripts, Bitcoin P2P Network, Transaction in Bitcoin Network, Block Mining, Block propagation and
block relay, Working with Consensus in Bitcoin: Distributed consensus in open environments, Consensus in a Bitcoin network, Proof of Work (PoW).

UNIT-IV (15 Hrs.)

Digital Transformation: Introduction, Digital business transformation, Causes of disruption and transformation, Digital transformation myths and realities, Digital Transformation and customer experience, 4 pillars in customer experience transformation; IT uplift, Digitizing operations, Digital marketing and Digital businesses. -
Applications of Digital transformation:
Applications of Digital transformation across various industries, Retail industry, Government and the public sector, Insurance industry, Healthcare, Banking: Royal Bank of Scotland case

study, Fintech: Travelex case study, Public Sector: The MET office case study.

Recommended Books:

1. Srinivas R Pangali, Shankar Prakash, Jyothi R Korem, 'Digital Transformation Strategies', Sage publications, 2021
2. Thomas M Siebel, 'Digital Transformation', Rosettabooks, 2019.
3. Antony Lewis, 'The Basics of Bitcoins and Blockchain', Mango Media Incorporation, 2018.

RENEWABLE ENERGY SYSTEM AND DISTRIBUTED GENERATION

Subject Code: MELED2-221 **L T P C** **Duration: 60 Hours**
4 0 0 4

Course Objectives: Students will be able to:
To learn various renewable energy sources.
To gain understanding of integrated operation of renewable energy sources.
To understand Power Electronics Interface with the Grid.
To understand about Distributed Generation.
Course Outcomes: Students will be able to:
Know about various renewable energy sources, especially solar and wind energy in detail.
Know that how to tap hydro energy and energy from biomass.
Know the means and methods to harness energy from tides, waves, and geothermal energy as well as working of fuel cells.
Know the distributed generation system in autonomous/grid connected modes and its impact on Power System.

UNIT-I (15 Hrs.)

Introduction to Renewable Energy Resources: World Energy Future, Conventional Energy Sources, Non-Conventional Energy Sources, Prospects of Renewable Energy Sources, Types, Advantages, Limitations & scope of renewable energy resources.
Solar Energy: Introduction to Solar Radiation and its measurement, Introduction to Solar Energy Collectors and Storage, Solar Electric Power Generation, Solar Photo-Voltaic, Solar Cell Principle, Semiconductor Junctions, Conversion efficiency and power output, Basic Photovoltaic System for Power Generation.
Wind Energy: Introduction to Wind Energy Conversion (WEC), Wind data and energy estimation, Site selection considerations, Basic Components of a Wind Energy Conversion System, Classification of WEC Systems, Schemes for Electric Generation using Synchronous Generator and Induction Generator, Wind energy Storage.

UNIT-II (15 Hrs.)

Hydro Energy: Site selection, Types of power stations, Major components & their working.
Biomass Energy: Biomass conversion technologies, photosynthesis, Bio-gas generation, types of bio-gas plants, Biomass as a Source of Energy: Method for obtaining energy from Bio-mass, Biological Conversion of Solar Energy.

UNIT-III (15 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 (15 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.
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**.
6. G.D. Rai, 'Non-Conventional Sources of Energy', Khanna Publishers.
7. David Boyles, 'Bio Energy', Elis Horwood Ltd.
8. N.K. Bansal and M. Kleemann, M. Heliss, 'Renewable Energy Sources and Conversion Technology', Tata McGraw Hill, **1990**.
9. O.P. Vimal and P.D. Tyagi, 'Bio Energy Spectrum', Bio Energy and Wasteland DevelopmentOrganization.

SCADA SYSTEM AND APPLICATIONS

Subject Code: MELED2-222 **L T P C** **Duration: 60 Hrs.**
4 0 0 4

Course Objectives: To make the students to get insight into the:
Basic architecture and components of SCADA.
Functions and communication in SCADA.
Applications of SCADA.
Course Outcomes: Students will be able to:
Describe the basic tasks of supervisory control and data acquisition systems (SCADA) as well as their typical applications.
Acquire knowledge about SCADA architecture, various advantages and disadvantages of each system.
Knowledge about single unified standard architecture IEC 61850.
To learn about SCADA system components: remote terminal units, PLCs, intelligent electronic devices, HMI systems, SCADA server.
Learn and understand about SCADA applications in transmission and distribution sector, industries etc.

UNIT-I (15 Hrs.)

Introduction to SCADA, Data acquisition systems, Evolution of SCADA, Building blocks of SCADA systems, SCADA System Components, Classification of SCADA systems, Communication technologies, Monitoring and supervisory functions, SCADA applications in Industries and Utility Automation.

UNIT-II (15 Hrs.)

Remote Terminal Unit (RTU) and its components, Intelligent Electronic Devices (IED), Programmable Logic Controller (PLC), Logic subsystem, Termination subsystem, Testing and human-machine interface (HMI) subsystem, Power supplies, Advanced RTU functionalities, Data concentrators and merging units, Master Station: Master station software components, Master station hardware components, SCADA Server, SCADA/HMI Systems, Server systems in the master station, Global positioning systems (GPS), Master station performance.

UNIT-III (15 Hrs.)

SCADA Architecture, Various SCADA architectures, advantages and disadvantages of each system, Single unified standard architecture -IEC 61850.
SCADA Communication, Communication Network, Communication subsystem, various industrial communication technologies, wired and wireless methods and fiber optics, Open standard communication protocols, comparison with wide area monitoring system (WAMS).

UNIT-IV (15 Hrs.)

SCADA Applications: Utility applications, Transmission and distribution sector operations, monitoring, analysis and improvement, Situational awareness, Intelligent alarm filtering: Need and technique, Alarm suppression techniques, Operator needs and requirements, Industries - oil, gas and water, Case studies, Implementation, Simulation exercises.

Recommended Books:

1. Stuart A. Boyer, 'SCADA-Supervisory Control and Data Acquisition', Instrument Society of America Publications, USA, 2004.
2. Gordon Clarke, Deon Reynders, 'Practical Modern SCADA Protocols: DNP3, 60870.5 and Related Systems', Newnes Publications, Oxford, UK, 2004.
3. William T. Shaw, 'Cyber-security for SCADA Systems', Penn Well Books, 2006.

4. David Bailey, Edwin Wright, 'Practical SCADA for Industry', Newnes, 2003.
5. Michael Wiebe, 'A Guide to Utility Automation: AMR, SCADA, and IT Systems for Electric Power', Penn Well Books, 1999.
6. Bela G. Liptak, Halit Eren, 'Instrument Engineers Process Software and Digital Networks', 4th Edn., Vol.-3, 2016.

OPTIMIZATION TECHNIQUES FOR POWER ENGINEERING

Subject Code: MELED2-223 **L T P C** **Duration: 60 Hrs.**
4 0 0 4

Course Objectives: - To introduce the students:
To learn about basics of optimization and essential optimization techniques for applying to day to day problems.
To learn about linear and non-linear programming problems and apply the methods for solving these problems in various fields of engg. and technology.
To acquaint them with unconstrained and constrained multivariable optimization nonlinear programming problems.
To non-conventional optimization methods such as, Genetic Algorithm, Particle swarm optimization etc. and their applications in power system.
Course Outcomes: Students will be able:
To gain knowledge about basics of optimization.
To apply linear and non-linear programming for solving problems in various fields of Engg. and Tech.
To acquire skills to solve unconstrained and constrained multivariable optimization nonlinear programming problems.
To apply non-conventional optimization methods such as Simulated annealing method, Genetic Algorithm, Particle swarm optimization etc.

UNIT-I (10 Hrs.)

Introduction to Optimization: Statement of an optimization problem, Classification of optimization problems, Classical Optimization techniques, Single variable optimization, Multivariable optimization, Optimization with and without inequality constraints, Single objective and multi objective optimization, Engineering applications of optimization.

UNIT-II (20 Hrs.)

Linear Programming (LP): Standard form of linear programming, Simplex method, Revised simplex method, Computer implementation of the Simplex method, Duality theory, Constrained Optimization, Theorems and procedure, linear programming, mathematical model, solution technique, duality.
Non-Linear Programming (NLP): One–Dimensional Minimization Methods: Unimodal function, Dichotomous search, Fibonacci search, Golden Section, Cubic interpolation method, Direct root, Newton Raphson Method.
Transportation Problem: North-West Corner rule, least cost method, Vogel approximation method, testing for optimality.

UNIT-III (15 Hrs.)

Unconstrained Multivariable Optimization Techniques: Random search method, Steepest descent method, Conjugate gradient method, Sequential quadratic programming, Newton Raphson Method, Evolutionary search, Hooke-Jeeves Method, Simplex search Method.
Constrained Optimization Techniques: Interior Penalty function method, Exterior penalty function method, Method of Multipliers, KKT Conditions.
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 (15 Hrs.)

Further Topics in Optimization: Critical path method (CPM), Program evaluation and review technique (PERT), Multi-objective Optimization Techniques, Weighting method, ε- constraint method, Genetic Algorithm, Particle swarm optimization.

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, Applications to power system.

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**.

A. Ravindran, K.M. Ragsdell and G.V. Reklaitis, 'Engineering Optimization: Methods and Applications', Wiley, **2008**.

5. Godfrey C. Onwubolu, B.V. Babu, 'New Optimization Techniques in Engineering', Springer, **2004**.
6. D.P. Kothari & J.S. Dhillon, 'Power System Optimization', Prentice-Hall of India, **2010**.

3rd & 4th Semester

PROJECT

Subject Code: MELES2-301 **L T P C**
0 0 6 3

The object of 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 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 initiation for the student in R&D work. The assignment to normally include:

Survey and study of published literature on the assigned topic.

Define the objective, formulate the problem and prepare an action plan for conducting the investigation.

Then perform the required Experiment/Develop a Simulation Model/Solve the Problem/Develop a Design/Explore the feasibility/Conduct a survey etc. depending upon the action plan.

Analyze the results and prepare a written report on the study conducted for presentation to the Department.

Final seminar, as oral presentation before a departmental committee.

SEMINAR

Subject Code: MELES2-302 **L T P C**
0 0 2 1

Course Objectives:

To identify, understand and discuss current advanced research topics.
To gain experience in the critical assessment of the available scientific literature
To practice the use of various resources to locate and extract information using offline & online tools, journals

Course Outcomes:

An ability to utilize technical resources
An ability to write technical documents and give oral presentations related to the work completed.
To learn preparation and presentation of scientific papers in an exhaustive manner
Each student will be required to prepare a Seminar Report and present a Seminar on a topic in any of the areas of modern technology related to Electrical Engineering including interdisciplinary fields.

NOTE: Seminar will carry 1 credit. It will be done on any topic within/outside the curriculum. Its evaluation will be done as under:

Sr. No.	Parameters for Evaluation	Internal Marks	External Marks
1	Depth & Coverage of Topic	40	-
2	PPT Presentation & Report	20	-
3	Presentation	20	-
4	Questions & Answers	20	-
Total		**100**	**-**

RESEARCH METHODOLOGY AND IPR

Subject Code - MREMI0-101 **LTPC** **Duration-60 hrs**
4 0 0 4

Course Objectives: To make the students to:

1. Understand that how to formulate a research problem, analyze research related information, follow research ethics, and to design experiments.
2. To learn to collect or sample data, process it and validate results etc.
3. Do effective literature studies and develop a research proposal.
4. Understand the need of information about Intellectual Property Right (IPR) in general & engineering in particular.
5. Understand that IPR protection provides an incentive to inventors for further research work and investment in R & D.

Course Outcomes: At the end of this course, students will be able to:

1. Formulate a research problem, analyze research related information, and follow research ethics and design experiments.
2. Collect, sample, scale, validate and process data.
3. To do literature survey effectively and develop a good research proposal.
4. Motivated to do research work and invest in R & D to create new and better products for economic growth and social benefits.

UNIT-I (15 Hrs.)

Research Problem: 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 problems, Data collection, Analysis, Interpretation, Necessary instrumentation.

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 (15 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.

Data Process Operations: Editing, Sorting, Coding, Classification and Tabulation.

UNIT-III (10 Hrs.)

Literature Survey: Importance of literature survey - Sources of information - Assessment of quality of journals and articles - Information through internet. Literature Review: Need of review - Guidelines for review - Record of research review.

Effective Literature Studies Approaches: Analysis Plagiarism, Research ethics, Effective technical writing, Essentials of report writing, Report Format, Paper Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee.

UNIT-IV (20 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.

Patent Rights: Scope of Patent Rights, Licensing and transfer of technology, Patent information

and databases, Introduction to patent searching and World Intellectual Property Organization (WIPO).

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', Juta & Co. Ltd., 1996.
2. Ranjit Kumar, 2nd Edn., 'Research Methodology: A Step by Step Guide for Beginners'.
3. C.R Kothari, "Research Methodology, Methods & Techniques", New Age International Publishers, New Delhi, 2004.
4. R. Ganesan, 'Research Methodology for Engineers', MJP Publishers, Chennai, 2011.
5. Ratan Khananabis and Suvasis Saha, "Research Methodology", Universities Press, Hyderabad, 2015.
6. Vijay Upagade and Aravind Shende, 'Research Methodology', S. Chand & Company Ltd., New Delhi, 2009.
7. G. Nageswara Rao, 'Research Methodology and Quantitative methods', BS Publications, Hyderabad, 2012.
8. Debora J. Halbert, 'Resisting Intellectual Property', Taylor & Francis Ltd., 2005, DOI https://doi.org/10.4324/9780203799512.
9. Robert P. Merges, Peter S. Menell, Mark A. Lemley, 'Intellectual Property in New Technological Age', 2016.
10. T. Ramappa, 'Intellectual Property Rights Under WTO', S. Chand, 2008.

DISSERTATION

Subject Code: MELES2-401 **L T P C**
0 0 --

Note: Students should be advised to go through maximum research papers and conclude a particular domain to work further. Each student will be required to complete a Dissertation and submit a written report on the topic on any of the areas of modern technology related to Electrical Engineering including interdisciplinary fields in the final semester of M. Tech Course.

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.

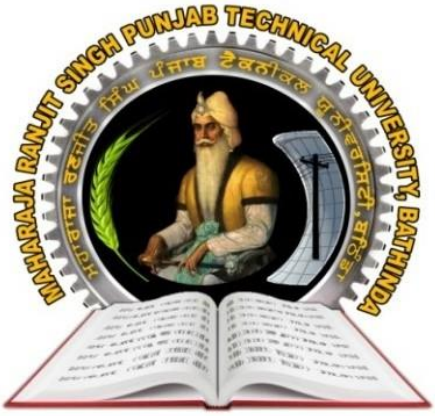
Course Outcomes:

Design a meaningful research project that demonstrates spatial thinking and uses the knowledge and skills.
Define and analyze a problem in latest research areas.
Formulate and write a research proposal.
Synopsis and its Presentation.
Execute a meaningful research project that demonstrates spatial thinking and uses the knowledge and skills.
Able to learn effectively record data and experiments so that others can understand them.
Communicate the findings by means of a thesis, written in the format specified by the department/institute.

The Dissertation will carry 20 credits and will be evaluated as under:

Sr. No.	Parameters for Evaluation	Internal Marks	External Marks
1.	Originality	12	08
2.	Presentation	12	08
3.	Contents & Volume of work	18	08
4.	Discussion (Contribution of the Candidate)	18	08
5.	Any research publication related to the thesis	-	08
Total		**60**	**40**

Maharaja Ranjit Singh Punjab Technical University
Bathinda-151001



FACULTY OF ENGINEERING AND TECHNOLOGY

SYLLABUS

M.Tech. (Electronics and Communication Engineering)

2022 BATCH ONWARDS

(For Full-Time and Part-Time Modes)

SCHEME FOR M.TECH. (ECE) FULL-TIME MODE

SEMESTER-I		Contact Hours			Marks			Credits
Sub Code	Subject Name	L	T	P	Int	Ext	Total	
MECES1-101	Advanced Communication Systems	4	0	0	40	60	100	4
MECES1-102	Advanced Digital Circuit Design	4	0	0	40	60	100	4
MECES1-103	Soft Computing	4	0	0	40	60	100	4
Department Elective – I (Select Any One)								
MECED1-111	Antenna System Design	4	0	0	40	60	100	4
MECED1-112	Microcontrollers & Embedded Systems							
MECED1-113	IoT & its Applications							
Department Elective – II (Select Any One)								
MECED1-121	Information Theory & Coding	4	0	0	40	60	100	4
MECED1-122	Digital Image Processing							
MECED1-123	AI & Machine Learning							
MECES1-104	Research Lab-I	0	0	4	60	40	100	2
Total:		**20**	**0**	**4**	**260**	**340**	**600**	**22**

SEMESTER-II		Contact Hours			Marks			Credits
Sub Code	Subject Name	L	T	P	Int	Ext	Total	
MECES1-201	Wireless Adhoc & Sensor Networks	4	0	0	40	60	100	4
MECES1-202	Advanced Digital Signal Processing	4	0	0	40	60	100	4
MECES1-203	Wireless & Mobile Communications	4	0	0	40	60	100	4
Department Elective – III (Select Any One)								
MECED1-211	VHDL: Design, Synthesis & Simulation	4	0	0	40	60	100	4
MECED1-212	Advanced Computer Architecture							
MECED1-213	Deep Learning							
Department Elective – IV (Select Any One)								
MECED1-221	Optical Communication Systems	4	0	0	40	60	100	4
MECED1-222	Cloud Computing							
MECED1-223	Big Data Analytics							
MECES1-204	Research Lab-II	0	0	4	60	40	100	2
Total:		**20**	**0**	**4**	**260**	**340**	**600**	**22**

SEMESTER-III		Contact Hours			Marks			Credits
Sub Code	Sub Name	L	T	P	Int.	Ext.	Total	
XXXXX	Open Elective	3	0	0	40	60	100	3
WWWWW	Research Methodology and IPR	4	0	0	40	60	100	4
MECES1-301	Project	0	0	--	60	40	100	6
MECES1-302	Seminar	0	0	2	100	--	100	1
Total:		**7**	**0**	**2**	**240**	**160**	**400**	**14**

SEMESTER-IV		Contact Hours			Marks		
Sub Code	Sub Name	L	T	P	Internal	External	Total
MECES1-401	Dissertation #	--	--	--	Satisfactory / Not Satisfactory as per CBCS-2016		
Total:		--	--	--	--		

Note: In addition, it is proposed that:

1. Seminar shall be preferably on the Literature survey of the proposed Thesis work.
2. Project work shall preferably be related to work to be undertaken in the Thesis work.

SCHEME FOR M.TECH. (ECE) PART-TIME MODE

SEMESTER-I		Contact Hours			Marks			Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Int**	**Ext**	**Total**	
MECES1-101	Advanced Communication Systems	4	0	0	40	60	100	4
MECES1-102	Advanced Digital Circuit Design	4	0	0	40	60	100	4
Department Elective–I (Select Any One)								
MECED1-111	Antenna System Design	4	0	0	40	60	100	4
MECED1-112	Microcontrollers & Embedded Systems							
MECED1-113	IoT & its Applications							
Total:		**12**	**0**	**0**	**120**	**180**	**300**	**12**

SEMESTER-2		Contact Hours			Marks			Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Int**	**Ext**	**Total**	
MECES1-103	Soft Computing	4	0	0	40	60	100	4
Department Elective – II (Select Any One)								
MECED1-121	Information Theory & Coding	4	0	0	40	60	100	4
MECED1-122	Digital Image Processing							
MECED1-123	AI & Machine Learning							
MECES1-104	Research LAB-I	0	0	4	60	40	100	2
Total:		**8**	**0**	**4**	**140**	**160**	**300**	**10**

SEMESTER-III		Contact Hours			Marks			Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Int**	**Ext**	**Total**	
MECES1-201	Wireless Adhoc & Sensor Networks	4	0	0	40	60	100	4
MECES1-202	Advanced Digital Signal Processing	4	0	0	40	60	100	4
Department Elective – III (Select Any One)								
MECED1-211	VHDL: Design, Synthesis & Simulation	4	0	0	40	60	100	4
MECED1 -212	Advanced Computer Architecture							
MECED1 -213	Deep Learning							
Total:		**12**	**0**	**0**	**120**	**180**	**300**	**12**

SEMESTER-IV		Contact Hours			Marks			Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Int**	**Ext**	**Total**	
MECES1-203	Wireless & Mobile Communications	4	0	0	40	60	100	4
Department Elective – IV (Select Any One)								
MECED1-221	Optical Communication Systems	4	0	0	40	60	100	4
MECED1-222	Cloud Computing							
MECED1-223	Big Data Analytics							
MECES1-204	Research LAB-II	0	0	4	60	40	100	2
Total:		**8**	**0**	**4**	**140**	**160**	**300**	**10**

SEMESTER-V		Contact Hours			Marks			Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Int**	**Ext**	**Total**	
XXXXX	Open Elective	3	0	0	40	60	100	3
WWWWW	Research Methodology and IPR	4	0	0	40	60	100	4
MECES1-301	Project	0	0	--	60	40	100	6
MECES1-302	Seminar	0	0	2	100	--	100	1
Total:		**8**	**0**	**8**	**240**	**160**	**400**	**14**

SEMESTER-IV		Contact Hours			Marks		
Sub Code	**Sub Name**	**L**	**T**	**P**	**Internal**	**External**	**Total**
MECES1-401	Dissertation #	--	--	--	**Satisfactory / Not Satisfactory as per CBCS-2016**		
Total:		**--**	**--**	**--**	**--**		

Note: In addition, it is proposed that:

1. Seminar shall be preferably on the Literature survey of the proposed Thesis work.
2. Project work shall preferably be related to work to be undertaken in the Thesis work.

ADVANCED COMMUNICATION SYSTEM

Subject Code: MECES1-101 **L T P C** **Duration: 60 Hrs.**
4 0 0 4

Course Objectives

This course is meant to give knowledge to students for understanding of the various advanced concepts & techniques and applications in Communication Systems

1. To familiarize the students with digital communication systems.
2. To understand about bandlimited channels and estimation techniques.
3. To familiarize with fading and fading channels.
4. To understand OFDM and other 4G techniques.

Course Outcomes

1. To understand the concept of complex baseband representation and orthogonalization procedure.
2. To analyze the performance of band-limited channels.
3. To evaluate the receiver performance in fading channels.
4. To differentiate b/w various OFDM issues.

UNIT-I (15 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 (15 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 (15 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 (15 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**.

ADVANCED DIGITAL CIRCUIT DESIGN

Subject Code: MECES1-102 **L T P C** **Duration: 60 Hrs**
4 0 0 4

Course Objectives:
This course shall provide the understanding to students about various conceptual techniques and their applications leading to Advanced Digital Circuit Design:

1. To understand codes, logic families and realization of logic gates.
2. To learn basic techniques for the design of digital circuits and fundamental concepts used in the design of digital systems.
3. To understand the concepts of combinational logic circuits and sequential circuits.
4. To understand the realization of circuit using multiplexers, decoders and PLDs

Course Outcomes: At the end of this course students will demonstrate the ability to:

1. Design of canonical functions based on composite gates.
2. Evaluate the minimization techniques, including VEM & glitches remedy.
3. Develop and analyze, combinational and sequential circuits.
4. Formulate and investigate PLD based lgic design.

UNIT-I (15 Hrs)

Weighted and non-weighted codes: Properties & Applications. Error detection & correction. Parity check and Hamming code, Canonical functions based array design, Positive/Negative logic based gates and their properties. Composite gates – XOR/AOI/OAI & applications. Multilevel NAND/NOR realizations.

UNIT-II (15 Hrs)

Switching algebra & theorems. Duality & its applications. Mapping/ Kitty corner/Offset adjacencies. Analytical simplification. VEM upto 6-variables. Analysis and synthesis of combinational circuit design. CLA. Design using Decoders/ Multiplexers. Scaling. Glitches/ Hazards & remedies in combinational circuit design.

UNIT-III (15 Hrs)

Debounce switch, Flip-flop conversions. Racing & remedies. Analysis and synthesis of synchronous/asynchronous sequential circuit design using characteristics equations, excitation tables & state transition diagrams. Mealy and Moore models. Registers & their applications. Analysis and synthesis of 4-bit asynchronous and synchronous counters.

UNIT-IV (15 Hrs)

A/D conversion mechanism, characteristics and comparisons. Realization of circuit using PLDs: PAL/PLA, their performance comparison. FPGA based design. Comparative aspects of IC logic family: TTL/CMOS & their variants. Interfacing of TTL and CMOS. FSM/ASM. 555-timer applications. Digital twin technology. Emerging technologies. Digital India applications.

Text/Reference Books:

1. Switching and Finite Automata Theory-Zvi Kohavi & Niraj K. Jha, 3rd Edition, Cambridge.
2. Modern Digital Electronics - R. P. Jain, 3rd Edition, 2007 - Tata McGraw-Hill
3. Digital Design - Morris Mano, PHI, 4th Edition,2006
4. Introduction to Switching Theory and Logic Design - Fredriac J. Hill, Gerald R. Peterson, 3rd Ed., John Wiley & Sons Inc.
5. Fundamentals of Logic Design- Charles H. Roth, Cengage Learning, 5th, Edition, 2004.
6. Switching Theory and Logic Design - A. Anand Kumar, PHI, 2013.

SOFT COMPUTING

Subject Code: MECES1-103 **L T P C** **Duration: 60 Hrs.**
4 0 0 4

Course Objectives:

This course is meant to give knowledge to students for understanding of the various concepts, techniques and applications in Soft Computing

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.

Course Outcomes: After completion of course, students would be able to:

1. Identify and describe soft computing techniques and their roles in building intelligent machines
2. Apply fuzzy logic and reasoning to handle uncertainty and solve various engineering problems.
3. Apply genetic algorithms to combinatorial optimization problems.
4. Evaluate and compare solutions by various soft computing approaches for a given problem.

UNIT – I (15 Hrs)

Soft Computing: Introduction of soft computing, soft computing vs. hard computing, varioustypes 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 (15 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 (15 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 (15 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', WileyPublications, 2007.

Reference Books

1. Michael Negnevitsky, 'Artificial Intelligence', Pearson Education, New Delhi, 2008.
2. Timothy J. Ross, 'Fuzzy Logic with Engineering Applications', Wiley, 2010.

ANTENNA SYSTEM DESIGN

Course Code: MECED1-111 **L T P C** **Duration: 60 Hrs.**
4 0 0 4

Course Objectives:

1. This course is meant to give knowledge to students for understanding of the various concepts, techniques and applications in Antenna System Design.
2. Study of propagation of waves through different media.
3. To study various types of antennas, antenna arrays and associated antenna parameters.
4. Familiarize the students with different design parameters of antennas.

Course Outcomes: After completion of course, students would be able to:

1. Review of EM wave propagation in free space & different media and radiating elements.
2. Analysis and characterization of antenna parameters.
3. Design and analysis of antennas arrays.
4. Design and analysis of antennsa for broadband applications.

UNIT-I (15 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 wavedipole, Fields in the vicinity of an antenna and far field approximation.

UNIT-II (15 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 (15 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 (15 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.

MICROCONTROLLERS AND EMBEDDED SYSTEMS

Subject Code: MECED1-112 **L T P C** **Duration: 60 Hrs.**
4 0 0 4

Course Objectives

1. This course is meant to give knowledge to students for understanding of the various concepts, techniques and applications in Microcontrollers and Embedded Systems
2. To familiarize the students with typical embedded system.
3. To acquaint the students with ability to design and develop embedded system.
4. To introduce the students about ARM architecture and programming.

Course Outcomes

1. To understand and model a typical embedded system.
2. Design, development and analysis of embedded system.
3. To understanding of ARM architecture and ARM processor family.
4. Designing and programming of ARM processor.

UNIT-I (15 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 (15 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 (15 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, ConditionalInstructions. 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 (15 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

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**.

IoT & ITS APPLICATIONS

Subject Code: MECED1-113 **L T P C** **Duration: 60 Hrs**
4 0 0 4

Course Objectives:

1. This course is meant to give knowledge to students for understanding of the various concepts, techniques and applications of Internet of Things:
2. To learn the definition and significance of the Internet of Things.
3. To understand about SDN and data handling methods.
4. To explore the relationship between IoT and cloud computing.
5. To acquire knowledge about the different application-domain.

Course Outcomes: At the end of this course students will demonstrate the ability to:

1. Explore the interconnection and integration of the physical world and the cyber space.
2. Develop skills to build machine to machine communication.
3. Design and develop of IoT Devices.
4. Identify how IoT differs from traditional data collection systems.

UNIT-I (15 Hrs)

Introduction to Internet of Things (IoT): Definition, Characteristics, Evolution, Applications, IoT versus M2M (Machine to Machine) and IoT versus WoT (Web of Things). Sensing, Actuation, Sensors-Definition, Features, Classes. Sensor versus Transducers, Sensor Networks, UAV Networks, Actuator-Definition, Types (Hydraulic, Pneumatic, Electrical, Thermal, Magnetic and Mechanical).
IoT Networking: IoT Components, IoT Categories (Industrial and Consumer).
Connectivity Technologies: LAN, WAN, Node, Gateway and Proxy, IPv4 versus IPv6. Communication Protocols.

UNIT-II (15 Hrs)

Machine-to-Machine Communications: Introduction, Applications, Features.
Interoperability in IoT: Current Challenges in IoT, Requirement, Types (User and Device).
IoT Platform Overview: Features and Types of Arduino Board. Integration of Sensors and Actuators with Arduino, Introduction to Python and Raspberry Pi.

UNIT-III (15 Hrs)

Software-Defined Networking (SDN): Current Network and its limitations, Introduction to SDN, Current Network to SDN, SDN Architecture, Components of SDN, SDN for IoT, Benefits of Integrating SDN in IoT, Data Handling and Analytics.
Cloud Computing: Recent Trends in Computing, Components of Cloud Computing, Service Models, Comparison of Different Service Models.

UNIT-IV (15 Hrs)

Fog Computing: Introduction, its Need, Architecture and working of Fog, Advantages, Challenges and Applications of Fog.
IoT Applications: Smart Cities and Smart Homes-IoT Challenges in Smart Cities, Data Fusion and its Opportunity in IoT, Stages of Data Fusion. Connected Vehicles-Introduction, Challenges, Vehicle-to-Everything (V2X) Paradigm. Smart Grid-Introduction, Benefits of Smart Grid, Smart Grid Architecture. Industrial IoT.
Case Study: Agriculture, Healthcare and Activity Monitoring.

Text/Reference Books:

1. Raj Kamal, "Internet of Things - Architecture and Design Principles" McGrawHill
2. Mayur Ramgir, "Internet of Things - Architecture, Implementation, and Security", First Edition, Pearson Education.
3. Olivier Hersent, David Boswarthick and Omar Elloumi, "The Internet of Things: Key Applications and Protocols", 2nd Edition, Wiley.
4. Arsheep Bahga and Vijay Madisetti "Internet of Things: A Hands-On Approach" Orient Blackswan Publishers.

MOOCs Course Mapping:

"Introduction to Internet of Things" by Prof. Sudip Misra, Department of Computer Science and Engineering, IIT Kharagpur ***(https://nptel.ac.in/courses/106/105/106105166/)***

INFORMATION THEORY AND CODING

Subject Code: MECED1-121 **L T P C** **Duration: 60 Hrs.**
4 0 0 4

Course Objectives:

1. This course is meant to provide the knowledge to students for understanding of the various concepts, techniques and applications of Information Theory & Coding:
2. To understand channel and source coding schemes.
3. To learn baseband and bandpass sampling theorems.
4. To understand various digital modulation techniques and its applications.
5. To understand waveform coding techniques and its uses.

Course Outcomes: At the end of this course students will demonstrate the ability to:

1. Apply various channel and source coding schemes.
2. Differentiate between baseband and bandpass sampling theorems.
3. Performance evaluation of various digital modulation techniques.
4. Applications of waveform coding techniques.

UNIT-1 (15 Hrs)

Elements of Information Theory: Source coding theorem, Huffman coding, Channel coding theorem, channel capacity theorem, Shenonfano theorem, entropy

UNIT-2 (15 Hrs)

Sampling Processes: Base band and band pass sampling theorems reconstruction from samples, Practical aspects of sampling and signal recovery TDM

UNIT-3 (15 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 (15 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**.**

DIGITAL IMAGE PROCESSING

Subject Code: MECED1-122 **L T P C** **Duration: 60 Hrs.**
4 0 0 4

Course Objectives:

1. This course is meant to provide the in depth knowledge to students for understanding of the various concepts, techniques and applications of Digital Image Processing:
2. To understand image transforms for image manipulations.
3. To learn different operations on image processing for many applications.
4. To understand the concept of image compression along with spatial and frequency domain techniques.
5. To understand various image processing applications.

Course Outcomes: At the end of this course students will demonstrate the ability to:

1. Apply various image transforms for image manipulations.
2. Deal with different operations on image processing for real time applications.
3. Understand the need for image compression and to learn the spatial and frequency domain techniques of image compression.
4. Develop various image processing applications.

UNIT I (15 Hrs)

D**igital 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 (15 Hrs)

Image Enhancement Techniques: Spatial Domain methods: Basic grey leveltransformation, Histogram Equalization, Image Subtraction, Image averaging, Spatial filtering: Smoothing, sharpening filters – Laplacian filters, Frequency domain filters: Smoothing – Sharpening filters, Homomorphic filtering.

UNIT III (15 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 (15 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**.

AI & MACHINE LEARNING

Subject Code: MECED1-123 **L T P C** **Duration: 60 Hrs.**
3 1 0 4

Course Objectives:

1. To study the concepts of Artificial Intelligence.
2. To learn the methods of solving problems using Artificial Intelligence.
3. To introduce Image processing and NLP as application areas of AI.

Course Outcomes: At the end of the course the students will demonstrate the ability to:

1. Apply the concepts of knowledge representation, planning and reasoning for real world applications.
2. Apply AI techniques to solve complex problems of Industry using machine learning.
3. Apply AI techniques to solve problems in Image Processing and NLP.
4. Learn to use AI with complete Ethics and Follow legal considerations.

UNIT-I (15 Hrs)

Introduction to AI: Introduction to artificial intelligence, History, AI applications, Problem spaces and search, Knowledge and rationality, Heuristic search strategies, Search and optimization (gradient descent), Adversarial search, Planning and scheduling.

UNIT-II (15 Hrs)

Knowledge Representation and Reasoning: Propositional logic, First-order logic, Knowledge representation, Quantifying uncertainty, Probabilistic reasoning.

UNIT-III (15 Hrs)

Machine Learning Supervised methods: What is machine learning, Supervised vs. unsupervised learning, Regression - linear, logistic, ridge, Classification – decision trees, SVM, random forests, Model performance evaluation – MSE, lift, AUC, Type 1 vs 2 errors.
Deep Learning: Neural networks and back-propagation, Convolutional neural networks, Recurrent neural networks and Long Short-Term Memory (LSTM) networks.
Machine Learning: Unsupervised Methods, Dimensionality reduction: PCA, Clustering – k-means, hierarchical clustering, Semi-supervised methods, Reinforcement learning, Choosing among machine learning techniques.

UNIT-IV (15 Hrs)

AI and Machine learning in industry Image Processing: Introduction to computer vision, Image segmentation, Object and motion detection, Object classification.
Natural Language Understanding: Intro to natural language understanding, Application of deep learning to NLP.
Ethical and Legal Considerations in AI: Privacy, Bias, AI and the future of work, Appropriate uses of AI, Future of AI: Emerging developments.

Recommended Text Books / Reference Books:

1. Stuart Russell and Peter Norvig, “Artificial Intelligence: A Modern Approach”, 3rd
2. Edition, Prentice Hall, 2001.
3. Goodfellow, I., Bengio, Y. and Courville A., “Deep Learning”, MIT Press, 2016.
4. Elaine Rich and Kevin Knight, “Artificial Intelligence”, Tata McGraw Hill, 2008.
5. Trivedi, M.C., “A Classical Approach to Artifical Intelligence”, Khanna Publishing House, Delhi.
6. Artificial Intelligence, George F. Luger, Pearson Education, 2001.

RESEARCH LAB.-1

Subject Code: MECES1-104 **L T P C**
4 0 0 4

Course Objectives

1. To acquaint the students with state-of-the-art software's related to Electronics and Communications.
2. To prepare the students to apply the software tools in experimentation, application and project.

Course Outcomes: At the end of the course the students shall demonstrate the ability of:

1. Using of various software tools available in the field of ECE pertaining to their curriculum.
2. Application of these toolboxes for developing experiments/applications/project work etc.

Every Subject In-charge will define/develop at least two experiments from the concerned subject area, to be performed in Research Lab-I.

(3rd SEMESTER)

Course		Contact Hrs.			Marks			Credits
Code	**Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
	Calculus and Ordinary Differential Equation	3	0	0	40	60	100	3
	Computer Peripherals & Interfaces	3	0	0	40	60	100	3
	Data structure &Algorithms	3	1	0	40	60	100	4
	Digital Electronics	3	1	0	40	60	100	4
	Data structure & Algorithms Laboratory	0	0	4	60	40	100	2
	Digital Electronics Laboratory	0	0	2	60	40	100	1
	IT Workshop (SciLab / MATLAB) Laboratory	0	0	4	60	40	100	2
	Training-I*	-	-	-	60	40	100	3
	Development of Societies	3	0	0	40	60	100	3
Total 5 Theory &3 Lab. Courses		**15**	**2**	**10**	**440**	**460**	**900**	**25**

***NOTE:** Training after the 2nd Semester.

(4th SEMESTER)

Course		Contact Hrs.			Marks			Credits
Code	**Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
	Discrete Mathematics	3	1	0	40	60	100	4
	Computer Organization &Architecture	3	0	0	40	60	100	3
	Operating Systems	3	1	0	40	60	100	4
	Object Oriented Programming	3	1	0	40	60	100	4
	Operating Systems Laboratory	0	0	2	60	40	100	1
	Object Oriented Programming Laboratory	0	0	4	60	40	100	2
	Organizational Behaviour	3	0	0	40	60	100	3
Total 5 Theory & 2 Lab. Courses		**15**	**3**	**06**	**320**	**380**	**700**	**21**

Calculus and Ordinary Differential Equation

Subject Code- BMATH1- 301 **L T P C** **Duration – 45hrs**
3 0 0 3

COURSE OBJECTIVE

The objective of this course is to familiarize the prospective engineers with techniques in basic calculus 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.

COURSE OUTCOME

CO1 To apply differential and integral calculus to notions of curvature and to improper integrals. Apart from various applications, they will have a basic understanding of Beta and Gamma functions.

CO2 The essential tools of matrices and linear algebra including linear transformations, eigenvalues, diagonalization and orthogonalization.

COURSE CONTENT

UNIT-I (12hrs)

Sequences and Series: Basic concept of Convergence, tests for convergence, power series, Taylor's series, Series for exponential, trigonometric and logarithmic functions.

Multivariable Calculus: Partial derivatives, directional derivatives, total derivative, Tangent plane and normal line, Maxima, minima and saddle points, Method of Lagrange multipliers.

UNIT-II (11 hrs)

Multiple Integration: double and triple integrals (Cartesian and polar), change of order of integration in double integrals, Change of variables, Theorems of Green, Gauss and Stokes (without proof), orthogonal curvilinear coordinates, Simple applications involving cubes, sphere and rectangular parallelepipeds.

UNIT-III(11 hrs)

First order ordinary differential equations: Exact, linear and Bernoulli's equations, Euler's equations, Equations not of first degree: equations solvable for p, equations solvable for y, equations solvable for x and Clairaut's type.

UNIT-IV (11 hrs)

Ordinary differential equations of higher orders: Second order linear differential equations with variable coefficients, method of variation of parameters, Cauchy-Euler equation; Power series solutions; Legendre polynomials, Bessel functions of the first kind and their properties.

RECOMMENDED BOOKS

1. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.
2. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.
3. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.
4. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
5. W. E. Boyce and R. C. DiPrima, Elementary Differential Equations and Boundary Value Problems, 9th Edition, Wiley India, 2009.
6. S. L. Ross, Differential Equations, 3rd Ed., Wiley India, 1984.
7. Earl A. Coddington, An Introduction to Ordinary Differential Equations, Prentice Hall India, 1995.

COMPUTER PERIPHERALS & INTERFACES

Subject Code- BCSES1-301 **L T P C** **M Duration – 45 hrs.**
3 0 0 3

COURSE OBJECTIVCE

To learn the functional and operational details of various peripheral devices.

COURSE CONTENT

UNIT I(12hrs)

SYSTEM RESOURCES: Interrupt, DMA Channel, I/O Port Addresses and resolving and resolving the conflict of resources. I/O buses- ISA, EISA, Local bus, VESA Local bus, PCI bus, PCI Express, Accelerated graphics port bus.

IDE & SCSI Interfaces: IDE origin, IDE Interface ATA standards. ATA feature, ATA RAID and SCSI RAID, SCSI Cable and pin Connector pin outs SCSI V/s IDE Advantages and limitation, SATA, SSD drives.

UNIT II(11hrs)

Video Hardware: Video display technologies, DVI Digital signals for CRT Monitor, LCD, LED, OLED Panels, Video adapter types, Integrated Video/ Motherboard chipset, Video RAM,Video driver and multiple Monitor, Graphic accelerators. Advanced 3D Technologies,TV Tuner and Video Capture upgrades troubleshooting Video Cards and Drivers.

UNIT III(11hrs)

I/O Interfaces: I/O Interfaces from USB1.0, 2.0, 3.0, lighting port, I/O Interface from serial, Parallel to SCSI converter. Testing of serial andparallel port, USB Mouse/ Keyboard Interfaces like HDMI

Input/ Output Driver software aspects: Role of device driver DOS and UNIX/ LINUX device drivers.

UNIT IV(11hrs)

Design & Integration of Peripheral devices to a computer system as a Case Study

Future Trends: Detailed Analysis of recent Progress in the Peripheral devices. Some aspects of cost Performance analysis and applications of latest digital devices like WiFi-LED projectors, HDMI devices, wireless printers and other devices

RECOMMENDED BOOKS

1. Douglas V. Hall,"Microprocessors and Interfacing", Tata McGraw Hill 2006.
2. Barry B. Brey&C.R.Sarma, "The intel microprocessors," Pearson 2003.
3. P. Pal Chandhari, "Computer Organization and design" Prentice Hall of India Pvt. Ltd, 1994.
4. Del Corso, H.Kirrman, JD Nicond "Microcomputer buses & links" Academic Press 1986.

DATA STRUCTURE & ALGORITHMS

Subject Code- BCSES1-302 **L T P C** **Duration – 60hrs**
3 1 0 4

COURSE OBJECTIVE

1. To impart the basic concepts of data structures and algorithms
2. To understand concepts about searching and sorting techniques.
3. To understand basic concepts about stacks, queues, lists, trees and graphs
4. To enable them to write algorithms for solving problems with the help of fundamental data structures

COURSE CONTENT

UNIT-I (15hrs)

Introduction: Basic Terminologies: Elementary Data Organizations, Data StructureOperations: insertion, deletion, traversal etc.; Analysis of an Algorithm, AsymptoticNotations, Time-Space trade off. Searching: Linear Search and Binary Search Techniquesand their complexity analysis.

UNIT-II (15hrs)

Stacks and Queues: ADT Stack and its operations: Algorithms and their complexityanalysis, Applications of Stacks: Expression Conversion and evaluation –corresponding algorithms and complexity analysis. ADT queue, Types of Queue: SimpleQueue, Circular Queue, Priority Queue; Operations on each types of Queues: Algorithmsand their analysis.

UNIT-III (15hrs)

Linked Lists: Singly linked lists: Representation in memory, Algorithms of severaloperations: Traversing, Searching, Insertion into, Deletion from linked list; Linkedrepresentation of Stack and Queue, Header nodes, Doubly linked list: operations on it andalgorithmic analysis; Circular Linked Lists: all operations their algorithms and thecomplexity analysis.

Trees: Basic Tree Terminologies, Different types of Trees: Binary Tree, Binary Search trees, Binary Search Tree,Tree operations on each of the trees and theiralgorithms with complexity analysis. Introduction to B Tree, B+ Tree and AVL Tree

UNIT-IV (15hrs)

Sorting and Hashing: Objective and properties of different sorting algorithms:Selection Sort, Bubble Sort, Insertion Sort, Quick Sort, Merge Sort, Heap Sort;Performance and comparison among all the methods, Hashing.

Graph: Basic Terminologies and Representations, Graph search and traversal algorithms and

complexity analysis.

RECOMMENDED BOOKS:

1. "Fundamentals of Data Structures", Illustrated Edition by Ellis Horowitz, SartajSahni, Computer Science Press.

SUGGESTED REFERENCE BOOKS:

2. Algorithms, Data Structures, and Problem Solving with C++", Illustrated Edition byMark Allen Weiss, Addison-Wesley Publishing Company
3. "How to Solve it by Computer", 2nd Impression by R.G. Dromey, Pearson Education.

COURSE OUTCOMES

CO1 For a given algorithm student will able to analyze the algorithms to determine the timeand computation complexity and justify the correctness.
CO2 For a given Search problem (Linear Search and Binary Search) student will able toimplement it.
CO3 For a given problem of Stacks, Queues and linked list student will able to implement it and analyze the same to determine the time and computation complexity.
CO4 Student will able to write an algorithm Selection Sort, Bubble Sort, Insertion Sort,Quick Sort, Merge Sort, Heap Sort and compare their performance in term of Spaceand Time complexity.
CO5 Student will able to implement Graph search and traversal algorithms and determinethe time and computation complexity.

DIGITAL ELECTRONICS

Subject Code- BCSES1-303 **L T P C** **Duration – 60hrs**
3 1 0 4

COURSE OBJECTIVE

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

At the end of this course, students will demonstrate the ability to

CO1 Understand working of logic families and logic gates.
CO2 Design and implement Combinational and Sequential logiccircuits.
CO3 Understand the process of Analog to Digital conversion and Digital to Analog conversion.
CO4 Be able to use PLDs to implement the given logical problem.

COURSE CONTENT

UNIT-I (15hrs)

Fundamentals of Digital Systems and logicfamilies: Digital signals, digital circuits, AND, OR, NOT, NAND, NOR and Exclusive-OR operations,Boolean algebra, examples ofICgates, number systems-binary, signed binary, octal hexadecimalnumber, binaryarithmetic,one's and two's complements arithmetic, codes, error detecting andcorrectingcodes, characteristics of digital lCs, digital logic families, TTL, Schottky TTL and CMOSlogic, interfacing CMOS and TTL, Tri-statelogic.

Combinational DigitalCircuits: Standard representation for logic functions, K-map representation, simplification oflogicfunctionsusing K-map, minimization of logical

functions. Don't care conditions, Multiplexer,De-Multiplexer/Decoders, Adders, Subtractors, BCD arithmetic, carry look ahead adder,serialadder,ALU, elementary ALU design, popular MSI chips, digital comparator,paritychecker/generator, codeconverters, priority encoders, decoders/drivers for display devices,Q-M method offunctionrealization.

UNIT-II (15hrs)

Sequential circuits and systems: A 1-bit memory, the circuit properties of Bistable latch, the clocked SR flip flop, J- K-T and D types flip flops, applications of flip flops, shift registers, applications of shift registers, serial to parallelconverter, parallel to serial converter, ring counter, sequence generator, ripple(Asynchronous) counters, synchronous counters, counters design using flip flops, special counter IC's, asynchronous sequential counters, applications of counters.

UNIT-III (15hrs)

A/D and D/A Converters: Digital to analog converters: weighted resistor/converter, R-2R Ladder D/Aconverter,specificationsfor D/A converters, examples of D/A converter lCs, sample and hold circuit,analog to digitalconverters: quantization and encoding, parallel comparator A/Dconverter,successive approximationA/D converter, counting A/D converter, dual slope A/Dconverter,A/DconverterusingVoltagetofrequencyandvoltagetotimeconversion,specificationsofA/Dconverters, example of A/DconverterICs

UNIT-IV (15hrs)

Semiconductor memories and Programmable logic devices: Memory organization and operation, expanding memory size, classification andcharacteristicsofmemories, sequential memory, read only memory (ROM), read and write memory(RAM), contentaddressable memory (CAM), charge de coupled device memory (CCD), commonly used memorychips, ROM as a PLD, Programmable logic array, Programmable array logic, complexProgrammable logic devices (CPLDS), Field Programmable Gate Array (FPGA).

RECOMMENDED BOOKS

1. R. P. Jain, "Modern Digital Electronics", McGraw Hill Education, 2009.
2. M. M. Mano, "Digital logic and Computer design", Pearson Education India, 2016.
3. A. Kumar, "Fundamentals of Digital Circuits", Prentice Hall India, 2016.

DATA STRUCTURE & ALGORITHMS LABORATORY

Subject Code- BCSES1-304 **L T P C**
0 0 4 2

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.

DIGITAL ELECTRONICS LABORATORY

Subject Code- BCSES1-305 **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.

IT WORKSHOP (SciLab / MATLAB) LABORATORY

Subject Code- BCSES1-306 **L T P C**
0 0 4 2

Following experiments to be conducted using Sci Labs / MATLAB

1. Introduction to Sci Labs / MATLAB environment and types of Sci Labs / MATLAB files.
2. Use of help command to get help about different inbuilt functions.
3. Write a program to show the output of various unary and binary operators.
4. Write programs for Matrix Manipulations, (reshaping matrices, expanding matrix size, appending or deleting a row/column to a matrix, concatenation of matrices).
5. Write programs which demonstrate the use special matrices.
6. Write programs to show output for various matrix and array operations.
7. Write programs for demonstrating the use for various control statements.
8. Write a MATLAB code for computing factorial of a number n. Assume n is already defined. The code should return a scalar, not a vector.
9. Write programs using functions and plot results.

*other programs related to some application area may also be done

TRAINING-1

Subject Code- BCSES1-307 **L T P C** **Duration – 4 WEEKS**
0 0 0 3

Training after the 2nd Semester, students are required to be involved in Inter/ Intra Institutional Activities viz; Training with higher Institutions; Soft skill training organized by Training and Placement Cell of the respective institutions; contribution at incubation/ innovation /entrepreneurship cell of the institute; participation in conferences/ workshops/ competitions etc.; Learning at Departmental Lab/Tinkering Lab/ Institutional workshop; Working for consultancy/ research project within the institutes and Participation in all the activities of Institute's Innovation Council for eg: IPR workshop/Leadership Talks/ Idea/Design/ Innovation/ Business Completion/ Technical Expos etc.

DEVELOPMENT OF SOCIETIES

Subject Code- BHSMC0-007 **L T P C** **Duration – 45hrs**
3 0 0 3

COURSE OBJECTIVE:

This is one of the foundation courses of Humanities (in Foundation Area 1). It is envisaged that this course will provide a natural link between engineering and humanities with an emphasis that Development is not just materialistic, larger view of all round human development should also be considered. Importance of sustainable development, inter-dependence and co-existence in nature should be realised through this course. It is to gain an understanding of alternative models of development**.**

UNIT-I (15hrs)

Social Development: Concepts behind the origin of Family, Clan and Society, Different Social Systems, Relation between Human being and Society, Comparative studies on different models of Social Structures and their evolution

UNIT-II (15hrs)

Political Development: Ideas of Political Systems as learnt from History, Different models of Governing system and their comparative study

UNIT-III(15hrs)

Economic Development: Birth of Capitalism, Socialism, Marxism, Concept of development in pre-British, British and post British period- Barter, Jajmani, Idea of development in current context., E. F. Schumacher's idea of development, Buddhist economics. Gandhian idea of development. Swaraj and Decentralization.

RECOMMENDED BOOKS:

TEXTBOOK:

1. 'Indian Society' by Dr S.K Jena & B.N Mohanty
2. 'Indian Society' by C.N Shankar Rao
3. 'Foundations of Political Science, Indian Constitution & Government' by Gulshan Rai, SomNathVerma& Suresh Kumar

***REFERENCE BOOKS:**

1. 'The Interpretation of Cultures: Selected Essays' by Geertz & Clifford. 1973, New York
2. 'Dictionary of Modern Sociology Hoult' by Thomas Ford, ed. 1969) Totowa, New Jersey, United States: Littlefield, Adams & Co.
3. 'Sociology –In a Changing Society' by William Korblum
4. 'The Origin of Humankind' by Leakey, Richard 1996, New York Basic Books

4. OTHER SESSIONS

*TUTORIALS:

*LABORATORY:

*PROJECT: Possible projects in this course could be

a) Interact with local communities and understand their issues.

b) Study local cottage industry and agricultural practices. Role of engineering and specialized knowledge.

c) Evaluation of technology in the context of its application. Social impact of technology. Environmental impact of technology. Evaluation from a holistic perspective.

DISCRETE MATHEMATICS

Subject Code- BMATH1-401 **L T P C** **Duration – 60 hrs.**
3 1 0 4

COURSE OBJECTIVE

Throughout the course, students will be expected to demonstrate their understanding of Discrete Mathematics by being able to do each of the following:

1. Use mathematically correct terminology and notation.
2. Construct correct direct and indirect proofs.
3. Use division into cases in a proof.
4. Use counterexamples.
5. Apply logical reasoning to solve a variety of problems.

COURSE OUTCOMES

At the end of this course, students will demonstrate the ability to

CO1 For a given logic sentence express it in terms of predicates, quantifiers, and logicalconnectives

CO2 For a given a problem, derive the solution using deductive logic and prove the solutionbased on logical inference

CO3 For a given a mathematical problem, classify its algebraic structure

CO4 Evaluate Boolean functions and simplify expressions using the properties of BooleanAlgebra

CO5 Develop the given problem as graph networks and solve with techniques of graphtheory**.**

COURSE CONTENTS

UNIT-I (15 hrs)

Sets, Relation and Function: Operations and Laws of Sets, Cartesian Products,Binary Relation, Partial Ordering Relation, Equivalence Relation, Image of a Set, Sumand Product of Functions, Bijective functions, Inverse and Composite Function, Size of aSet, Finite and infinite Sets, Countable and uncountable Sets, Cantor's diagonal argumentand The Power Set theorem, Schroeder-Bernstein theorem.

Principles of Mathematical Induction: The Well-Ordering Principle, Recursivedefinition, The Division algorithm: Prime Numbers, The Greatest Common Divisor:Euclidean Algorithm, The Fundamental Theorem of Arithmetic.

UNIT-II (15 hrs)

Basic counting techniques-inclusion and exclusion, pigeon-hole principle, permutation andcombination.

Propositional Logic: Syntax, Semantics, Validity and Satisfiability, Basic Connectives andTruth Tables, Logical Equivalence: The Laws of Logic, Logical Implication, Rules ofInference, The use of Quantifiers. Proof Techniques: Some Terminology, Proof Methods and

Strategies, Forward Proof, Proof by Contradiction, Proof by Contraposition, Proof ofNecessity and Sufficiency.

UNIT-III (15 hrs)

Algebraic Structures and Morphism: Algebraic Structures with one Binary Operation,Semi Groups, Monoids, Groups, Congruence Relation and Quotient Structures, Free andCyclic Monoids and Groups, Permutation Groups, Substructures, Normal Subgroups,Algebraic Structures with two Binary Operation, Rings, Integral Domain and Fields.Boolean Algebra

and Boolean Ring, Identities of Boolean Algebra, Duality,Representation of Boolean Function, Disjunctive and Conjunctive Normal Form

UNIT-IV (15 hrs)

Graphs and Trees: Graphs and their properties, Degree, Connectivity, Path, Cycle,Sub Graph, Isomorphism, Eulerian and Hamiltonian Walks, Graph Colouring, Colouring mapsand Planar Graphs, Colouring Vertices, Colouring Edges, List Colouring, Perfect Graph,definition properties and Example, rooted trees, trees and sorting, weighted trees andprefix codes, Bi-connected component and Articulation Points, Shortest distances.

RECOMMENDED BOOKS:

1. Kenneth H. Rosen, Discrete Mathematics and its Applications, Tata McGraw – Hill
2. Susanna S. Epp, Discrete Mathematics with Applications,4th edition, WadsworthPublishing Co. Inc.
3. Satinder Bal Gupta, Discrete Mathematics and structures, University Science Press, New Delhi.
4. C L Liu and D P Mohapatra, Elements of Discrete Mathematics A Computer Oriented Approach, 3rd Edition by, Tata McGraw – Hill.

SUGGESTED REFERENCE BOOKS:

1. J.P. Tremblay and R. Manohar, Discrete Mathematical Structure and It's Application toComputer Science", TMG Edition, TataMcgraw-Hill
2. Norman L. Biggs, Discrete Mathematics, 2nd Edition, Oxford University Press.Schaum's Outlines Series, Seymour Lipschutz, Marc Lipson,
3. Discrete Mathematics, Tata McGraw - Hill

COMPUTER ORGANIZATION & ARCHITECTURE

Subject Code- BCSES1-401 **L T P C** **Duration – 45hrs**
3 0 0 3

COURSE OBJECTIVE

To expose the students to the following:
1. How Computer Systems work & the basic principles
2. Instruction Level Architecture and Instruction Execution
3. The current state of art in memory system design
4. How I/O devices are accessed and its principles.
5. To provide the knowledge on Instruction Level Parallelism
6. To impart the knowledge on micro programming
7. Concepts of advanced pipelining techniques.

COURSE CONTENT

UNIT-I (11 hrs)

Functional blocks of a computer: CPU, memory, input-output subsystems, control unit.Instruction set architecture of a CPU–registers, instruction execution cycle, RTLinterpretation of instructions, addressing modes, instruction set. Case study – instruction sets of some common CPUs.

Data representation: signed number representation, fixed and floating pointrepresentations, character representation. Computer arithmetic – integer addition andsubtraction, ripple carry adder, carry look ahead adder etc. multiplication shift and add.

UNIT-II (12 hrs)

Introduction to x86 architecture.

CPU control unit design: hardwired and micro-programmed design approaches.
Memory system design: semiconductor memory technologies, memory organization.

UNIT-III (11 hrs)

Peripheral devices and their characteristics: Input-output subsystems, I/O deviceinterface, I/O transfers–program controlled, interrupt driven and DMA, software interrupts and exceptions. Programs andprocesses–role of interrupts in process state transitions.

UNIT-IV (11 hrs)

Pipelining: Basic concepts of pipelining, throughput and speedup, pipeline hazards.
Parallel Processors: Introduction to parallel processors.
Memory organization: Memory interleaving, concept of hierarchical memory organization,cache memory, cache size vs. block size, mapping,replacement algorithms.

RECOMMENDED BOOKS:

1. "Computer Organization and Design: The Hardware/Software Interface", 5th Edition by David A. Patterson and John L. Hennessy, Elsevier.
2. "Computer Organization and Embedded Systems", 6th Edition by Carl Hamacher, McGraw Hill Higher Education.

SUGGESTED REFERENCE BOOKS:

1. "Computer Architecture and Organization", 3rd Edition by John P. Hayes, WCB/McGraw-Hill
2. "Computer Organization and Architecture: Designing for Performance", 10th Edition by William Stallings, Pearson Education.
3. "Computer System Design and Architecture", 2nd Edition by Vincent P. Heuring and Harry F. Jordan, Pearson Education.

COURSE OUTCOMES

CO1 Draw the functional block diagram of a single bus architecture of a computer anddescribe the function of the instruction execution cycle, RTL interpretation ofinstructions, addressing modes, instruction set.
CO2 Write assembly language program for specified microprocessor for computing16 bit multiplication, division and I/O device interface (ADC, Control circuit, serialport communication).
CO3 Write a flowchart for Concurrent access to memory and cache coherency in ParallelProcessors and describe the process.
CO4 Given a CPU organization and instruction, design a memory module and analyze itsoperation by interfacing with the CPU.
CO5 Given a CPU organization, assess its performance, and apply design techniques toenhance performance using pipelining, parallelism and RISC methodology

OPERATING SYSTEMS

Subject Code- BCSES1-402 **L T P C** **Duration – 60hrs**
3 1 0 4

COURSE OBJECTIVE

To learn the fundamentals of Operating Systems.

1. To learn the mechanisms of OS to handle processes and threads and their communication
2. To learn the mechanisms involved in memory management in contemporary OS
3. To gain knowledge on distributed operating system concepts that includes architecture, Mutual exclusion algorithms, deadlock detection algorithms and agreement protocols
4. To know the components and management aspects of concurrency management
5. To learn to implement simple OS mechanisms

COURSE OUTCOMES

At the end of this course, students will demonstrate the ability to

CO1 Create processes and threads.

CO2 Develop algorithms for process scheduling for a given specification of CPU utilization, Throughput, Turnaround Time, Waiting Time, Response Time.

CO3 For a given specification of memory organization develop the techniques foroptimally allocating memory to processes by increasing memory utilization andfor improving the access time.

CO4 Design and implement file management system and For a given I/O devices and OS (specify) develop the I/O management functions in OSas part of a uniform device abstraction by performing operations for synchronizationbetween CPU and I/O controllers.

COURSE CONTENT

UNIT-I (15hrs)

Introduction: Concept of Operating Systems, Generations of Operating systems, Typesof Operating Systems, OS Services, System Calls, Structure of an OS-Layered,Monolithic, Microkernel Operating Systems, Concept of Virtual Machine. Case study onUNIX and WINDOWS Operating System.

UNIT-II (16hrs)

Processes: Definition, Process Relationship, Different states of a Process, Process Statetransitions, Process Control Block (PCB), Context switching

Process Scheduling: Foundation and Scheduling objectives, Types of Schedulers, **Scheduling criteria:** CPU utilization, Throughput, Turnaround Time, Waiting Time, Response Time;

Scheduling algorithms: Pre-emptive and Non pre-emptive, FCFS, SJF, RR; Multiprocessorscheduling: Real Time scheduling: RM and EDF.

Inter-process Communication: Critical Section, Race Conditions, Mutual Exclusion, Hardware Solution, Strict Alternation, Peterson's Solution, The Producer\ Consumer Problem, Semaphores, Event Counters, Monitors, Message Passing, Classical IPC Problems: Reader's & Writer Problem, Dinning Philosopher Problem etc.

UNIT-III (15hrs)

Deadlocks: Definition, Necessary and sufficient conditions for Deadlock, DeadlockPrevention, Deadlock Avoidance: Banker's algorithm, Deadlock detection and Recovery.

Memory Management: Basic concept, Logical and Physical address map, Memoryallocation: Contiguous Memory allocation – Fixed and variable partition–Internal and External fragmentation and Compaction; Paging: Principle of operation – Page allocation -Hardware support for paging, Protection and sharing, Disadvantages of paging.

Virtual Memory: Basics of Virtual Memory – Hardware and control structures – Locality of reference, Page fault , Working Set , Dirty page/Dirty bit – Demand paging,Page Replacement algorithms: Optimal, First in First Out (FIFO), Second Chance (SC),Not recently used (NRU) and Least Recently used (LRU).

UNIT-IV (14hrs)

File Management: Concept of File, Access methods, File types, File operation, Directory structure, File System structure, Allocation methods (contiguous, linked,indexed), Free-space management (bit vector, linked list, grouping), directory implementation(linear list, hash table), efficiency and performance.

Disk Management: Disk structure, Disk scheduling - FCFS, SSTF, SCAN, C-SCAN, Diskreliability, Disk formatting, Boot-block, Bad blocks

RECOMMENDED BOOKS

1. Operating System Concepts Essentials, 9th Edition by AviSilberschatz, Peter Galvin, Greg Gagne, Wiley Asia Student Edition.
2. Operating Systems: Internals and Design Principles, 5th Edition, William Stallings, Prentice Hall of India.

SUGGESTED REFERENCE BOOKS:

1. Operating System: A Design-oriented Approach, 1st Edition by Charles Crowley, Irwin Publishing
2. Operating Systems: A Modern Perspective, 2nd Edition by Gary J. Nutt, Addison-Wesley
3. Design of the Unix Operating Systems, 8th Edition by Maurice Bach, Prentice-Hall of India
4. Understanding the Linux Kernel, 3rd Edition, Daniel P. Bovet, Marco Cesati, O'Reilly and Associates

OBJECT ORIENTED PROGRAMMING

Subject Code- BCSES1-403 **L T P C** **Duration – 60 hrs**
3 1 0 4

COURSE OBJECTIVE

To introduce the principles and paradigms of Object Oriented Programming Language for design and implement the Object Oriented System

COURSE OUTCOME

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

COURSE CONTENT

UNIT-I (15hrs)

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 (15hrs)

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

UNIT-III (15hrs)

Polymorphism, Pointer to Derived class, Virtual Functions, Pure Virtual Function, Abstract Base Classes, Static and Dynamic Binding

Fundamentals of Operator Overloading, Rules for Operators Overloading, Implementation of Operator Overloading Like <<,>> Unary Operators, Binary Operators.

Basics of C++ Exception Handling, Try, Throw, Catch, multiple catch, Re-throwing an Exception.

UNIT-IV (15hrs)

Text Streams and binary stream, Sequential and Random Access File, Stream Input/ Output Classes, Stream Manipulators.

Templates: Function Templates, Overloading Template Functions, Class Template, Class Templates

Introduction: design patterns, Classifications

Introduction: model- view- controller pattern

RECOMMENDED BOOKS:

4. Robert Lafore, 'Object Oriented Programming in Turbo C++',2nd Ed., The WAITE Group Press, **1994**.
5. Herbert shield, 'The complete reference C ++', 4th Ed., Tata McGraw Hill, **2003**.
6. Shukla, 'Object Oriented Programming in C++', Wiley India, 2008.
7. H M Deitel and P J Deitel, 'C++ How to Program',2nd Ed., Prentice Hall, **1998**.
8. D Ravichandran, 'Programming with C++', 3rd Ed., Tata McGraw Hill, **2003**.
9. Bjarne Stroustrup, 'The C++ Programming Language',4th Ed.,Addison Wesley,**2013**.
10. R. S. Salaria, 'Mastering Object-Oriented Programming with C++', Salaria Publishing House, **2016**.

OPERATING SYSTEMS LABORATORY

Subject Code- -BCSES1-404 **L T P C**
0 0 2 1

1. Installation Process of various operating systems
2. Virtualization, Installation of Virtual Machine Software and installation of Operating System on Virtual Machine
3. Commands for files & directories: cd, ls, cp, md, rm, mkdir, rmdir. Creating and viewing files using cat. File comparisons. Disk related commands: checking disk free spaces. Processes in linux, connecting processes with pipes, background processing, managing

multiple processes. Manual help. Background process: changing process priority, scheduling of processes at command, batch commands, kill, ps, who, sleep. Printing commands, grep, fgrep, find, sort, cal, banner, touch, file. File related commands ws, sat, cut, grep.

4. Shell Programming: Basic of shell programming, various types of shell, Shell Programming in bash, conditional & looping statement, case statements, parameter passing and arguments, shellvariables, shell keywords, creating shell programs for automate system tasks, report printing.

OBJECT ORIENTED PROGRAMMING USING C++ LABORATORY

Subject Code- BCSES1-405 **L T P C**
0 0 4 2

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 explicit constructor.
7. Initializer Lists- Write a program to demonstrate the use of initializer list.
8. Operator Overloading- Write a program to demonstrate the overloading of increment and decrement operators.
9. Operator Overloading- Write a program to demonstrate the overloading of binary arithmetic operators.
10. Typecasting- Write a program to demonstrate the typecasting of basic type to class type.
11. Typecasting- Write a program to demonstrate the typecasting of class type to basic type.
12. Typecasting- Write a program to demonstrate the typecasting of class type to class type.
13. Inheritance- Write a program to demonstrate the multilevel inheritance

ORGANIZATIONAL BEHAVIOR

Subject Code- BHSMC0-016 **L T P C** **Duration – 45hrs**
3 0 0 3

Course Objectives: The course aims to provide an understanding of basic concepts, theories and techniques in the field of human behaviour at the individual, group and organizational levels in the changing global scenario. The course must be taught using case study method.

UNIT-I (12Hrs)

Organizational Behaviour: Concepts, Theories and organization aspects of OB, Contributing Disciplines to OB, challenges and opportunities for OB. Foundations of Individual Behaviour: Biographical Characteristics, Course, Theories of Course, Attitudes,

Attitude Change, Values & Believes, Prejudices Personality: Determinants of Personality, Perception, Attribution Theory, Person's Perception.

UNIT-II (11Hrs)

Motivation: Definition & Process, Early Theories of Motivation, Contemporary Theories of Motivation, Nature and process of Motivation, Application of Motivation Concept. Job Satisfaction: Nature & Significance of Job satisfaction. Leadership: Nature Significance & Theories; Leadership Effectiveness Model; Leadership Traits & Skills; Behavioural Styles in Leadership. Transactional Analysis, Life Position, Johari Window Model.

UNIT-III (11Hrs)

Foundations of Group Behaviour: Nature & Concept of Group Formation, Stages of Group Formation, Theories of Group Formation. Teams, Difference between Group and Team Group Decision Making: Meaning & Nature, Decision Making Process; Decision Making Styles; Advantages & disadvantages of Decision Making; Techniques of Decision Making; Group Size & Decision Making.

UNIT-IV (11Hrs)

Organizational Change & Development: Meaning & Definition, Change Agents, Change Models, Resistance to Change. Power and Politics in Organization: Nature & Concepts, Sources & Types of Power, Techniques of Politics. Stress Management: Meaning and Concept of Stress, Stress in Organizations

Recommended Books

1. Robbins, 'Organization Behavior', Pearson Education.
2. Luthans, Organization Behavior', Tata McGraw Hill.
3. Hersey, 'Management of Organizational Behavior', Prentice Hall India.
4. Aswathappa, 'Organization Behavior', Himalaya Publications.
5. L.M. Prasad, 'Organization Behavior', Sultan Chand & Sons
6. Parikh, Gupta, 'Organizational Behavior', Tata McGraw Hill

AWS CLOUD PRACTITIONER

COURSE CODE: MOOCCSE-A01 **DURATION: 10 Weeks.**

Course Prerequisites:

Basic knowledge of Computer Networking, Operating Systems

Learning Outcomes:

1. Cloud Practitioner,
2. Architect, Operations

Course Description:

AWS Cloud Practitioner validates cloud expertise to help professionals highlight in-demand skills and organizations build effective, innovative teams for cloud initiatives using AWS.

COURSE DETAILS

MODULE 1: (Introduction to AWS)

TOPIC 1: (Introduction)

Lecture 1.1: Introduction to AWS
Lecture 1.2: Introduction to AWS WEB Services
Lecture 1.3: Types of Cloud Computing
Lecture 1.4: Cloud Computing Architecture
Lecture 1.5: AWS Global Infrastructure
Lecture 1.6: AWS Management Console
Lecture 1.7: Amazon EBS (Elastic Block Store) VS Object Storage.

MODULE 2: (EC2 Instances)

TOPIC 1: (EC2 Instances win & Linux)

Lecture 1.1: EC2 Instances 1
Lecture 1.2: EC2 Instances 2
Lecture 1.3: Create an Image of EC2 Instance

MODULE 3: (ELB (Elastic Load Balancing)

TOPIC 1: (ELB)

Lecture 1.1: ELB (Elastic Load Balancing)
Lecture 1.2: How to create load balancer in AWS?

MODULE 4: (S3 Buckets)

TOPIC 1: (Introduction S3)

Lecture 1.1: What is Amazon S3?
Lecture 1.2: Amazon S3
Lecture 1.3: Amazon Cloud front
Lecture 1.4: Brief Introduction Cloud Front

MODULE 5: (DNS)

TOPIC 1: (Introduction DNS)

Lecture 1.1: Domain Name System (DNS)

Lecture 1.2: Types of Domain Name System (DNS)

MODULE 6: (RDS)

TOPIC 1: (Introduction of RDS)

Lecture 1.1: Amazon Relational Database Service (RDS)

MODULE 7: (Snapshots)

TOPIC 1: (Introduction Snapshots)

Lecture 1.1: Amazon EBS Snapshots

Lecture 1.2: Creating windows machine snapshot AWS

Lecture 1.3: Elastic IP Addresses

MODULE 8: (AWS Cloud Trail)

TOPIC 1: (Introduction AWS Cloud Trail)

Lecture 1.1: AWS Cloud Trail

Lecture 1.2: Amazon EC2 Reserved instances

MODULE 9: (Identity and Access Management (IAM)

TOPIC 1: (Introduction Identity and Access Management (IAM)

Lecture 1.1: What is IAM?

Lecture 1.2: Introduction to AWS Billing

MODULE 10: (AWS Cloud Practitioner)

TOPIC 1: (Introduction AWS Cloud Practitioner (Billing))

Lecture 1.1: AWS Cloud Practitioner (Billing)

BASICS OF C#

COURSE CODE: MOOCCSE-A02 **DURATION: 8 Weeks.**

Course Prerequisites:

You should know how to use a computer at a basic level.

Learning Outcomes:

1. The fundamentals of C#
2. Control Flow: Decision making statements & Conditional Statements
3. Conditional Statements
4. Methods and Classes
5. Arrays & List
6. Different Methods of String & String Builder
7. DateTime & TimeSpan

Course Description:

This course is designed for the complete beginners to C# Programming. This course aims to teach programming at a steady pace which will help you to gasp complex C# topics in a simple way.

COURSE DETAILS

MODULE 1: (Introduction to C#)

TOPIC 1: (Introduction)

Lecture 1.1: (Introduction to .Net & C#)
Lecture 1.2: (Architecture of .net)
Lecture 1.3: (Getting Visual Studio)
Lecture 1.4: (Creating First Application)

MODULE 2: (C# Basics)

TOPIC 1: (Introduction C# Basics)

Lecture 1.1: (Variables)
Lecture 1.2: (Identifiers and Keyword)
Lecture 1.3: (Data Types)
Lecture 1.4: (Type Casting)
Lecture 1.5: (User Inputs)
Lecture 1.6: (Introduction to Operators)
Lecture 1.7: (Arithmetic Operators)
Lecture 1.8: (Assignment Operators)
Lecture 1.9: (Comparison Operators)
Lecture 1.10: (Logical Operators)
Lecture 1.11: (Comments)

MODULE 3: (Conditional Statements)

TOPIC 1: (Introduction of Conditional Statements)

Lecture 1.1: (If Statement)
Lecture 1.2: (If Else Statement)

Lecture 1.3: (If Else If Statement)
Lecture 1.4: (Nested If Statement)
Lecture 1.5: (Switch Statement)
Lecture 1.6: (Ternary Operator)

MODULE 4: (Iterative Statements)

TOPIC 1: (Introduction of Iterative Statements)

Lecture 1.1: (For Loop)
Lecture 1.2: (While Loop)
Lecture 1.3: (Do While Loop)
Lecture 1.4: (For Each Loop)
Lecture 1.5: (Goto Statement)
Lecture 1.6: (Continue Statement)

MODULE 5: (Methods and Classes)

TOPIC 1: (Introduction of Methods and Classes)

Lecture 1.1: (Introduction to Methods)
Lecture 1.2: (Call by Value)
Lecture 1.3: (Call by Reference)
Lecture 1.4: (Out Parameter)
Lecture 1.5: (Classes)
Lecture 1.6: (Constructors)
Lecture 1.7: (This Keyword)
Lecture 1.8: (Static Keyword)

MODULE 6: (Arrays & List)

TOPIC 1: (Introduction of Arrays & List)

Lecture 1.1: (Arrays)
Lecture 1.2: (Multi-dimensional Array)
Lecture 1.3: (Jagged Array)
Lecture 1.4: (Passing Array to a function)
Lecture 1.5: (Array Class)
Lecture 1.6: (List)

MODULE 7: (Strings)

TOPIC 1: (Introduction of Strings)

Lecture 1.1: (What is String?)
Lecture 1.2: (String Methods: Length, Concate & Join)
Lecture 1.3: (String Methods: Split & SubString)
Lecture 1.4: (String Methods: StartsWith & EndWith)
Lecture 1.5: (String Methods: Contains, Replace & Trim)
Lecture 1.6: (Comparing Two Strings)
Lecture 1.7: (String Escape Sequence)
Lecture 1.8: (String Builder)

MODULE 8: (Working with Date and Time)

TOPIC 1: (Introduction of Working with Date and Time)

Lecture 1.1: (DateTime)
Lecture 1.2: (TimeSpan)

CYBER SECURITY & ETHICAL HACKING

COURSE CODE: MOOCCSE-A11 **DURATION: 8 Weeks**

Course Outcomes:

1. BASICS OF SECURITY
2. WINDOWS & AD FUNDAMENTALS
3. TCP/IP & NETWORK SERVICES
4. BASICS OF ETHICAL HACKING
5. SCANNING OF SYSTEMS/APPLICATIONS
6. SECURING WEB APPLICATIONS

COURSE DESCRIPTION:

Build Your Career With the Most In-Demand field.

The Cyber Security & Ethical Hacking Program will equip you with the skills needed to become familiar in this rapidly growing domain. You will learn hacking tools, methodologies and techniques and learn how to secure them from these hackers.

COURSE DETAILS

MODULE 1: (Title of the Module)

TOPIC 1: (Introduction)

Lecture 1.1: Cyber space
Lecture 1.2: Encryption
Lecture 1.3: Email security
Lecture 1.4: Antiviruses
Lecture 1.5: Career in cyber sec

MODULE 2: (Microsoft OS)

TOPIC 1: (Windows)

Lecture 1.1: File System
Lecture 1.2: System Configuration
Lecture 1.3: Computer Management
Lecture 1.4: System Information
Lecture 1.5: Resource Monitor
Lecture 1.6: Command Prompt
Lecture 1.7: Registry Editor

TOPIC 2: (Active Directory)

Lecture 2.1: Domain Controller
Lecture 2.2: Forest
Lecture 2.3: Users & Groups
Lecture 2.4: Domain Authentication

MODULE 3: (Networking)

Lecture 1.1: TCP/IP
Lecture 1.2: Layers in TCP/IP
Lecture 1.3: Ports & Sockets
Lecture 1.4: Firewall

Lecture 1.5: Network Services
Lecture 1.6: DNS, Telnet, SSH
Lecture 1.7: Video Forensic

MODULE 4: (Ethical Hacking)

Lecture 1.1: What is Hacking?
Lecture 1.2: Types of Hackers
Lecture 1.3: Google Dorks as Hacking Tools
Lecture 1.4: Phases of Hacking
Lecture 1.5: Passive Reconnaissance
Lecture 1.6: Active Reconnaissance
Lecture 1.7: Port Scanning
Lecture 1.8: NMAP as Scanning Tool
Lecture 1.9: NMAP Scripting Tool
Lecture 1.10: Exploit Searching
Lecture 1.11: Video Password Cracking

MODULE 5: (Websites)

Lecture 1.1: Working of Website
Lecture 1.2: HTML
Lecture 1.3: HTTP
Lecture 1.4: HTTP Methods
Lecture 1.5: Headers & Cookies

MODULE 6: (Web Applications)

Lecture 1.1: Walking a Application
Lecture 1.2: Browser Developer Tools

RESOURCES:

- OWASP Installation - Vulnerable Web Application
- DIRB & Whatweb For Website Identification
- Hydra - Bruteforcing Any Login Page
- Burpsuite Introduction & Configuration
- Command Injection & Target Exploitation
- Combining Our Python Tool With Command Injection Vulnerability
- XSS Attack Theory
- Finding XSS Vulnerability On A Webpage
- Solving XSS Challenges On An Online Lab
- HTML Character Encoding To Exploit an XSS Vulnerability

MODULE 7: (Web Applications Security Risks)

Lecture 1.1: Injection

RESOURCES:

- HTML Code Injection Vulnerability
- What is SQL & SQL Injection Theory
- Stealing Database Passwords With Advance Manual SQL Injection
- Broken Access Control
- Sensitive Data Exposure
- Security Misconfigurations

MODULE 8: (Hacking)

Lecture 1.1: Password Tool John the Ripper
Lecture 1.2: Hacking Video

DATABASE MANAGEMENT SYSTEM

COURSE CODE: MOOCCSE-A10 **DURATION: 06 Weeks**

Course Prerequisites:
Introduction to Computer Science and Engineering, Programming Fundamentals

Course Outcomes:
1. Fundamental elements of relational database management systems and non-relational database
2. Design ER-models to represent simple database application scenarios
3. Able to create SQL queries using multiple tables.
4. Improve the database design by normalization.
5. Database indexing (B and B+ Trees).

Course Description:
The main objective of this course is to provide students with the background to design, implement, and use database management systems. This course offers a good understanding of database systems concepts and prepares the student to be in a position to use and design databases for different applications. Behind the development and design of this course is to know.

1. How to design, manipulate and manage databases.
2. The course participants are exposed to the various forms, types and models of database systems to enable them make viable choices.
3. Supportive and complementary concepts of managing data and documents are thoroughly examined to give a wholesome view of data/information management.

COURSE DETAILS

MODULE 1 (Introduction to Database Systems)

Topic 1: (DBMS and File System)
- Lecture 1.1: (File Systems Versus a DBMS)
- Lecture 1.2: (Advantages of a DBMS)

Topic 2: (Architectures)
- Lecture 2.1: (Components of DBMS)
- Lecture 2.2: (Architecture of DBMS)

Topic 3: (Data Abstraction and Schemas)
- Lecture 3.1: (Database System Architecture)
- Lecture 3.2: (Data Independence and Schemas)

MODULE 2 (Relational Database)

Topic 1: (Types of Databases)
- Lecture 1.1: (CRUD Operations)
- Lecture 1.2: (Types of Databases, Relational Database)

Topic 2: (Non-Relational Database)
- Lecture 2.1: (Non-Relational Database)

Topic 3: (Basics of SQL)
- Lecture 3.1: (Creating Tables, Rows and Keys)
- Lecture 3.2: (What is SQL?, SQL as DML, DDL and DCL)

MODULE 3 (Lets Start SQL)

Topic 1: (SQL Workbench)

Lecture 1.1: (SQL Workbench - Apex)

Topic 2: (Creating Database for SQL)

Lecture 2.1: (Creating Database)

Topic 3: (SQL Clauses and Operations)

Lecture 3.1: (Select Clause)

Lecture 3.2: (Where Clause And Clause)

Lecture 3.3: (Practice SQL Operators on Workbench)

MODULE 4 (Types of File Organization and Practice SQL)

Topic 1: (What is File Organization?)

Lecture 1.1: (File Organization and SQL – OR Operator)

Lecture 1.2: (5 types of File Organization and SQL – IN, Between, Null Clause)

Topic 2: (Different Types of File Organization and SQL hands-on Practice)

Lecture 2.1: (Types of Hashing, SQL – Query Filtering Conditions, Operator Precedence)

Lecture 2.2: (Cluster, B+ Tree file Organization, SQL–Ordering, Concatenation, Aliasing Query)

Topic 3: (Indexing and SQL Functions)

Lecture 3.1: (What is Indexing? , SQL Function – SumThese, Use of Concat, Pipes)

MODULE 5 (Data Models in Database Management System and Practice SQL)

Topic 1: (Hierarchical Model)

Lecture 1.1: (Hierarchical Model , SQL Functions – Upper , Lower , DUAL Table)

Topic 2: (Network Model)

Lecture 2.1: (Network Model , SQL Functions – Using Functions in Where Clause)

Topic 3: (Entity Relationship Model)

Lecture 3.1: (ER Model , SQL Functions – Initcap Function and Length Function)

Resources: PDF:

KEYS & Constraints (Primary Key, Foreign Key, Unique, Not Null, Check)

JOIN Queries

MODULE 6 (Normal Forms, Functional Dependency and ACID Properties)

Topic 1: (Types of Functional Dependencies)

Lecture 1.1: (Functional Dependency and SQL – SUBSTR Function)

Topic 2: (Normal Forms and SQL Functions)

Lecture 2.1: Different Normal Forms, SQL – LPAD, RPAD, LTRIM, RTRIM Functions)

Topic 3: (ACID Properties)

Lecture 3.1: (ACID Properties)

FUNDAMENTAL OF JAVA

COURSE CODE: MOOCCSE-A09 **DURATION: 7 Weeks.**

Course Prerequisites:

You should know how to use a computer at a basic level

Course Outcomes:

1. The fundamentals of Java
2. The building blocks of java program.
3. Conditional Statements
4. Iterative Statements
5. Object-Oriented Programming

Course Description:

This course is designed for the complete beginners to java programming. This course aims to teach programming at a steady pace which will help you to gasp complex java topics in a simple way.

COURSE DETAILS

MODULE 1: (Basic of Java Language Part-1)

TOPIC 1: (Introduction)

Lecture 1.1: Introduction to Java Language
Lecture 1.2: Installing JDK & IDE
Lecture 1.3: First Program in Java
Lecture 1.4: User Input using Scanner Class
Lecture 1.5: Comments

MODULE 2: (Basic of Java Language Part-2)

TOPIC 1: (Basic Language of Elements)

Lecture 1.1: Variables
Lecture 1.2: Datatypes
Lecture 1.3: Type Casting in Java
Lecture 1.4: Operators in Java
Lecture 1.5: Strings
Lecture 1.6: Array

MODULE 3: (Conditional Statements)

TOPIC 1: (Conditional Statements)

Lecture 1.1: If Statement
Lecture 1.2: If-else Statement
Lecture 1.3: If-else-if ladder
Lecture 1.4: Nested if-statement
Lecture 1.5: Switch Statement

MODULE 4: (Iterative Statements)

TOPIC 1: (Iterative Statements)

Lecture 1.1: Do-While Loop
Lecture 1.2: While Loop
Lecture 1.3: For Loop
Lecture 1.4: For Each Loop
Lecture 1.5: Break Statement

Lecture 1.6: Continue Statement

MODULE 5: (OOPs: Object Class Part-1)

TOPIC 1: (Basics of OOPS Concepts in Java)

Lecture 1.1: OOPs Concept in Java
Lecture 1.2: Object and Class
Lecture 1.3: Method
Lecture 1.4: Constructor
Lecture 1.5: Static Keyword
Lecture 1.6: This Keyword

MODULE 6: (OOPs: Object Class Part-1)

TOPIC 1: (Inheritance & Overloading)

Lecture 1.1: Basics Inheritance
Lecture 1.2: Single and Multilevel Inheritance
Lecture 1.3: Hierarchical Inheritance
Lecture 1.4: Basics of Polymorphism
Lecture 1.5: Method Overloading
Lecture 1.6: Super keyword

MODULE 7: (Abstraction & Encapsulation)

TOPIC 1: (Abstraction & Encapsulation)

Lecture 1.1: Abstraction: Abstract Class
Lecture 1.2: Abstraction: Interface
Lecture 1.3: Basic of Encapsulation
Lecture 1.4: Encapsulation: Package
Lecture 1.5: Encapsulation: Access Modifiers

RESOURCES: PDF: Exceptional handling

JDBC with MYSQL

- Types of JDBC Drivers
- JDBC Classes/Interfaces
- JDBC Connectivity Steps
- Establishing connection with the database
- Reading data from database
- Creating Table using Statement
- Insert using Statement
- Update using Statement
- Delete using Statement
- Statement Vs PreparedStatement
- Insert using PreparedStatement
- Update using PreparedStatement
- Delete using PreparedStatement
- CallableStatement:
- CallableStatement:
- ResultSetMetaData
- DatabaseMetaData
- Storing Image
- Retrieving Image
- Storing File
- Retrieving File

INTRODUCTION TO CLOUD COMPUTING

COURSE CODE: MOOCCSE-A04 **DURATION: 06 Weeks.**

Course Prerequisites:

Basic knowledge of Computer

Learning Outcomes:

1. Learn general Cloud Computing Concepts.
2. Gain and understand the fundamental systems on which the cloud is based.
3. Build knowledge from beginner level.
4. You will learn about the various cloud service models & deployment models of cloud computing.

Course Description:

You will learn general cloud computing concepts and this cloud computing full course will provide you with everything you need to know about cloud computing. Starting from introduction of cloud computing, why cloud computing came to existence, Service models of cloud computing & we will also cover cloud storage & cloud security. Even though this course does not require any prior cloud computing.

COURSE DETAILS

MODULE 1: (Introduction)

TOPIC 1: (Introduction of Cloud Computing)

Lecture 1.1: **(**What is Cloud Computing?**)**

Lecture 1.2: **(**Why Cloud Computing?**)**

MODULE 2: (Deployment Models)

TOPIC 1: (Introduction of Deployment Model & Types)

Lecture 1.1: **(**Deployment Models (Public Cloud, Private Cloud, Hybrid Cloud & Community Cloud)

MODULE 3: (Service Models)

TOPIC 1: (Introduction & Types of Service Models)

Lecture 1.1: **(**Introduction & Infrastructure as a Service(Iaas)**)**

Lecture 1.2: **(**Platform as a Service (Paas))

Lecture 1.3: (Software as a Service (Saas))

Lecture 1.4: **(**Iaas vs. Paas vs. Saas**)**

MODULE 4: (Cloud Computing Architecture & Components)

TOPIC 1: (Cloud Computing Architecture)

Lecture 1.1: **(**What is Cloud Computing Architecture?)

Lecture 1.2: **(**Important Components of Cloud Computing**)**

Lecture 1.3: **(**Essential Characteristics of Cloud Computing**)**

TOPIC 2: (Challenges of Cloud Computing)

Lecture 2.1: **(**Most common challenges of Cloud Computing**)**

MODULE 5: (Cloud Storage)

TOPIC 1: (Introduction of Cloud Storage)

Lecture 1.1: **(**What is Cloud Storage?**)**

Lecture 1.2: **(**Types of Cloud storage)

Lecture 1.3: **(**Benefits of Cloud storage adoption**)**

MODULE 6: (Cloud Security and Career Opportunities)

TOPIC 1: (Cloud Security)

Lecture 1.1: **(**What is Cloud Security?)

Lecture 1.2: **(**How cloud security works?)

Lecture 1.3: **(**Measures & Controls in Cloud Security)

Lecture 1.4: **(**Facts about Cloud Computing Security)

TOPIC 2: (Career Opportunities in Cloud Computing & Cloud Comparison)

Lecture 2.1: **(**Career opportunities in Cloud Computing)

Lecture 2.2: **(**Cloud Comparison)

OFFICE AUTOMATION

COURSE CODE: MOOCCSE-A05 **DURATION: 04 Weeks**

Course Prerequisites:

Basic Programming fundamentals

Learning Outcomes:

1. Office Automation Concepts
2. MS Word
3. MS PowerPoint
4. Basics of MS Excel
5. Internet Basics

Course Description:

Introduces the basic features of Microsoft Office. Develops familiarity with Word, Excel, PowerPoint, email & Internet basics. Learners use Microsoft Office programs to create personal, academic & business documents.

COURSE DETAILS

MODULE 1: (MS-WORD)

TOPIC 1: (Working with Documents)

Lecture 1.1: (How to Create & Add Text in Word File)
Lecture 1.2: (How to Save File)
Lecture 1.3: (How to Open and Selecting Text in Word Document)
Lecture 1.4: (Cut, Copy, Paste)
Lecture 1.5: (Find and Replace)
Lecture 1.6: (Undo and Redo)

TOPIC 2: (Formatting Documents)

Lecture 2.1: (Type Face - Bold, Italic, Underline, Subscripts)
Lecture 2.2: (Text Effects- Font, Text Highlight Colour, Font Colour, Font Style, Font Size, Increase Font Size and Decrease Font Size)
Lecture 2.3: (Styles, Alignments, Bullets, Numbering & Multilevel list)
Lecture 2.4: (Increase Indent and Decrease Indent)
Lecture 2.5: (Change Case- Sentence Case, Lowercase, UPPERCASE, Capitalised Each Word, tOggle Case)

TOPIC 3: (Setting Page Style)

Lecture 3.1: (Formatting Page)
Lecture 3.2: (Tab Stops)
Lecture 3.3: (Margins, Border & Shading, Columns)
Lecture 3.4: (Header & Footer)

TOPIC 4: (Creating Tables)

Lecture 4.1: (Inserting Table & Draw Table - How to do Settings (Borders, Alignments, Insertion, deletion, Merging, Splitting)

Lecture 4.2: (How to Add Excel Spreadsheet and Quick Tables)

TOPIC 5: (Page Background)

Lecture 5.1: (Watermark, Page Colour & Page Borders)

Lecture 5.2: (Proofing and Speech)

Lecture 5.3: (Print and Export a File)

Lecture 5.4: (How to Print and Export a File?)

MODULE 2: (MS-PowerPoint)

TOPIC 1: (Introduction to Presentation)

Lecture 1.1: (How to Create a New Presentation)

Lecture 1.2: (How to Open and Save Presentation)

Lecture 1.3: (Selecting Backgrounds)

Lecture 1.4: (Different Presentation Templates)

Lecture 1.5: (Selecting Presentation Layouts)

TOPIC 2: (Creating a Presentation)

Lecture 2.1: (Setting Presentation style)

Lecture 2.2: (Adding text to the Presentation)

TOPIC 3: (Formatting a Presentation)

Lecture 3.1: (Adding Style, Colour, Gradient fills)

Lecture 3.2: (Arranging Objects, Adding Header and Footer)

TOPIC 4: (Adding Graphics to Presentation)

Lecture 4.1: (Insert Pic)

Lecture 4.2: (Insert Table)

TOPIC 5: (Adding Effects to Presentation)

Lecture 5.1: (Setting Animation)

Lecture 5.2: (Transition Effect)

MODULE 3: (MS-EXCEL)

TOPIC 1: (Basics of MS-Excel)

Lecture 1.1: (Excel Screen and How to create a Workbook)

Lecture 1.2: (Spreadsheet, Rows & Columns, Cells, Scroll Bar)

Lecture 1.3: (How to zoom in & zoom out in Workbook, Formula Bar, Sheets & Selecting Ranges)

Lecture 1.4: (Simple Data Entry)

Lecture 1.5: (Saving Workbook Formats)

TOPIC 2: (Formatting Workbook)

Lecture 2.1: (Setting Font Styles in Workbook)

Lecture 2.2: (Setting Alignments in Workbook)

Lecture 2.3: (How to Merge & Centre Cells)

TOPIC 3: (How to work with Cells)

Lecture 3.1: (How to Insert and Delete Cells)

Lecture 3.2: (Basic Formula used in Excel (Add, Subtract, Multiply, Divide, Sum, Average, Count, Min, Max and Current time)

MODULE 4: (Internet & Mail)

TOPIC 1: (Introduction of Internet & Mail)

Lecture 1.1 (Basics of Internet)

Lecture 1.2 (How to send a Mail)

OPERATING SYSTEM

COURSE CODE: MOOCCSE-A06 **DURATION: 05Weeks.**

Course Prerequisites:

Basic Knowledge of Computer

Learning Outcomes:

1. You will become very familiar with the core concepts of Operating Systems
2. Understand how Operating Systems work
3. You will view Computer Science in a different dimension
4. Understand how Process scheduling is done in Operating Systems
5. Understand Memory management in Operating Systems

Course Description:

In this course, you will learn what is an Operating system, and how it works. You will gain about how operating system works, how multitasking works, how scheduling works, what is a process, thread, deadlock and much more. This course will equip learners with foundational knowledge of operating systems. This course is designed to give you the operating system skills you need to crack the interview questions on operating system, so this course is for you.

COURSE DETAILS

MODULE 1 (Overview of Operating System)

TOPIC 1: (Operating System)

Lecture 1.1: (Definition of operating system)

TOPIC 2: (Functions and Operations of Operating System)

Lecture 2.1: (Functions of Operating System)
Lecture 2.2: (Operations of Operating System)

MODULE 2 (Process & Thread Management)

TOPIC 1: (Process Management)

Lecture 1.1: (Process in Operating System)
Lecture 1.2: (Process Synchronization)
Lecture 1.3: (Process Scheduling)
Lecture 1.4: (Context Switching)

TOPIC 2: (Multi-threading)

Lecture 2.1: (Introduction of Threads)
Lecture 2.2: (Types of Threading)

MODULE 3 (Resource Management & Communication)

TOPIC 1: (Resource Management & Communication)

Lecture 1.1: (What is Resource Management in Operating System?)
Lecture 1.2: (Inter Process Communication)
Lecture 1.3: (I/0 Management)

TOPIC 2: (Memory Management)

Lecture 2.1: (Introduction of Memory Management)

MODULE 4 (Distributed System in Operating System)

TOPIC 1: (Distributed System)

Lecture 1.1: (Overview of Distributed System in operating system)

MODULE 5 (Deadlocks)

TOPIC 1: (Explain and understanding Deadlocks)

Lecture 1.1: (Deadlocks)

PHP

COURSE CODE: MOOCCSE-A07 **DURATION: 8 Weeks**

Course Prerequisites:

Basic Knowledge of Computer

Learning Outcomes:

Some basic concept of computers.

Course Description:

You will learn the concept of programming using php & project from scratch.

COURSE DETAILS

MODULE 1: Introduction & environment setup

TOPIC 1: Introduction

Lecture 1.1: Overview details of programing & Web Development
Lecture 1.2: Installation of XAMPP on windows
Lecture 1.3: Installation of XAMPP on mac.
Lecture 1.4: phpstrom installation on windows
Lecture 1.5: phpstrom installation on mac.

MODULE 2: PHP Basics

TOPIC 1: Introduction PHP Basics

Lecture 1.1: Syntax of php.
Lecture 1.2: Data types in php.
Lecture 1.3: Variables in php.
Lecture 1.4: Our first program in php.
Lecture 1.5: Task for addition
Lecture 1.6: Solution of addition

MODULE 3: Operators in PHP

TOPIC 1: Introduction of Operators in PHP

Lecture 1.1: Use of concatenation.
Lecture 1.2: Addition & subtraction of numbers.
Lecture 1.3: Divide, multiply of numbers & modules.

MODULE 4: Condition statements in PHP

TOPIC 1: Introduction Condition statements in PHP

Lecture 1.1: Logical & Comparison operators.
Lecture 1.2: If Statements
Lecture 1.3: If Else statements
Lecture 1.4: Else If Statements
Lecture 1.5: Task for greetings
Lecture 1.6: Solution of greetings

MODULE 5: Loops & Iterations in PHP

TOPIC 1: Introduction of Loops & Iterations in PHP

Lecture 1.1: For Loops
Lecture 1.2: While Loops
Lecture 1.3: Foreach Loops
Lecture 1.4: Do-While Loops
Lecture 1.5: Break & continue

MODULE 6: Pre-defined & Custom functions in PHP

TOPIC 1: Introduction Of Pre-defined & Custom functions in PHP

Lecture 1.1: Function definition
Lecture 1.2: Parameters in functions
Lecture 1.3: Global Variables
Lecture 1.4: Call by value
Lecture 1.5: Call by reference.
Lecture 1.6: Default arguments
Lecture 1.7: Variable arguments
Lecture 1.8: Arrays
Lecture 1.9: Strings

MODULE 7: HTML forms in PHP

TOPIC 1: Introduction of HTML forms in PHP

Lecture 1.1: Basics of HTML
Lecture 1.2: Form Creation & Sublimations
Lecture 1.3: HTTP Methods in php
Lecture 1.4: Validation of html forms
Lecture 1.5: Form Example

MODULE 8: Object oriented programing in PHP

TOPIC 1: Introduction of Object-oriented programing in PHP

Lecture 1.1: Classes & Object
Lecture 1.2: Constructors
Lecture 1.3: Inheritance in OOPS

PYTHON FOR DATA SCIENCE

COURSE CODE: MOOCCSE-A08 **DURATION: 7 Weeks.**

Course Prerequisites:

Beginner Level Python

Course Outcomes:

1. Working ON Python Environment (Jupyter Notebook)
2. Python operation for data analysis
3. Libraries like Numpy and Pandas
4. Data Handling
5. Data Manipulation

Course Description:

Data science can be defined as a blend of mathematics, business acumen, tools, algorithms and machine learning techniques, all of which help us in finding out the hidden insights or patterns from raw data which can be of major use in the formation of big business decisions. In this course we are going to learn data handling and manipulation methods with the help of Python.

COURSE DETAILS

MODULE 1: (Introduction Part)

TOPIC 1: (Introductory part)

Lecture 1.1: (Introduction)
Lecture 1.2: (Introduction to Jupyter Notebook)

TOPIC 2: (List and Set)

Lecture 2.1: (Revising List)
Lecture 2.2: (List and Sets)
Lecture 2.3: (More on Sets)

TOPIC 3: (Dictionaries and Tuples)

Lecture 3.1: (Intro to Dictionaries)
Lecture 3.2: (More on Dictionaries)
Lecture 3.3: (Intro to Tuples)
Lecture 3.4: (More on Tuples)

MODULE 2: (Functions and Recursion)

TOPIC 1: (Understanding Function)

Lecture 1.1: (Intro to Functions)
Lecture 1.2: (Examples using functions)
Lecture 1.3: (Type of function argument)

TOPIC 2: (Recursion)

Lecture 2.1: (Recursion in Python)
Lecture 2.2: (More examples on recursion)
Lecture 2.3: (Sorting Recursively)

MODULE 3: (While and for loops)

TOPIC 1: (Lambda Function)

Lecture 1.1: (Introduction to Lambda Functions)

Lecture 1.2: (Lambda Functions part 2)

TOPIC 2: (Datetime Module)

Lecture 2.1: (Introduction to Datetime Module)

Lecture 2.2: (Datetime Module Part 2)

TOPIC 3: (Handling TXT File)

Lecture 3.1: (R/W on txt Files)

Lecture 3.2: (Text File Handling)

MODULE 4: (Numpy and CSV files)

TOPIC 1: (All about Numpy)

Lecture 1.1: (Intro to Numpy)

Lecture 1.2: (Numpy part 1)

Lecture 1.3: (Numpy part 2)

TOPIC 2: (Handling CSV files)

Lecture 2.1: (Reading CSV files)

Lecture 2.2: (Why Pandas?)

MODULE 5: (Pandas Series and DataFrmae)

TOPIC 1: (Introduction to Pandas)

Lecture 1.1: (pandas part 1)

Lecture 1.2: (pandas part 2)

TOPIC 2: (Dataframe and Series)

Lecture 2.1: (Dataframe and Series)

TOPIC 3: (Data Viewing)

Lecture 3.1: (Data Viewing Part 1)

Lecture 3.2: (Data Viewing Part 2)

MODULE 6: (Data Handling and Manipulation)

TOPIC 1: (Missing Data Management)

Lecture 1.1: (Handling Missing Data)

TOPIC 2: (Statistical Operations)

Lecture 2.1: (Descriptive Stats using pandas)

TOPIC 3: (Data Merge and Group)

Lecture 3.1: (Data Merging)

Lecture 3.2: (Data Grouping)

Lecture 3.3: (Stack in pandas)

MODULE 7: (Data Handling and Manipulation)

TOPIC 1: (Pivot Table)

Lecture 1.1: (Pivot Table and Cut function)

TOPIC 2: (Date Time in Pandas)

Lecture 2.1: (DateTime part 1)

Lecture 2.2: (DateTime part 2)

TOPIC 3: (Categoricals and Different file types)

Lecture 3.1: (Categoricals in Pandas)

Lecture 3.2: (Reading and Writing different types of Files)

MAHARAJA RANJIT SINGH PUNJAB TECHNICAL UNIVERSITY BATHINDA-151001 (PUNJAB), INDIA

(A State University Estb. by Govt. of Punjab vide Punjab Act No. 5 of 2015 and Approved u/s 2(f) & 12 (B) of UGC; Member AIU)

Department: **COMPUTER SCIENCE ANDENGINEERING**
GianiZail Singh Campus College of Engineering & Technology, MRSPTU

Program: M Tech Computer Science and Engineering

Revised COs, POs, PSOs Mapping

Subject: MATHEMATICAL FOUNDATION OF COMPUTER SCIENCE	**Subject Code:** MCSCE1-101	**Semester: 1st**
Credit: 3	**L T P 3 0 0**	**38Hrs.**

COs	Statement	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	To understand the basic notions of discrete and continuous probability.	3									
CO2	To understand the methods of statistical inference, and the role that samplingdistributions play in those methods		1					1		1	
CO3	To be able to perform correct and meaningful statistical analyses of simple to moderate complexity.			3			2				
CO4	Applications of Mathematics in various fields of Computer science and engineering.				3	1			1		1

Subject: ADVANCED DATA STRUCTURES	Subject Code: MCSCE1-102	Semester: 1st
Credit: 3	L T P 3 0 0	38Hrs.

COs	Statement	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	Understand the implementation of symbol table using hashing techniques			3			1				1
CO2	Develop and analyze algorithms for red-black trees, B-trees and Splay trees.			3		2				1	1
CO3	Develop algorithms for text processing applications.				2					3	2
CO4	Identify suitable data structures and develop algorithms for computational geometry Problems	3			1					3	

Subject: RESEARCH METHODOLOGY AND IPR	Subject Code: MRMIP0-101	Semester: 1st
Credit: 2	L T P 2 0 0	28Hrs.

COs	Statement	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	Understand research problem formulation, analyze research related information,Follow research ethics		3				2			3	
CO2	Understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity.	3		3		2				1	1
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 Rightto be promoted among students in general& engineering in particular.		3		2		3	3		1	2
CO4	Understand that IPR protection provides an incentive to inventors for further researchwork and investment in R & D, which leads to creation of new and better products, and inturn brings about, economic growth and social benefits.		3	2	2					3	1

Subject: ADVANCEDDATA Structures Laboratory	**Subject Code:** MCSCE1-103	**Semester: 1st**
Credit: 2	**L T P 0 0 4**	**60Hrs.**

COs	Statement	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	To implement Binary search tree and AVL trees	3		1							3
CO2	To implement insertion and deletion in AVL trees.	3		1							3
CO3	To implement Red-Black Trees and various operations in m-way search trees.	3		2							3
CO4	To implement various algorithms.	3		2							3

Subject: MACHINE LEARNING	**Subject Code:** MCSCE1-156	**Semester: 1st**
Credit: 3	**L T P 3 0 0**	**38Hrs.**

COs	Statement	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	Extract features that can be used for a particular machine learning approach in variousIOT applications	3		1							3
CO2	To compare pros and cons of various machine learning techniques and toget an insight of when to apply a particular machine learning approach.							1		1	2
CO3	To mathematically analyze various machine learning approaches and paradigms.	1	2				2			2	3
CO4	To learn various trends of machine learning techniques.	1		3		1					1

Subject: WIRELESS SENSOR NETWORKS	**Subject Code:** MCSCE1-157	**Semester: 1st**
Credit: 3	**L T P 3 0 0**	**38Hrs.**

COs	Statement	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	Describe and explain radio standards and communication protocols for wireless sensornetworks			3	1		1			3	
CO2	Explain the function of the node architecture and use of sensors for variousapplications.	3	1	3							1
CO3	Be familiar with architectures, functions and performance of wireless sensor networkssystems and platforms.		1	3	2						2
CO4	To understand various security issues.	3	1		2					3	

Subject: INTRODUCTION TO INTELLIGENT SYSTEMS	**Subject Code:** MCSCE1-158	**Semester: 1st**
Credit: 3	**L T P 3 0 0**	**38Hrs.**

COs	Statement	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	Able to demonstrate knowledge of the fundamental principles of intelligent systems andwould be able to analyses and compare the relative merits of a variety of AI problem solvingtechniques.	3		1						1	
CO2	To understand the basic concepts of Basic concepts of graph and tree search	1		3							3
CO3	To learn knowledge representation.						2				1
CO4	To learn recent trends in Fuzzy logic, Knowledge Representation.	2									2

Subject: DATA SCIENCE	**Subject Code:** MCSCE1-159	**Semester: 1st**
Credit: 3	**L T P 3 0 0**	**38Hrs.**

COs	Statement	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	Explain how data is collected, managed, and stored for data science.	1		3			1			1	
CO2	Understand the key concepts in data science, including their real-world applicationsand the toolkit used by data scientists	3		3		2				2	1
CO3	Implement data collection and management scripts using MongoDB	2		3						1	2
CO4	To learn applications of data science.	3			2					3	1

Subject: DISTRIBUTED SYSTEMS	**Subject Code:** MCSCE1-160	**Semester: 1st**
Credit: 3	**L T P 3 0 0**	**38Hrs.**

COs	Statement	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	Design trends in distributed systems.	1		2						1	
CO2	To learn distributed databases.					1	1		2		
CO3	To understand the concept of distributed query optimization.		1							1	
CO4	To understand the concept of parallel databases.	2		3	1	1				3	2

Subject: ADVANCED WIRELESS AND MOBILE NETWORKS	**Subject Code:** MCSCE1-161	**Semester: 1st**
Credit: 3	**L T P 3 0 0**	**38Hrs.**

COs	Statement	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	Demonstrate advanced knowledge of networking and wireless networking andunderstand various types of wireless networks, standards, operations and use cases.	2		3			2			1	2
CO2	Be able to design WLAN, WPAN, WWAN, Cellular based upon underlyingpropagation and performance analysis.	2		3		1					1
CO3	Demonstrate knowledge of protocols used in wireless networks and learn simulating wireless networks	2	1		1		1			3	
CO4	Design wireless networks exploring trade-offs between wire line and wireless links	3		3		2					1

Subject: MACHINE LEARNING LAB.	**Subject Code:** MCSCE1-162	**Semester: 1st**
Credit: 2	**L T P 0 0 4**	**60 Hrs.**

COs	Statement	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	To implement supervised machine learning (regression) algorithms.		3		2					1	
CO2	To implement supervised machine learning (classification) algorithms.	3			2					3	
CO3	To implement unsupervised machine learning algorithms.	3		3			2			1	
CO4	To implement dimensionality reduction and PCA.			3		1					

Subject: WIRELESS SENSOR NETWORKS LAB.	**Subject Code:** MCSCE1-163	**Semester: 1st**
Credit: 2	**L T P 0 0 4**	**60 Hrs.**

COs	Statement	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	To learn Introduction to Network Simulators	1	3				2			1	
CO2	To learn TCL Scripting and trace file formats of network simulators.	1		3		1				1	
CO3	Create different simulation scenarios by varying MAC protocols.	3			1		1			3	
CO4	To implement and compare various routing protocols	1		3		2					1

Subject: INTRODUCTION TO INTELLIGENT SYSTEMS LAB	**Subject Code:** MCSCE1-164	**Semester: 1st**
Credit: 2	**L T P 0 0 4**	**60 Hrs.**

COs	Statement	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	To implement simple artificial neural network and neural network with back propagation.	1		3			2			1	
CO2	To implement recurrent neural network and fuzzy neural network.		1			1					1
CO3	To implement iterative deepening search and Hill Climbing Algorithm.	1	2	3			1			1	
CO4	Implementation of optimization genetic algorithm	1		3		2					1

Subject: DATA SCIENCE LAB.	**Subject Code:** MCSCE1-165	**Semester: 1st**
Credit: 2	**L T P 0 0 4**	**60 Hrs.**

COs	Statement	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	To learn basics of R	1	2	3			1			3	
CO2	To learn basic Statistics and Visualization	2		3		2					1
CO3	To learn K-Means Clustering and association rules.	1	1	3							2
CO4	To learn linear regression and implement other classifiers.	1	2	1							1

Subject: DISTRIBUTED SYSTEMS LAB.	**Subject Code:** MCSCE1-166	**Semester: 1st**
Credit: 2	**L T P 0 0 4**	**60 Hrs.**

COs	Statement	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	To install database packages.	1									
CO2	To create and manage database objects and security.		1							2	
CO3	Implement Partitioning on the database tables.	2		2							2
CO4	Implement various Transaction concurrency control methods.	2			1	1					1

Subject: ADVANCED WIRELESS AND MOBILE NETWORKS LAB.	**Subject Code:** MCSCE1-167	**Semester: 1st**
Credit: 2	**L T P 0 0 4**	**60 Hrs.**

COs	Statement	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	Setup & Configuration of Wireless Access Point (AP)		3				2			1	
CO2	Study of WLAN, Bluetooth Protocol and Applications	1	2	3		1					2
CO3	To study GSM modem and SMS client-server application	1	1	3			1				2
CO4	To Implement J2ME Program for Mobile Node Discovery	1		3		2				2	1

Subject: ADVANCEDALGORITHMS (Revised)	**Subject Code:** MCSCE1-204	**Semester: 2nd**
Credit: 3	**L T P 3 0 0**	**45 Hrs.**

COs	Statement	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	Analyze the complexity/performance of different algorithms and learn about matroids.	3	3				2			3	
CO2	To be able to understand the different flow networks.	2					3			2	1
CO3	To understand various shortest path algorithms.	3					1			1	3
CO4	Students should have an insight of the linear programming and recent activities in the field and advanced datastructure.	3				2			3	2	1

Subject: SOFT COMPUTING	**Subject Code:** MCSCE1-205	**Semester: 2nd**
Credit: 3	**L T P 3 0 0**	**45 Hrs.**

COs	Statement	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	Identify and describe soft computing techniques and their roles in building intelligentmachines	3					2			1	3
CO2	Apply fuzzy logic and reasoning to handle uncertainty and solve various engineeringproblems.	3		3		2			1	2	
CO3	Apply genetic algorithms to combinatorial optimization problems.	3	1			1					
CO4	Evaluate and compare solutions by various soft computing approaches for a given problem.	3				2				2	3

Subject: ADVANCED ALGORITHMS LAB. (Revised)	**Subject Code:** MCSCE1-268	**Semester: 2nd**
Credit: 2	**L T P 0 0 4**	**60 Hrs.**

COs	Statement	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	To implement Dijkstra's algorithm	3	3	1			2			2	
CO2	To implementFloyd-Warshall algorithm	2									2
CO3	To find inverse of a triangular matrix using divide and conquer strategy.	3					1				2
CO4	To convert base (decimal/hexa) representation to modulo representation.					2			3		3

Subject: SOFT COMPUTING LAB.	**Subject Code:** MCSCE1-269	**Semester: 2nd**
Credit: 2	**L T P 0 0 4**	**60 Hrs.**

COs	Statement	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	To implement string and array operations in Python	3	3				2				
CO2	To study neural network toolbox	3				2			3		1
CO3	To study fuzzy logic toolbox		1			1					
CO4	To perform operations on fuzzy sets.	3				2					1

Subject: Data Preparation and Analysis (Revised)	**Subject Code:** MCSCE1-270	**Semester: 2nd**
Credit: 3	**L T P 3 0 0**	**45 Hrs.**

COs	Statement	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	To be familiar with Data gathering and preparation analysis	1	2			1	1			1	1
CO2	To learn about data cleaning	1	2			1	1			1	1
CO3	To be familiar with exploratory analysis	1	2			1	1			1	1
CO4	To be familiar with various Visualization concepts and issues	1	2			1	1			1	1

Subject: SECURE SOFTWARE DESIGN AND ENTERPRISE COMPUTING	**Subject Code:** MCSCE1-271	**Semester: 2nd**
Credit: 3	**L T P 3 0 0**	**45 Hrs.**

COs	Statement	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	Differentiate between various software vulnerabilities		2						3		1
CO2	Software process vulnerabilities for an organization	2		1			1			1	
CO3	Monitor resources consumption in a software.				3			1			1
CO4	Interrelate security and software development process	2		2		1				1	

Subject: COMPUTER VISION	**Subject Code:** MCSCE1-272	**Semester: 2nd**
Credit: 3	**L T P 3 0 0**	**45 Hrs.**

COs	Statement	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	Developed the practical skills necessary to build computer vision applications.		3				2				1
CO2	To have gained exposure to object and scene recognition and categorization from images.					2					
CO3	To extract features from data.		1								1
CO4	To perform pattern analysis.	3								1	

Subject: HUMAN AND COMPUTER INTERACTION	**Subject Code:** MCSCE1-273	**Semester: 2nd**
Credit: 3	**L T P 3 0 0**	**45 Hrs.**

COs	Statement	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	Understand the structure of models and theories of human computer interaction and vision.		3				2				1
CO2	Design an interactive web interface on the basis of models studied.	1			2						
CO3	To study Mobile Ecosystem.		1								1
CO4	To Study designing Web Interfaces.									1	

Subject: GPU COMPUTING	Subject Code: MCSCE1-274	Semester: 2nd
Credit: 3	L T P 3 0 0	45 Hrs.

COs	Statement	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	Understand the structure of models and theories of human computer interaction and vision.		3				2				1
CO2	Design an interactive web interface on the basis of models studied.	1			2						
CO3	To study Mobile Ecosystem.		1								1
CO4	To Study designing Web Interfaces.									1	

Subject: GPU COMPUTING LAB	Subject Code: MCSCE1-280	Semester: 2ND
Credit: 2	L T P 0 0 4	60 Hrs.

COs	Statement	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	Implement efficient algorithms for common application kernels, such as matrix multiplication				1						1
CO2	Given a problem, implement an efficient and correct code to solve it, analyze its performance, and give convincing written and oral presentations explaining the achievements.					1				1	
CO3	Describe common GPU architectures and programming models.			1							
CO4	Define terminology commonly used in parallel computing, such as efficiency and speedup.	1									

Subject: DIGITAL FORENSICS LAB	Subject Code: MCSCE1-281	Semester: 2ND
Credit: 2	L T P 0 0 4	60 Hrs.

COs	Statement	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	conduct digital investigations that conform to accepted professional standards and are based on the investigative process: identification, preservation, examination, analysis, and reporting							1			

CO2	Cite and adhere to the highest professional and ethical standards of conduct, including impartiality and the protection of personal privacy					1					1
CO3	Identify and document potential security breaches of computer data that suggest violations of legal, ethical, moral, policy, and/or societal standards			1						2	
CO4	Apply a solid foundational grounding in computer networks, operating systems, file systems, hardware, and mobile devices to digital investigations and to the protection of computer network resources from unauthorized activity	2			1						

Subject: Human and Computer Interaction Lab	**Subject Code:** MCSCE1-279	**Semester: 2ND**
Credit: 2	**L T P 0 0 4**	**60 Hrs.**

COs	Statement	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	Analyze and identify usability issues in User interfaces..	1									1
CO2	Design user interfaces according to the standards			1							
CO3	Evaluate user interfaces using Heuristic Evaluation and Thinking aloud Test.						1			1	
CO4	Demonstrate skills to collaborate in a team for justifying identified problems and to write interface related reports as per the standards.					1					

Subject: DIGITAL FORENSICS	**Subject Code:** MCSCE1-275	**Semester: 2ND**
Credit: 3	**L T P 3 0 0**	**45 Hrs.**

COs	Statement	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	Understand relevant legislation and codes of ethics	1					3	1			2
CO2	Computer forensics and digital detective and various processes, policies and procedures	1		1	3					1	
CO3	E-discovery, guidelines and standards, E-evidence, tools and environment	1		3		1			3		1
CO4	Email and web forensics and network forensics.	1		3			1				1

Subject: DATA PREPARATION AND ANLYSIS LAB (Revised)	Subject Code: MCSCE1-276	Semester: 2ND
Credit: 2	L T P 0 0 4	60 Hrs.

COs	Statement	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	Learn pre-processing method for multi-dimensional data	1	2				1			1	1
CO2	Practice on data cleaning mechanisms and data exploratory analysis	1	2				1			1	1
CO3	Develop the code for the visualizations	1	2				1			1	1
CO4	Develop the mini project using WEKA Tool	1	2	2			1			1	1

Subject: Secure Software Design & Enterprise Computing Lab	Subject Code: MCSCE1-277	Semester: 2ND
Credit: 2	L T P 0 0 4	60 Hrs.

COs	Statement	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	Learn various authentication methods	1		3		1				1	
CO2	Practice on debugging.	1		3	1	1				1	
CO3	Set up their own Private cloud storage	1		3		1					2
CO4	Learn Rhapsody Tool.	1		3		1					2

Subject: MOBILE APPLICATION AND SERVICES	Subject Code: MCSCE1-382	Semester: 3rd
Credit: 3	L T P 3 0 0	45 Hrs.

COs	Statement	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	Identify the target platform and users and be able to define and sketch a mobile application		3				2				1
CO2	Understand the fundamentals, frameworks, and development lifecycle of mobile application platforms including iOS, Android, and PhoneGap	1			2						
CO3	Design and develop a mobile application prototype in one of the platform (challenge project)		1								1
CO4	To Study recent trends.									1	

Subject: COMPILER FOR HPC	Subject Code: MCSCE1-383	Semester: 3rd
Credit: 3	L T P 3 0 0	45 Hrs.

COs	Statement	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	Familiar with the structure of compiler		3								1
CO2	Parallel loops, data dependency and exception handling and debugging in compiler.	1			2						
CO3	To study concurrency analysis										1
CO4	To Study recent trends.	3				2				1	

Subject: OPTIMIZATION TECHNIQUES	Subject Code: MCSCE1-384	Semester: 3rd
Credit: 3	L T P 3 0 0	45 Hrs.

COs	Statement	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	Formulate optimization problems.		2								1
CO2	Understand and apply the concept of optimality criteria for various types of optimization problems.	1			1						
CO3	Solve various constrained and unconstrained problems in Single variable as well as multivariable.										1
CO4	Apply the methods of optimization in real life situation.	2				2				1	

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(A State University Estb. by Govt. of Punjab vide Punjab Act No. 5 of 2015 and Approved u/s 2(f) & 12 (B) of UGC; Member AIU)

Department: **COMPUTER SCIENCE AND ENGINEERING**
GianiZail Singh Campus College of Engineering & Technology, MRSPTU

Program: B Tech Computer Science and Engineering

REVISED COURSE ARTICULATION MATRIX (STUDY SCHEME: 2018)

Subject	S Code	Semester	Credit	Duration (Hrs)	L T P	COs	Statement	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
Data Structure &Algorithm (Revised)	BCSES1-302	3	4	60	3 1 0	CO1	To impart the basic concepts of data structures, algorithms and time complexity.	2	1	1									1		1	2
						CO2	To understand concepts about stacks and queues	1	1	1												2
						CO3	To understand concepts about linked lists and trees	1	1	1												2
						CO4	To enable them to learn and write algorithms for hashing, sorting and graphs	2	1	1												2

Computer Peripherals & Interfaces	BCSES1-301	3	3	45	3 0 0	CO1	To be able to learn system resources, IDE & SCSI Interfaces.			**3**		**2**											**3**		
						CO2	To be able to learn different video Hardware.			**3**		**1**	**2**										**1**		
						CO3	To learn different, I/O Interfaces and Input/ Output Driver Software Aspects.			**3**		**1**											**2**		
						CO4	To be able to design and implement different peripheral devices.		**2**	**3**		**1**	**2**										**1**		
DIGITAL ELECTRONICS	BCSES1-303	3	4	60	3 1 0	CO1	Understand working of logic families and logic gates.	3				2								3	3	2	3		
						CO2	Design and implement Combinational and Sequential logiccircuits.	3		3		3								3	3	2	2		
						CO3	Understand the process of Analog to Digital conversion and Digital to Analogconversion.	3	2			3		1			3			3	3	1	1		
						CO4	Be able to use PLDs to implement the given logical problem.	2		3	3									3	3	2	2		
DATA STRUCTURE & ALGORITHMS LABORATORY (Revised)	BCSES1-304	3	2		0 0 4	CO1	To implementing searching algorithms and operations on stacks		1	2			2							2	1	2	2		
						CO2	To enable the students to learn and implement sorting algorithms		1	2			2							2	1	2	2		
						CO3	To implement operations for different types of queues.		1	2			2							2	1	2	2		
						CO4	To implement programs related to various types of Linked Lists			2			2							2	1	2	2		
DIGITAL ELECTRONICS LABORATORY	BBCSES1-305	3	1		0 0 2	CO1	To Familiarization with Digital Trainer Kit and associated equipment.	3	3	1	1	3	1							3	3	2	3		
						CO2	To Study and design of TTL gates	3	3	3	3	2					3			3	3	1	2		

						CO3	To learn the formal procedures for the analysis and design of combinational circuits.	3	3	3	2	3					3		3	3	2	2
						CO4	To learn the formal procedures for the analysis and design of sequential circuits	3	3	3	2	3					3		3	3	2	2
IT WORKSHOP (SciLab / MATLAB) LABORATORY	BCSES1-306	3	2		0 0 4	CO1	Introduction to Sci Labs / MATLAB environment and types of Sci Labs / MATLAB files.	3	3	1	1	3	1						3	3	2	3
						CO2	To be able to write programs for Matrix manipulations.	3	3	3	3	2					3		3	3	1	2
						CO3	MATLAB code for computing factorial of a number	3	3	3	2	3					3		3	3	2	2
						CO4	To be able to write programs using functions and plotting results	3	3	3	2	3					3		3	3	2	2
DISCRETE MATHEMATICS	BMATH1-401	4	4	60	3 1 0	CO1	For a given logic sentence express it in terms of predicates, quantifiers, andLogical connectives	1												2		
						CO2	For a given a problem, derive the solution using deductive logic and prove theSolution based on logical inference	1													2	
						CO3	For a given a mathematical problem, classify its algebraic structure				3	2									2	1
						CO4	Evaluate Boolean functions and simplify expressions using the properties of Boolean Algebra				3	2									2	

COMPUTER ORGANIZATION & ARCHITECTURE	BECES1-502	5	3	45	3 0 0	CO1	Draw the functional block diagram of a single bus architecture of a computer and describe the function of the instruction execution cycle, RTL interpretation of instructions, addressing modes, instruction set.	3	3	1	1	3	1						3	3	2	3
						CO2	Write assembly language program for specified microprocessor for computing 16-bit multiplication, division and I/O device interface (ADC, Control circuit, serial port communication).	3	3	3	3	2					3		3	3	1	2
						CO3	Write a flowchart for Concurrent access to memory and cache coherency in Parallel Processors and describe the process.	3	3	3	2	3					3		3	3	2	2
						CO4	To learn the formal procedures for the analysis and design of sequential circuits	3	3	3	2	3					3		3	3	2	2
OPERATING SYSTEMS	BCSES1-402	4	4	60	3 1 0	CO1	Create processes and threads.	**1**				**1**								**1**	**2**	
						CO2	Develop algorithms for process scheduling for a given specification of CPU utilization,Throughput, Turnaround Time, Waiting Time, Response Time	**1**	**3**			**1**								**1**	**3**	
						CO3	For a given specification of memory organization develop the techniques foroptimallyallocating memory to processes by increasing memory utilization andfor improving theaccess time.	**2**	**3**			**1**		**1**						**2**	**2**	
						CO4	4Design and implement file management system and for a given I/O devices and OS(specify) develop the I/O management functions in OSas part of a uniform device abstractionby performing operations for synchronizationbetween CPU and I/O controllers.	**3**	**2**			**1**		**2**						**1**	**3**	

OBJECT ORIENTED PROGRAMMING (Revised)	BCSES1-403	4	4	60	3 1 0	CO1	To introduce the basic concepts of object-oriented programming language and itsrepresentation	1												1		
						CO2	To allocate dynamic memory, access private members of class and the behavior ofinheritance and its implementation		**1**	3											3	
						CO3	To introduce polymorphism, interface design and overloading of operator				2									2		
						CO4	To handle backup system using file, general purpose template and handling of raisedexception during programming	1														1
OPERATING SYSTEMS LABORATORY	BCSES1-404	4	1		0 0 2 1	CO1	To be able to install various operating systems	1				1								1	2	
						CO2	To learn commands for files and directories.	1	3			1								1	3	
						CO3	To learn about background processes and commands to print something.	2	3			1		1						2	2	
						CO4	To be able to learn shell programming.	3	2			1		2						1	3	
OBJECT ORIENTED PROGRAMMING USING C++ LABORATORY	BCSES1-405	4	2		0 0 4 2	CO1	To learn the concept of classes and objects.	1												1		
						CO2	To be able to implement constructors and destructors.			3											3	
						CO3	To implement initializer list and operator overloading				2									2		
						CO4	To learn type casting and inheritance.	1														1

DATABASE MANAGEMENT SYSTEM (Revised)	BECES1-502	5	3	45	3 0 0	CO1	To be able to learn different DBMS languages, data models and normalisation	3	2											3		
						CO3	For a given specification construct the SQL queries for Open source and Commercial DBMS -MYSQL, ORACLE, and DB2.			2		3								2	3	2	
						CO4	Able to learn about query processing and transaction processing system	3	2	3		3										2	
						CO4	Implement database security and recovery techniques.	3	2	2										2		2	
Formal languages and Automata	BECES1-503	5	3	45	3 0 0	CO1	Design finite automata to accept a set of strings of a language.	3	3	3	2	×	×	×	×	1	×	×	2	×	1	×
						CO3	Design context free grammars to generate strings of context free language.	3	3	3	2	×	×	×	×	×	×	1	2	×	1	×
						CO4	Design Turing machine for accepting context sensitive languages.	3	3	3	2	×	×	×	×	×	×	1	2	×	1	×
						CO4	To learn Rice's theorem.	1	×	×	×	×	×	×	×	×	×	×	2	×	x	1
Design & Analysis of Algorithms (Revised)	BECES1-504	5	4	60	3 1 0	CO1	For a given algorithms analyze worst-case running times of algorithms based on asymptotic analysis..		2											1		
						CO2	Describe the algorithmic strategies.			1	2										2	
						CO3	Describe the different graph and tree traversal algorithms.	1													1	
						CO4	Describe the computability of problem using Cook's theorem.					1										1

COMPILER DESIGN	BCSES1-501	5	4	60	3 1 0	CO1	For a given grammar specification, develop the lexical analyzer	2	3	3		1				3			3	1		
						CO2	For a given parser specification design top-down and bottom-up parsers.	2	3	3		1				3			3	1		
						CO3	Use syntax directed translation schemes to develop intermediate code.	2	2	3		1				3			2		1	
						CO4	Learn algorithms to generate code for a target machine	1	3	3		3				2			2		1	
DESIGN &ANALYSIS OF ALGORITHMS LABORATORY (Revised)	BECES1-506	5	1		002	CO1	To perform different operations on integers.		2											1		
						CO2	To sort number of elements of an array using different sorting techniques.			1	2										2	
						CO3	To implement dynamic programming for various problems.	1													1	
						CO4	To implement various Graph Techniques.					1										1
COMPUTER GRAPHICS	BCSED1-511	5	3	45	3 0 0	CO1	Able to learn about the basics of graphics, its applications, uses and Knowledge to drawdifferent shapes in graphics on computer.	3	×	×	×	×	×	×	×	×	×	×	2	1	x	×
						CO2	Ability to apply different 2-D and 3-D transformations on an object.	3	2	3	×	×	×	×	×	×	×	×	2	×	1	×
						CO3	Learn clipping operations and various object filling techniques, different projectionstechniques. Various hidden surface removal	2	2	1	×	×	×	×	×	×	×	×	1	1	x	×
						CO4	Knowledge of Rendering techniques, Fractals and different colour models.	2	×	×	2	2	×	×	×	×	×	×	2	×	1	×

GRAPH THEORY	BCSED1-512	5	3	45	3 0 0	CO1	To have knowledge of the basic concepts of graph	3	3	2	1	1	×	×	×	×	1	×	×	1	×	×
						CO2	To have a knowledge of classes of graphs and its properties.	3	3	2	×	×	×	×	×	×	×	×	1	1	×	×
						CO3	To have knowledge of graph algorithms.	2	3	1	1	×	×	×	×	×	×	×	×	1	×	×
						CO4	Be exposed to constrained and unconstrained optimization techniques	1	×	1	×	×	×	×	×	×	×	×	1	x	×	1
WEB TECHNOLOGIES (Revised)	BCSED1-513	5	3	45	3 0 0	CO1	To understand the HTML and Style Sheets	3		3		3					3			3	3	3
						CO2	To have knowledge of client-side scripting using JSP	3		3							3		2	3	3	3
						CO3	To understand the basics and object-oriented concepts of PHP.	3				1								3	1	
						CO4	To access database using PHP programming.	3		3	3	2					2		2	3	3	3
JAVA PROGRAMMING	BCSED1-514	5	3	45	3 0 0	CO1	To learn the basics of Java and to understand the implementation of Classes and Inheritancewith respect to Java.	2												1	1	
						CO2	To describe the concept of handling of exceptions and multithreading.	2												2		
						CO3	To understand how to implement I/O, Applets and Graphics in Java		2	3											2	
						CO4	To comprehend the advanced topics of Java Programming	2		2										1		

DATABASE MANAGEMENT SYSTEMLABORATORY (Revised)	BECES1-505	5	2	60	004	CO1	To understand basic DDL, DML, DCL commands	2				1									2	
						CO2	To understand the SQL queries using SQL operators and implement the database constraints.	2				3									2	
						CO3	To understand the concept of relational algebra and SQL functions	1				2									2	
						CO4	To implement sub queries and and transaction processing.	3				3									2	
SOFTWARE ENGINEERING	BCSES1-601	6	3	45	300	CO1	To learn the basics of Java and to understand the implementation of Classes and Inheritancewith respect to Java.	2												1	1	
						CO2	To describe the concept of handling of exceptions and multithreading.	2												2		
						CO3	To understand how to implement I/O, Applets and Graphics in Java		2	3											2	
						CO4	To comprehend the advanced topics of Java Programming	2		2										1		
COMPUTER NETWORKS	BCSES1-602	6	4	60	310	CO1	Explain the functions of the different layer of the OSI Protocol.	**3**				**2**		**2**			**1**		**1**	**1**		
						CO2	Draw the functional block diagram of wide-area networks (WANs), local area networks(LANs) and Wireless LANs (WLANs) describe the function of each block.	**3**				**1**		**1**		**2**	**1**		**1**	**2**	**1**	
						CO3	For a given problem related TCP/IP protocol developed the network programming.	**3**				**2**	**2**				**1**		**1**	**2**	**1**	
						CO4	Configure DNS DDNS, TELNET, EMAIL, File Transfer Protocol (FTP), WWW,HTTP,SNMP, Bluetooth, Firewalls using open source available software and tools.	**3**				**3**	**3**				**1**		**1**	**1**		**1**

COMPUTER NETWORKS LABORATORY	BCSES1-603	6	1	45	002	CO1	To become familiarize with different networking components.	**3**		**1**							**3**			**1**		
						CO2	To learn the concept of data transmission using different cables.	**3**		**1**			**3**							**1**	**2**	
						CO3	To learn different topologies and implement file sharing	**3**		**2**		**3**								**1**		**3**
						CO4	To implement different networks.	**3**		**1**					**3**					**1**	**2**	**1**
MACHINE LEARNING (Revised)	BCSED1-612	6	3	45	300	CO1	To learn the concept of learning algorithm	2	×	1	2	2	×	×	×	×	×	×	2	1	×	×
						CO2	To learn supervise learning	×	×	3	1	1	×	×	×	×	×	×	2	1	×	×
						CO3	To learn unsupervised learning.	×	×	1	2	1	×	×	×	×	×	×	2	1	×	×
						CO4	To learn about SVMs.	×	×	1	2	1	×	×	×	×	×	×	2	1	×	×
DISTRIBUTED SYSTEMS	BCSES1-603	6	3	45	300	CO1	To learn architecture of DDBS.	1	2											3		
						CO2	To learn different design strategies and query processing		2												2	
						CO3	To Optimize Distributed queries.					2									2	
						CO4	To learn reliability issues.						2							2		

SIGNALS AND SYSTEMS	BCSED1-614	6	3	45	300	CO1	Analyze the properties of signals & systems and representation in time and frequencydomain.	3			1	3					3		3	3	1	1
						CO2	Classify systems based on their properties and determine the response of LSI system.	3	2		1	3		`			3		3	2		1
						CO3	Apply random signal theory and understand various types of noise.	3		1	3	1							3	1		1
						CO4	Understand the process of sampling and reconstruction.	3	3		2								3	2	1	2
DATA MINING	BCSED1-621	6	3	45	300	CO1	To introduce the basic concepts of Data Mining techniques.		2											2		
						CO2	To have knowledge of decision trees and algorithms used for it.		1			3									3	
						CO3	To learn the concept of search engines.		1			3								2		
						CO4	To understand web mining.		1											2		
CLOUD COMPUTING	BCSED1-622	6	3	45	300	CO1	To learn basic terms used in cloud computing and its benefits.	2	2	×	×	×	×	×	×	×	×	×	2	1	x	×
						CO2	To learn architecture of Hadoop	2	1	2	1	×	×	×	×	×	×	×	2	1	x	×
						CO3	To implement cloud security.	2	×	×	1	×	×	×	1	×	×	×	1	×	1	×
						CO4	To manage services provided by cloud.	2	1	×	×	×	×	×	×	×	1	×	1	×	x	1
PARALLEL PROCESSING	BCSED1-623	6	3	45	300	CO1	Design and analyze the parallel algorithms for real world problems and implement themon available parallel computer systems.	3	3	3	2		1				2		3	3	3	3
						CO2	To implement basic communication operations.	3		3							3		3	3	3	3

						CO3	To implement various threads.	3		3	2												3	3	2	2
						CO4	To learn different sorting algorithms.	3	3			3											3	3	3	3
EMBEDDED SYSTEMS	BCSED1-624	6	3	45	300	CO1	To learn specifications and analysis of embedded systems	3	×	2	×	1	×	×	×	×	×	×	1	1	×	×
						CO2	To estimate hardware and software costs.	×	×	1	×	×	×	×	×	×	1	×	×	×	1	×
						CO3	To learn arm programming instruction set.	2	×	×	1	×	×	×	×	×	×	×	×	1	×	×
						CO4	To learn IDE.	2	×	1	×	×	×	×	×	×	×	×	×	1	×	×
DISTRIBUTED OPERATING SYSTEMS	BCSED1-711	7	3	45	300	CO1	To learn architecture of distributed operating systems	2		1										1		
						CO2	To learn resource management.		2		2									1		
						CO3	To learn distributed OS implementation.			3		2									2	
						CO4	To learn multiprocessor system.		2											1		
SOFT COMPUTING	BCSED1-712	7	3	45	300	CO1	Identify and describe soft computing techniques and their roles in building intelligentmachines	2													1	
						CO2	To have knowledge of neural networks I	1				1								1		
						CO3	To have knowledge of neural networks-II.	1				1								1		

						CO4	To learn the concepts of genetic algorithms.	1			1											1		
HUMAN COMPUTER INTERACTION	BCSED1-713	7	3	45	300	CO1	To have knowledge of task centered systems design	2					1							1	1			
						CO2	Understand the fundamental aspects of designing and evaluating interfaces			2	1		1								1	1	
						CO3	To understand different design principles			2	1		1								1		
						CO4	To learn different HCI design standards.			2	1										1		
Ad-hoc and SENSOR NETWORKS	BCSED1-714	7	3	45	300	CO1	To be able to learn wireless technologies.	**2**		**3**		**1**									**2**		
						CO2	To be able to learn different protocols for ad-hoc networks.	**3**			**3**	**1**									**2**	**1**	
						CO3	To learn different routing algorithms used for ad-hoc networks.	**2**		**1**		**1**									**2**	**1**	
						CO4	To learn how to synchronize network nodes.	**2**		**1**		**1**									**2**	**1**	
BIOINFORMATICS	BCSED1-721	7	3	45	300	CO1	To learn basic concepts of bioinformatics.		2												1	2	
						CO2	To learn different motif models.	1		2											1	2	
						CO3	To learn the concept of genomics.	1	2			3									1	2	
						CO4	To analyse DNA data.		2	2		1										1	

IMAGE PROCESSING	BCSED1-722	7	3	45	300	CO1	To give introduction of image processing.	1												3		
						CO2	To understand image enhancement.		2											3	1	
						CO3	To have knowledge of image Compression Redundancy models		3	2										2		
						CO4	To have knowledge of Image Segmentation.		2										1	2		
CRYPTOGRAPHY & NETWORK SECURITY	BCSED1-723	7	3	45	300	CO1	To understand security trends.	**3**								**3**			**2**	**2**	**1**	
						CO2	To implement various cryptographic algorithms.	**1**			**2**	**1**			**3**					**2**	**3**	
						CO3	To implement public key cryptography.	**1**				**1**			**3**					**2**	**3**	
						CO4	To implement IP Security.	**1**			**3**	**2**	**3**						**3**	**2**	**3**	**1**
ARTIFICIAL INTELLIGENCE	BCSED1-724	7	3	45	300	CO1	Understand the concept of Artificial intelligence, problem solving and various typesof search strategies.	2	2	1	×	×	×	×	×	2	2	1	3	1	×	×
						CO2	Understand the concept of Knowledge base, knowledge representation, AI languages& tools and various planning techniques.	1	2	1	1	1	×	×	×	1	2	1	2	1	×	×
						CO3	Identify uncertainty and understand fuzzy logic concept to handle uncertainty.	1	2	1	1	1	×	×	×	1	2	×	2	×	1	×
						CO4	Understand the COURSE of AI agents and various COURSE methods it also includesneural network and includes the communication of AI agents and natural languageprocessing.	2	2	2	1	1	×	×	×	1	2	×	2	×	1	×

INTERNET OF THINGS	BCSED1-812	8	3	45	300	CO1	To Understand the Architectural Overview of IoT	**3**		**2**										**2**	**1**	
						CO2	To Understand Raspberry.			**3**					**2**	**3**				**3**	**2**	
						CO3	To Understand the various IoT Protocols (Datalink, Network).					**3**	**2**		**1**		**2**		**3**	**3**	**1**	
						CO4	To understand sensor applications.						**3**				**2**		**3**	**2**	**2**	**3**
ADVANCED DATABASE MANAGEMENT SYSTEMS	BCSED1-813	8	3	45	300	CO1	To be able to use different database analyse techniques.		2			2								3		
						CO2	To learn about query compiler	1	2			1								3	2	
						CO3	To learn different distributed database models.	1											1	2		
						CO4	To learn emerging models and techniques in databases.			2									2	2		
SOFTWARE PROJECT MANAGEMENT	BCSED1-814	8	3	45	300	CO1	Apply the basics of Software Project Managementto manage and deliverqualified product and plan the activities within time schedules with CPM and PERT Analysis.	3	2													1
						CO2	For managing the quality of product and managing the risk involved					1		1								1
						CO3	Managing team and measuring and tracking the planning									2		2				1
						CO4	To learn Configuration management and project monitoring and control											1	1	1		
MOBILE APPLICATION	BCSED1-611	6	3	45	300	CO1	To learn application models of mobile application frameworks.		2													1

						CO2	To learn Mobile OS architectures.							1										1
						CO3	To be database access in different mobile OS.									2		2						1
						CO4	To learn testing methodologies for mobile applications.											1	1	1				
ENTERPRISE RESOURCE PLANNING	BCSED1-811	8	3	45	300	CO1	To understand the concepts of ERP and its related technologies.	3																1
						CO2	To understand the implementation of ERP in an organization.							1										1
						CO3	To have a deep understanding of different business modules of an organization.						2			2								1
						CO4	To have a basic understanding of applications of ERP and various ERP software‟s					1							1					1
Introduction to ConcernedBranch of Engineering	BCOBE0-101	1	0	24	200	CO1	To be able to learn the basic terminologies- computer, science, and engineering.	3	3		1	3	1						3	3				3
						CO2	To understand different branches of Computer Science.	3		3		2									1			
						CO3	To learn different parts of computer.	3	3	3	2						3				2			2
						CO4	To learn different types of softwares.	3			2	3					3		3	3				2
Programming for ProblemSolving	BCSCE0-101	2	3	41	300	CO1	To learn the basic terms related to programming and understand arithmetic expressions.				1		1						3	3				3
						CO2	To understand the concept of arrays.	3		3		2									1			
						CO3	To implement functions and recursion.		3		2						3				2			

						CO4	To learn structure, pointers and file handling.	3			2									3		
Programming for ProblemSolving Laboratory	BCSCE0-102	2	2	45	300	CO1	To learn the basic terms related to programming and understand arithmetic expressions.				1		1						3	3		3
						CO2	To understand the concept of arrays.	3		3		2									1	
						CO3	To implement functions and recursion.		3		2						3				2	
						CO4	To learn structure, pointers and file handling.	3			2									3		