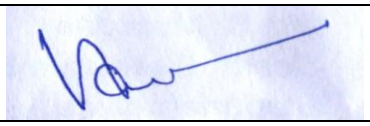
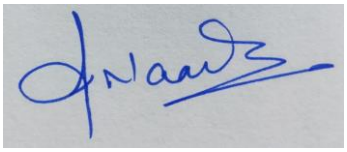
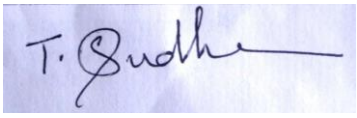
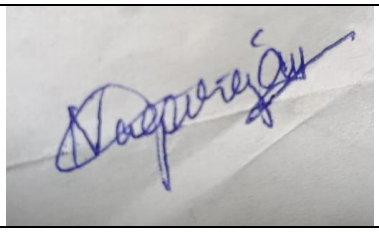
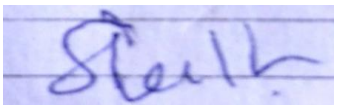
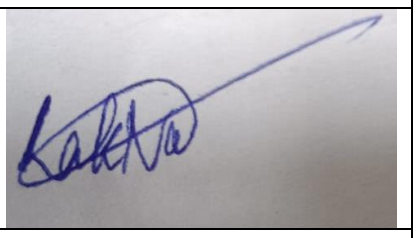
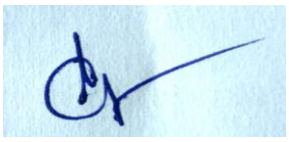
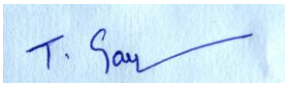
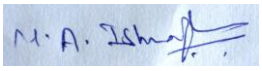
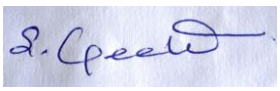
Department of Instrumentation and Control Engineering

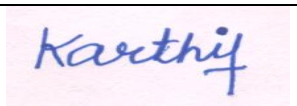
Minutes of Board of Studies

The first Board of Studies meeting of the Department of Instrumentation and Control Engineering was held on 17th July 2020 at 09:00 A.M in the Simulation Laboratory, Department of ICE, Sri Manakula Vinayagar Engineering College with the Head of the Department in the Chair.

The following members were present for the BoS meeting

Sl.No	Name of the Member with Designation and official Address	Responsibility in the BoS	Signature
1	Dr. L. M.Varalakshmi Professor and Head Department of ICE, SMVEC	Chairman	
External Members			
2	Dr. P. A. Karthick, P.D.F. Professor Department of Instrumentation and Control Engineering National Institute of Technology, Tiruchirappalli	External Member	
3	Dr.D. Manamalli Professor Department of Instrumentation Engineering, MIT Campus, Anna University	External Member	
4	Dr. Anima Nanda Professor & Head/ BMI Director IQAC, Sathyabama University	External Member	
Internal Members			
5	Prof.T. Sudha Assistant Professor Department of ICE, SMVEC	Internal Member	
6	Prof. N. Nagarajan Assistant Professor Department of ICE, SMVEC	Internal Member	

7	Prof..M.Omamageswari Assistant Professor Department of ICE, SMVEC	Internal Member	
8	Prof.J.Jeevanantham Assistant Professor Department of ICE, SMVEC	Internal Member	
9	Prof.M.Rekha Assistant Professor Department of ICE, SMVEC	Internal Member	
10	Prof.Laxminarayanan Assistant Professor Department of ICE, SMVEC	Internal Member	
11	Prof A.S Sai Nishhok Krrishnaa Assistant Professor Department of ICE, SMVEC	Internal Member	
12	Dr.S.Deepa Professor & Head Department of Chemistry,SMVEC	Internal Member	
13	Dr. T. Gayarhri Professor & Head Department of Mathematics,SMVEC	Internal Member	
14	Dr. M. A. Ishrath Jahan Professor Department of English, SMVEC	Internal Member	
15	Mrs.S.Geetha Assistant Professor Department of Physics, SMVEC	Internal Member	
Co-opted Members			

1	Mr. B. Murugan Senior Executive Engineer Biogenomonics	Co-opted Member	
2	Mr. S.Karthikeyan E-Beam control Operator Siechem Technologies pvt.Ltd	Co-opted Member	

Agenda of the Meeting

1) Discuss about the curriculum Structure of B.Tech –Instrumentation and Control Engineering
2) To discuss and approve the B.Tech. Degree Regulations 2020 (R-2020), Curriculum and Syllabi from I to VIII semesters for the B.Tech – Instrumentation and Control Engineering and the students admitted in the Academic Year 2020-21. (First Year)
3) To discuss and approve the B.Tech. Degree Regulation 2019, Curriculum, syllabi from I to VIII semesters under for the B.Tech – Instrumentation and Control Engineering and the students admitted in the Academic Year 2019-20 (Second Year)
4) To discuss and approve the B.Tech. Degree Curriculum and Syllabi from I to VIII semesters under Pondicherry University Regulations 2013 for the B.Tech – Instrumentation and Control Engineering and the students admitted in the Academic Year 2017-18 (Final Year) and in the Academic Year 2018-19 (Third Year)
5) To discuss about the uniqueness of the Curriculum (R-2020)
6) To discuss and approve Evaluation Systems
7) To discuss about the Innovative Teaching / Practices Methodology adopted to handle the emerging. / Advanced Technological concept courses
8) Any other item with the permission of chair

Minutes of the Meeting

Dr. L.M.Varalakshmi, Chairman, BoS opened the meeting by welcoming and introducing the external members,to the internal and co-opted members and thanked them for accepting to become the member of the Board of Studies and the meeting thereafter deliberated on agenda items that had been approved by the Chairman.

Item:1	**Recommended and forwarded to Academic Council**
Item:2	**Suggestions for Curriculum 2020:** 1. Fundamental of Instrumentation Engineering may be removed. 2. Material science can be shifted to First semester. 3. Signals and System can be included as a core subject in Second semester. 4. Industrial Unit Operations can be shifted before the Process Control. 5. Industrial Instrumentation Subject can be Spitted into Industrial Instrumentation – I and Industrial Instrumentation-II. 6. Unit 4 of Circuit Theory to be changed to include Two-Phase Networks.

Item:3	**Approved and forwarded to Academic Council**
Item:4	**Approved and forwarded to Academic Council**
Item:5	**Accepted and forwarded to Academic Council**
Item:6	**Recommended and forwarded to Academic Council**
Item:7	**Discussed and forwarded to Academic Council**
Item:8	**Nil**

The meeting was concluded at 11.00 AM with vote of thanks by **Dr.L.M.Varalakshmi**, Head of Department, Instrumentation and Control Engineering

SRI MANAKULA VINAYAGAR
ENGINEERING COLLEGE
(An Autonomous Institution)

Puducherry

B.TECH.

INSTRUMENTATION AND CONTROL ENGINEERING

ACADEMIC REGULATIONS 2020
(R-2020)

CURRICULUM

COLLEGE VISION AND MISSION

Vision

To be globally recognized for excellence in quality education, innovation, and research for the transformation of lives to serve the society.

Mission

M1: Quality Education: To provide comprehensive academic system that amalgamates the cutting edge technologies with best practices.

M2: **Research and Innovation**: To foster value- based research and innovation in collaboration with industries and Institutions globally for creating intellectuals with new avenues.

M3: Employability and Entrepreneurship: To inculcate the employability and entrepreneurial skills through value and skill based training.

M4: Ethical Values: To Instill deep sense of human values by blending societal righteousness with academic professionalism for the growth of society.

DEPARTMENT VISION AND MISSION

Vision

To provide quality education, training and research in the area of Instrumentation and Control Engineering to meet the industrial and societal needs with ethical values.

Mission

M1: Quality education: To impart technical knowledge, leadership and managerial skills to meet the current industrial and societal needs.
M2: Research and Innovation: To foster innovation, research and development for the benefit of global community.
M3: Employability and Entrepreneurship: To enhance the employability skills and inculcate entrepreneurial attitude.
M4: Ethical Values: To provide extension services to rural society and instill ethical values among the students.
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PROGRAMME OUTCOMES (POs)

PO1: Engineering knowledge:

Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2: Problem analysis:

Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3: Design/development of solutions:

Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4: Conduct investigations of complex problems:

Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data and synthesis of the information to provide valid conclusions.

PO5: **Modern tool usage:**

Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO6: The engineer and society:

Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7: Environment and sustainability:

Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of and need for sustainable development.

PO8: Ethics:

Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9: Individual and team work:

Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10: Communication:

Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11: Project management and finance:

Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12: Life-long learning:

Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

PEO 1: Core Competency:

Solve real-life engineering problems, design and development of innovative and cost-effective products exhibiting a solid foundation in Instrumentation and Control Engineering fundamentals to cater needs of society.

PEO 2: State of the art technology:

To impart state of the art technology to the students in the field of Instrumentation and Control Engineering to meet the industrial needs.

PEO 3: Multi-disciplinary skills:

To develop Multi-disciplinary skills and acquire leadership qualities along with professional and ethical values.

PEO 4: Innovation and entrepreneurship:

To promote innovation and entrepreneurship in designing and developing instrumentation systems to address social and technical challenges.

PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO1: Basic Knowledge in ICE:

Apply the knowledge of Instrumentation and Control Engineering to relate the fundamental concepts of Instrumentation (measurement, control, operation, monitoring and maintenance) to varied measurement systems and models.

PSO2: Advanced Tools for industrial automation:

Apply the knowledge of hardware and software tools for industrial automation systems

PSO3: Design and development of Instrumentation systems:

Ability to design and develop instrumentation systems to solve real time applications.

STRUCTURE FOR UNDERGRADUATE ENGINEERING PROGRAM

Sl. No	Course Category	Breakdown of Credits
1	Humanities and Social Science (HS)	7
2	Basic Sciences(BS)	19
3	Engineering Sciences (ES)	28
4	Professional Core (PC)	71
5	Professional Electives (PE)	18
6	Open Electives (OE)	9
7	Project Work and Internship (PW)	12
8	Employability Enhancement Courses (EEC*)	-
9	Mandatory courses (MC*)	-
Total		**164**

SCHEME OF CREDIT DISTRIBUTION – SUMMARY

Sl.No	AICTE Suggested Course Category	Credits per Semester								Total Credits
		I	II	III	IV	V	VI	VII	VIII	
1	Humanities and Social Science (HS)	-	-	1	1	3	-	1	1	**07**
2	Basic Sciences(BS)	6	3	3	3	4	-	-	-	**19**
3	Engineering Sciences (ES)	12	4	8	4	-	-	-	-	**28**
4	Professional Core (PC)	-	14	10	8	12	15	9	3	**71**
5	Professional Electives (PE)	-	-	-	3	3	3	3	6	**18**
6	Open Electives (OE)	-	-	-	3	-	3	3	-	**09**
7	Project Work (PW)	-	-	-	-	-	-	2	8	**10**
8	Internship (PW)	-	-	-	-	-	-	2	-	**02**
9	Employability Enhancement Courses (EEC*)	-	-	-	-	-	-	-	-	-
10	Mandatory courses (MC*)	-	-	-	-	-	-	-	-	-
Total		**18**	**21**	**22**	**22**	**22**	**21**	**20**	**18**	**164**

**** EEC and MC are not included for CGPA calculation***

SEMESTER – I										
Sl. No.	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Theory										
1	U20BST101	Engineering Mathematics – I (Calculus and Linear Algebra)	BS	2	2	0	3	25	75	100
2	U20BST105	Material Science	BS	3	0	0	3	25	75	100
3	U20EST113	Basic Electronics	ES	3	0	0	3	25	75	100
4	U20EST115	Electrical Technology	ES	3	0	0	3	25	75	100
5	U20EST103	Fundamentals of Civil and Mechanical Engineering	ES	3	0	0	3	25	75	100
Practical										
6	U20ESP114	Basic Electronics Lab	ES	0	0	2	1	50	50	100
7	U20ESP116	Electrical Technology Lab	ES	0	0	2	1	50	50	100
8	U20ESP112	Engineering Graphics using AutoCAD	ES	0	0	2	1	50	50	100
Employability Enhancement Course										
9	U20ICC1XX	Certification Course – I **	EEC	0	0	4	-	100	-	100
Mandatory Course										
10	U20ICM101	Induction Program	MC	3 Weeks			-	-	-	-
							18	375	525	900

SEMESTER – II										
Sl. No.	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Theory										
1	U20BST215	Engineering Mathematics –II (Multiple Integrals and Transforms)	BS	2	2	0	3	25	75	100
2	U20EST201	Programming in C	ES	3	0	0	3	25	75	100
3	U20ICT201	Circuit Theory	PC	2	2	0	3	25	75	100
4	U20ICT202	Electronic Circuits	PC	3	0	0	3	25	75	100
5	U20ICT203	Signals and Systems	PC	2	2	0	3	25	75	100
6	U20ICT204	Transducer Engineering	PC	3	0	0	3	25	75	100
Practical										
7	U20ESP202	Programming in C lab	ES	0	0	2	1	50	50	100
8	U20ICP201	Electronic Circuits Lab	PC	0	0	2	1	50	50	100
9	U20ICP202	Transducer Engineering Lab	PC	0	0	2	1	50	50	100
Employability Enhancement Course										
10	U20ICC2XX	Certification Course – II **	EEC	0	0	4	-	100	-	100
11	U20ICS201	Skill Development Course 1: Demonstration of Workshop Practice	EEC	0	0	2	-	100	-	100
Mandatory Course										
12	U20ICM202	Environmental Science	MC	2	0	0	-	100	-	100
							21	600	600	1200

***** Certification courses are to be selected from the list given in Annexure III***

SEMESTER – III										
Sl. No.	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Theory										
1	U20BST320	Complex Analysis and Applications of Partial Differential Equations	BS	2	2	0	3	25	75	100
2	U20EST356	Data Structures	ES	3	0	0	3	25	75	100
3	U20EST361	Solid and Fluid Mechanics	ES	2	2	0	3	25	75	100
4	U20ICT305	Analog Integrated circuits	PC	3	0	0	3	25	75	100
5	U20ICT306	Digital Logic Circuits	PC	2	2	0	3	25	75	100
6	U20ICT307	Electrical and Electronic Measurements	PC	3	0	0	3	25	75	100
Practical										
7	U20HSP301	General Proficiency - I	HS	0	0	2	1	50	50	100
8	U20ESP357	Data Structures Lab	ES	0	0	2	1	50	50	100
9	U20ESP362	Solid and Fluid Mechanics Lab	ES	0	0	2	1	50	50	100
10	U20ICP303	Analog and Digital circuits Lab	PC	0	0	2	1	50	50	100
Employability Enhancement Course										
11	U20ICC3XX	Certification Course – III**	EEC	0	0	4	-	100	-	100
12	U20ICS302	Skill Development Course 2*	EEC	0	0	2	-	100	-	100
Mandatory Course										
13	U20ICM303	Physical Education	MC	0	0	2	-	100	-	100
							22	650	650	1300

SEMESTER – IV										
Sl. No	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Theory										
1	U20BST430	Probability and Statistics	BS	2	2	0	3	25	75	100
2	U20EST467	Programming in JAVA	ES	3	0	0	3	25	75	100
3	U20ICT408	Linear Control Systems	PC	2	2	0	3	25	75	100
4	U20ICT409	Microcontroller based system design	PC	3	0	0	3	25	75	100
5	U20ICE4XX	Professional Elective - I #	PE	3	0	0	3	25	75	100
6	U20XXO4XX	Open Elective – I $	OE	3	0	0	3	25	75	100
Practical										
7	U20HSP402	General Proficiency - II	HS	0	0	2	1	50	50	100
8	U20ESP468	Programming in JAVA Lab	ES	0	0	2	1	50	50	100
9	U20ICP404	Microcontroller based system design lab	PC	0	0	2	1	50	50	100
10	U20ICP405	Simulation Lab	PC	0	0	2	1	50	50	100
Employability Enhancement Course										
11	U20ICC4XX	Certification Course – IV**	EEC	0	0	4	-	100	-	100
12	U20ICS403	Skill Development Course 3*	EEC	0	0	2	-	100	-	100

Mandatory Course										
13	U20ICM404	NSS	MC	0	0	2	-	100	-	100
							22	650	650	1300

[#] Professional Electives are to be selected from the list given in Annexure I
[$] Open electives are to be selected from the list given in Annexure II
*** Certification courses are to be selected from the list given in Annexure III*
** Skill Development Courses (2 and 4) are to be selected from the list given in Annexure IV*

SEMESTER – V										
Sl. No.	**Course Code**	**Course Title**	**Category**	**Periods**			**Credits**	**Max. Marks**		
				L	**T**	**P**		**CAM**	**ESM**	**Total**
Theory										
1	U20BST547	Numerical Methods	BS	3	0	0	3	25	75	100
2	U20ICT510	Embedded System Design	PC	3	0	0	3	25	75	100
3	U20ICT511	Industrial Instrumentation - I	PC	3	0	0	3	25	75	100
4	U20ICT512	Industrial Unit Operations	PC	3	0	0	3	25	75	100
5	U20ICE5XX	Professional Elective - II [#]	PE	3	0	0	3	25	75	100
6	U20XXO5XX	Open Elective-II [$]	HS	3	0	0	3	25	75	100
Practical										
7	U20BSP549	Numerical Methods Lab	BS	0	0	2	1	50	50	100
8	U20ICP506	Embedded System Design Lab	PC	0	0	2	1	50	50	100
9	U20ICP507	Industrial Instrumentation Lab	PC	0	0	2	1	50	50	100
10	U20ICP508	Instrumentation System Design Lab	PC	0	0	2	1	50	50	100
Employability Enhancement Course										
11	U20ICC5XX	Certification Course - V**	EEC	0	0	4	-	100	-	100
12	U20ICS504	Skill Development Course 4: Foreign Language/ IELTS - I	EEC	0	0	2	-	100	-	100
13	U20ICS505	Skill Development Course 5: Presentation Skill using ICT	EEC	0	0	2	-	100	-	100
Mandatory Course										
14	U20ICM505	Indian Constitution	MC	2	0	0	-	100	-	100
							22	750	650	1400

SEMESTER – VI										
Sl. No	**Course Code**	**Course Title**	**Category**	**Periods**			**Credits**	**Max. Marks**		
				L	**T**	**P**		**CAM**	**ESM**	**Total**
Theory										
1	U20ICT613	Industrial Instrumentation - II	PC	3	0	0	3	25	75	100
2	U20ICT614	Internet of Things (IoT) for automation	PC	3	0	0	3	25	75	100
3	U20ICT615	Process Control	PC	3	0	0	3	25	75	100
4	U20ICT616	Robotics and Automation	PC	3	0	0	3	25	75	100
5	U20ICE6XX	Professional Elective - III [#]	PE	3	0	0	3	25	75	100
6	U20XXO6XX	Open Elective – III [$]	OE	3	0	0	3	25	75	100
Practical										

7	U20ICP609	Internet of Things Lab	PC	0	0	2	1	50	50	100
8	U20ICP610	Process Control Lab	PC	0	0	2	1	50	50	100
9	U20ICP611	Robotics Lab	PC	0	0	2	1	50	50	100
Employability Enhancement Course										
10	U20ICC6XX	Certification Course - VI**	EEC	0	0	4	-	100	-	100
11	U20ICS606	Skill Development Course 6: Foreign Language / IELTS – II	EEC	0	0	2	-	100	-	100
12	U20ICS607	Skill Development Course 7: Technical Seminar	EEC	0	0	2	-	100	-	100
13	U20ICS608	Skill Development Course 8: NPTEL / MOOC - I	EEC	0	0	0	-	100	-	100
Mandatory Course										
14	U20ICM606	Essence of Indian Traditional Knowledge	MC	2	0	0	-	100	-	100
							21	800	600	1400

[#] ***Professional Electives are to be selected from the list given in Annexure I***
[$] ***Open electives are to be selected from the list given in Annexure II***
****** ***Certification courses are to be selected from the list given in Annexure III***

SEMESTER – VII										
Sl. No	**Course Code**	**Course Title**	**Category**	**Periods**			**Credits**	**Max. Marks**		
				L	**T**	**P**		**CAM**	**ESM**	**Total**
Theory										
1	U20ICT717	Process automation	PC	3	0	0	3	25	75	100
2	U20ICT718	Biomedical Instrumentation	PC	3	0	0	3	25	75	100
3	U20ICE7XX	Professional Elective – IV [#]	PE	3	0	0	3	25	75	100
4	U20XXO7XX	Open Elective – IV [$]	OE	3	0	0	3	25	75	100
Practical										
5	U20HSP703	Business Basics for Entrepreneur	HS	0	0	2	1	100	-	100
6	U20ICP712	Process Automation Lab	PC	0	0	2	1	50	50	100
7	U20ICP713	Virtual Instrumentation Lab	PC	0	0	2	1	50	50	100
8	U20ICP714	Comprehensive Viva Voce	PC	0	0	2	1	50	50	100
Project Work										
9	U20ICW701	Project Phase – I	PW	0	0	4	2	50	50	100
10	U20ICW702	Internship / Inplant Training	PW	-	-	-	2	100	-	100
Mandatory Course										
11	U20ICM707	Professional Ethics	MC	2	0	0	-	100	-	100
							20	600	500	1100

SEMESTER – VIII										
Sl. No.	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Theory										
1	U20ICT819	Instrumentation in Process Industries	PC	3	0	0	3	25	75	100
2	U20ICE8XX	Professional Elective – V #	PE	3	0	0	3	25	75	100
3	U20ICE8XX	Professional Elective – VI #	PE	3	0	0	3	25	75	100
Practical										
4	U20HSP804	Entrepreneurship Management	HS	0	0	2	1	100	-	100
Project Work										
5	U20ICW803	Project phase – II	PW	0	0	16	8	40	60	100
Employability Enhancement Course										
6	U20ICS809	Skill Development Course 9: NPTEL / MOOC-II	EEC	0	0	0	-	100	-	100
							18	315	285	600

 # Professional Electives are to be selected from the list given in Annexure I
$ Open electives are to be selected from the list given in Annexure II

Annexure – I

PROFESSIONAL ELECTIVE COURSES

Professional Elective – I (Offered in Semester IV)		
Sl. No.	**Course Code**	**Course Title**
1	U20ICE401	Digital Signal Processing
2	U20ICE402	Electric and Hybrid Vehicles
3	U20ICE403	Communication Systems
4	U20ICE404	Electric drives and control
5	U20ICE405	Mechatronics and Instrumentation
Professional Elective – II (Offered in Semester V)		
Sl. No.	**Course Code**	**Course Title**
1	U20ICE506	Telemetry and Tele control
2	U20ICE507	Advanced control system
3	U20ICE508	Industrial electronics
4	U20ICE509	MEMS and NEMS
5	U20ICE510	Analytical Instrumentation
Professional Elective – III (Offered in Semester VI)		
Sl. No.	**Course Code**	**Course Title**

1	U20ICE611	Applied soft computing
2	U20ICE612	Power plant Instrumentation
3	U20ICE613	Building Automation
4	U20ICE614	Web Based Instrumentation
5	U20ICE615	Digital Control system
Professional Elective – IV (Offered in Semester VII)		
Sl. No.	**Course Code**	**Course Title**
1	U20ICE716	Computer control of processes
2	U20ICE717	Automotive Instrumentation System
3	U20ICE718	Fault Detection and Diagnosis
4	U20ICE719	Modern Electronic Instrumentation
5	U20ICE720	Fiber optics and Laser Instrumentation
Professional Elective – V (Offered in Semester VIII)		
Sl. No.	**Course Code**	**Course Title**
1	U20ICE821	Industrial safety and management
2	U20ICE822	System Identification and Adaptive Control
3	U20ICE823	Advanced Instrumentation system
4	U20ICE824	Industrial Data Networks
5	U20ICE825	Field Instrumentation and cabling
Professional Elective – VI (Offered in Semester VIII)		
Sl. No.	**Course Code**	**Course Title**
1	U20ICE826	Design of Process Control System Components
2	U20ICE827	Renewable Energy Resources
3	U20ICE828	Industry 4.0
4	U20ICE829	Cyber Security in Industrial Automation
5	U20ICE830	Piping and Instrumentation Diagram

Annexure - II

OPEN ELECTIVE COURSES

S. No	Course Code	Course Title	Offering Department	Permitted Departments
Open Elective – I (Offered in Semester IV)				
1	U20EEO401	Solar Photovoltaic Fundamental and applications	EEE	ECE, ICE, MECH, CIVIL, Mechatronics, CCE
2	U20EEO402	Electrical Safety	EEE	ECE, ICE, MECH, CIVIL, Mechatronics, CCE, BME, IT, CSE, FT
3	U20ECO401	Engineering Computation with MATLAB	ECE	EEE, ICE, MECH, CIVIL, CCE, BME, AI&DS, Mechatronics
4	U20ECO402	Consumer Electronics	ECE	EEE, ICE, CSE, MECH, IT, CIVIL, CCE, BME, Mechatronics, FT
5	U20CSO401	Web Development	CSE	EEE, ECE, ICE, MECH, CIVIL, BME, Mechatronics
6	U20CSO402	Analysis of Algorithms	CSE	EEE, ECE, ICE, MECH, CIVIL, BME, Mechatronics
7	U20ITO401	Database System: Design & Development	IT	EEE, ECE, ICE, CCE, BME
8	U20ITO402	R programming	IT	EEE, ECE, ICE, CCE, BME, MECH, Mechatronics
9	U20ICO401	Sensors and Transducers	ICE	ECE, CSE, IT, MECH, CIVIL, CCE, AI&DS, FT
10	U20ICO402	Control System Engineering	ICE	CSE, IT, MECH, CCE, AI&DS
11	U20MEO401	Rapid Prototyping	MECH	EEE, ECE, ICE, CIVIL, BME, FT
12	U20MEO402	Material Handling System	MECH	EEE, ICE, CIVIL, Mechatronics
13	U20MEO403	Industrial Engineering for Textile	MECH	FT
14	U20CEO401	Energy and Environment	CIVIL	EEE, ECE, MECH, BME, IT, Mechatronics, FT
15	U20CEO402	Building Science and Engineering	CIVIL	EEE, MECH, BME
16	U20BMO401	Medical Electronics	BME	EEE, ECE, CSE, IT, ICE, CCE, MECH, Mechatronics, AI&DS
17	U20BMO402	Telemedicine	BME	EEE, ECE, CSE, IT, ICE, CCE, AI&DS
18	U20CCO401	Basic DBMS	CCE	EEE, ECE, MECH, CIVIL, ICE, Mechatronics, BME
19	U20CCO402	Introduction to Communication Systems	CCE	EEE, CSE, IT, MECH, CIVIL, ICE, Mechatronics

20	U20ADO401	Knowledge Representation and Reasoning	AI&DS	EEE, ECE, CSE, IT, ICE, MECH, CIVIL, CCE, BME, Mechatronics
21	U20ADO402	Introduction to Data Science	AI&DS	EEE, ECE, CSE, IT, ICE, MECH, CIVIL, CCE, BME, Mechatronics
Open Elective – II / Open Elective – III				
1	U20HSO501/ U20HSO601	Product Development and Design	MBA	**Common to B. Tech** (Offered in Semester V for **EEE, ECE, ICE, CIVIL, BME, CCE, FT**) (Offered in Semester VI for **CSE, IT, MECH, Mechatronics, AI&DS**)
2	U20HSO502/ U20HSO602	Intellectual Property and Rights	MBA	
3	U20HSO503/ U20HSO603	Marketing Management and Research	MBA	
4	U20HSO504/ U20HSO604	Project Management for Engineers	MBA	
5	U20HSO505/ U20HSO605	Finance for Engineers	MBA	
Open Elective – II / Open Elective – III (Offered in Semester V for **CSE, IT, MECH, Mechatronics, AI&DS**) (Offered in Semester VI for **EEE, ECE, ICE, CIVIL, BME, CCE, FT**)				
1	U20EEO503/ U20EEO603	Conventional and Non-Conventional Energy Sources	EEE	ECE, ICE, MECH, CIVIL, BME, Mechatronics, CCE, AI&DS, FT
2	U20EEO504/ U20EEO604	Industrial Drives and Control	EEE	ECE, ICE, MECH, Mechatronics, AI&DS
3	U20ECO503/ U20ECO603	Electronic Product Design and Packaging	ECE	EEE, CSE, IT, ICE, MECH, CCE, BME, Mechatronics
4	U20ECO504/ U20ECO604	Automotive Electronics	ECE	EEE, ECE, ICE, MECH
5	U20CSO503/ U20CSO603	Platform Technology	CSE	EEE, ECE, ICE, MECH, CIVIL, CCE, BME, AI&DS
6	U20CSO504/ U20CSO604	Graphics Designing	CSE	EEE, ECE, ICE, MECH, CIVIL, BME, FT
7	U20ITO503/ U20ITO603	Essentials of Data Science	IT	EEE, ECE, ICE, MECH, CIVIL, BME
8	U20ITO504/ U20ITO604	Mobile App Development	IT	EEE, ECE, ICE, MECH, CIVIL, BME, Mechatronics, AI&DS
9	U20ICO503/ U20ICO603	Fuzzy logic and neural networks	ICE	CSE, IT, CIVIL, BME, AI&DS
10	U20ICO504/ U20ICO604	Measurement and Instrumentation	ICE	ECE, Mechatronics
11	U20MEO504/ U20MEO604	Heating, ventilation and air conditioning system (HVAC)	MECH	EEE, ECE, ICE, CIVIL
12	U20MEO505/ U20MEO605	Creativity Innovation and New Product Development	MECH	EEE, ECE, ICE, CIVIL, BME, Mechatronics
13	U20CEO503/ U20CEO603	Disaster Management	CIVIL	EEE, ECE, CSE, IT, ICE, MECH, BME, CCE, AI&DS,

				FT
14	U20CEO504/ U20CEO604	Air Pollution and Solid Waste Management	CIVIL	EEE, ECE, CSE, IT, ICE, MECH, BME, CCE, AI&DS, FT
15	U20BMO503/ U20BMO603	Biometric Systems	BME	EEE, ECE, CSE, IT, ICE, CCE, MECH, Mechatronics
16	U20BMO504/ U20BMO604	Medical Robotics	BME	EEE, ECE, CSE, IT, ICE, CCE, MECH, CIVIL , Mechatronics
17	U20CCO503/ U20CCO603	Network Essentials	CCE	EEE, MECH, CIVIL, ICE, Mechatronics, BME
18	U20CCO504/ U20CCO604	Web Programming	CCE	EEE, ECE, MECH, CIVIL, ICE, Mechatronics, BME
19	U20ADO503/ U20ADO603	Principle of Artificial Intelligence and Machine Learning	AI&DS	EEE, ECE, CSE, IT, ICE, MECH, CIVIL, CCE
20	U20ADO504/ U20ADO604	Data science Application of Vision	AI&DS	EEE, ECE, CSE, IT, ICE, MECH, CIVIL, CCE, BME, Mechatronics
21	U20MCO501/ U20MCO601	Industrial Automation for Textile	Mechatronics	FT
Open Elective – IV (Offered in Semester VII)				
1	U20EEO705	Hybrid and Electrical Vehicle	EEE	ECE, Mechatronics , MECH
2	U20EEO706	Electrical Energy Conservation and auditing	EEE	ECE, ICE, MECH, CIVIL, BME, Mechatronics, CCE, AI&DS
3	U20ECO705	IoT and its Applications	ECE	EEE, ICE, CSE, MECH, IT, CIVIL, CCE, FT
4	U20ECO706	Cellular and Mobile Communications	ECE	EEE, ICE, CSE, MECH, IT, CIVIL, CCE, BME, Mechatronics
5	U20CSO705	Artificial Intelligence	CSE	EEE, ICE, CIVIL, CCE, MECH, FT
6	U20CSO706	Cloud Technology and its Applications	CSE	EEE, ICE, MECH, CIVIL, CCE, BME, Mechatronics
7	U20ITO705	Automation Techniques & Tools- DevOps	IT	EEE, ECE, ICE, CSE, MECH, CIVIL, CCE, BME, Mechatronics, AI&DS
8	U20ITO706	Augmented and Virtual Reality	IT	EEE, ICE, MECH, CIVIL, CCE, BME, AI&DS
9	U20ICO705	Process Automation	ICE	EEE, ECE, CSE, MECH, IT, CIVIL, CCE, BME, Mechatronics
10	U20ICO706	Virtual Instrumentation	ICE	EEE, ECE, MECH, Mechatronics
11	U20MEO706	Principles of Hydraulic and Pneumatic System	MECH	EEE, ECE, ICE, CIVIL

12	U20MEO707	Supply Chain Management	MECH	EEE, ECE, CIVIL, Mechatronics
13	U20CEO705	Energy Efficient Buildings	CIVIL	EEE, ECE, MECH
14	U20CEO706	Global Warming and Climate Change	CIVIL	EEE, ECE, CSE, IT, ICE, MECH, BME, CCE, AI&DS, FT
15	U20MCO702	Building Automation	Mechatronics	MECH, CIVIL
16	U20MCO703	Automation in Manufacturing Systems	Mechatronics	MECH, CIVIL
17	U20BMO705	Internet of Things for Healthcare	BME	EEE, ECE, ICE, CCE
18	U20BMO706	Telehealth Technology	BME	EEE, ECE, ICE, CCE
19	U20CCO705	Data Science using python	CCE	EEE, ECE, MECH, CIVIL, ICE, Mechatronics, BME
20	U20CCO706	Mobile Applications Development using Android	CCE	EEE, ECE, MECH, CIVIL, ICE, Mechatronics, BME
21	U20ADO705	Data Science Application of NLP	AI&DS	EEE, ECE, CSE, IT, ICE, MECH, CIVIL, CCE, BME, Mechatronics.
22	U20ADO706	Artificial Intelligence Applications	AI&DS	EEE, ECE, CSE, IT, ICE, MECH, CIVIL, CCE, BME
23	U20HSO706	Industrial Safety and Human Resource Management	MBA	FT
24	U20HSO707	Operation Research in Textile Industry	MBA	FT
25	U20HSO708	Global marketing and Sourcing Strategies	MBA	FT
26	U20HSO709	Fashion Advertising and sales promotions	MBA	FT
27	U20HSO710	Luxury Brand management	MBA	FT
28	U20HSO711	Fashion Retail Store Operations	MBA	FT

Annexure – III

EMPLOYABILITY ENHANCEMENT COURSES – (A). CERTIFICATION COURSES

Sl. No.	Course Code	Course Title
1	U20ICCX01	3ds Max
2	U20ICCX02	Advance Structural Analysis of Building using ETABS
3	U20ICCX03	Advanced Java Programming
4	U20ICCX04	Advanced Python Programming
5	U20ICCX05	Analog System Lab Kit
6	U20ICCX06	Android Medical App Development
7	U20ICCX07	Android Programming
8	U20ICCX08	ANSYS -Multiphysics
9	U20ICCX09	Artificial Intelligence
10	U20ICCX10	Artificial Intelligence and Edge Computing
11	U20ICCX11	Artificial Intelligence in Medicines
12	U20ICCX12	AutoCAD for Architecture
13	U20ICCX13	AutoCAD for Civil
14	U20ICCX14	AutoCAD for Electrical
15	U20ICCX15	AutoCAD for Mechanical
16	U20ICCX16	Azure DevOps
17	U20ICCX17	Basic Course on ePLAN
18	U20ICCX18	Basic Electro Pneumatics
19	U20ICCX19	Basic Hydraulics
20	U20ICCX20	Bio Signal and Image Processing Development System
21	U20ICCX21	Blockchain
22	U20ICCX22	Bridge Analysis
23	U20ICCX23	Building Analysis and Construction Management
24	U20ICCX24	Building Design and Analysis Using AECO Sim Building Designer
25	U20ICCX25	CATIA
26	U20ICCX26	CCNA (Routing and Switching)
27	U20ICCX27	CCNA (Wireless)
28	U20ICCX28	Cloud Computing
29	U20ICCX29	Computer Programming for Medical Equipments
30	U20ICCX30	Corel Draw
31	U20ICCX31	Creo (Modeling and Simulation)
32	U20ICCX32	Cyber Security
33	U20ICCX33	Data Science and Data Analytics
34	U20ICCX34	Data Science using Python
35	U20ICCX35	Data Science using R
36	U20ICCX36	Deep Learning
37	U20ICCX37	Design and Documentation using ePLAN Electric P8
38	U20ICCX38	Design of Biomedical Devices and Systems

39	U20ICCX39	Digital Marketing
40	U20ICCX40	Digital Signal Processing Development System
41	U20ICCX41	DigSILENT Power Factory
42	U20ICCX42	Electro Hydraulic Automation with PLC
43	U20ICCX43	Embedded System using Arduino
44	U20ICCX44	Embedded System using C
45	U20ICCX45	Embedded System with IoT
46	U20ICCX46	ePLAN Data Portal
47	U20ICCX47	ePLAN Electric P8
48	U20ICCX48	ePLAN Fluid
49	U20ICCX49	ePLAN PPE
50	U20ICCX50	Fusion 360
51	U20ICCX51	Fuzzy Logic and Neural Networks
52	U20ICCX52	Google Analytics
53	U20ICCX53	Hydraulic Automation
54	U20ICCX54	Industrial Automation
55	U20ICCX55	Industry 4.0
56	U20ICCX56	Internet of Things
57	U20ICCX57	Introduction to C Programming
58	U20ICCX58	Introduction to C++ Programming
59	U20ICCX59	IoT using Python
60	U20ICCX60	Java Programming
61	U20ICCX61	Machine Learning
62	U20ICCX62	Machine Learning and Deep Learning
63	U20ICCX63	Machine Learning for Medical Diagnosis
64	U20ICCX64	Mechatronics
65	U20ICCX65	Medical Robotics
66	U20ICCX66	Microsoft Dynamics 365 ERP for HR , Marketing and Finance
67	U20ICCX67	Mobile Edge Computing
68	U20ICCX68	Modeling and Visualization using Micro station
69	U20ICCX69	MX Road
70	U20ICCX70	Photoshop
71	U20ICCX71	PLC
72	U20ICCX72	Pneumatics Automation
73	U20ICCX73	Project Management
74	U20ICCX74	Python Programming
75	U20ICCX75	Revit Architecture
76	U20ICCX76	Revit Inventor
77	U20ICCX77	Revit MEP
78	U20ICCX78	Robotics
79	U20ICCX79	Search Engine Optimization
80	U20ICCX80	Software Testing
81	U20ICCX81	Solar and Smart Energy System with IoT
82	U20ICCX82	Solid Works
83	U20ICCX83	Solid Works with Electrical Schematics
84	U20ICCX84	Speech Processing

85	U20ICCX85	STAAD PRO V8i
86	U20ICCX86	Structural Design and Analysis using Bentley
87	U20ICCX87	Total Station
88	U20ICCX88	Video and Image Processing Development System
89	U20ICCX89	VLSI Design
90	U20ICCX90	Web Programming - I
91	U20ICCX91	Web Programming - II

Annexure – IV

EMPLOYABILITY ENHANCEMENT COURSES – (B). SKILL DEVELOPMENT COURSES

Sl. No	Course Code	Course Title
1	U20ICS201	Skill Development Course 1 : Demonstration of Workshop Practice
2	U20ICS302	Skill Development Course 2 *
		1) Troubleshooting of Electronic Equipments
		2) Office Automation
		3) Mobile phone servicing
3	U20ICS403	Skill Development Course 3 *
		1) Calibration of Measuring Instruments
		2) Introduction to Robotics
		3) Labview Implementation
4	U20ICS504	Skill Development Course 4 : Foreign Language/ IELTS -I
5	U20ICS505	Skill Development Course 5 : Presentation Skills using ICT
6	U20ICS606	Skill Development Course 6 : Foreign Language/ IELTS - II
7	U20ICS607	Skill Development Course 7 : Technical Seminar
8	U20ICS608	Skill Development Course 8 : NPTEL / MOOC - I
9	U20ICS809	Skill Development Course 9 : NPTEL / MOOC-II

**** Any one course to be selected from the list***

		L	T	P	C	Hrs
U20BST101	**ENGINEERING MATHEMATICS I (Calculus and Linear Algebra)** (Common to all branches except CSBS)	**2**	**2**	**0**	**3**	**60**

Course Objectives

- To familiarize the concept of matrices.
- To introduce mathematical tools to solve first order differential equations
- To learn Linear differential equations of higher order with constant coefficients.
- To understand the concept of partial Differentiation.
- To introduce the concepts of Curl, Divergence and integration of vectors in vector calculus.

Course Outcomes

After completion of the course, the students will be able to

CO1 - Understand the concept of Eigen values and Eigen vectors, Diagonalization of a matrix. **(K3)**
CO2 - Solve differential equations. **(K3)**
CO3 - Solve higher order differential equations. **(K3)**
CO4 - Solve different types of partial differential equation. **(K3)**
CO5 - Understand the use of vector calculus. **(K2)**

UNIT I MATRICES (12 Hrs)

Rank of a Matrix, Consistency of system of equations. Eigen values and Eigen vectors of a real matrix- Characteristic equation - Properties of Eigen values and Eigen vectors. Cayley - Hamilton Theorem- Diagonalization of matrices.

UNIT II DIFFERENTIAL EQUATIONS (12 Hrs)

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

UNIT III DIFFERENTIAL EQUATIONS (Higher order) (12 Hrs)

Linear differential equations of higher order with constant coefficients, the operator D, Euler's linear equation of higher order with variable coefficients, solution by variation of parameters method.

UNIT IV PARTIAL DIFFERENTIAL EQUATIONS (12 Hrs)

Partial derivatives, Total derivatives, Differentiation of implicit functions, Maxima and Minima of two variable, Partial differential equations of higher order with constant coefficients.

UNIT V VECTOR CALCULUS (12 Hrs)

Gradient, divergence and curl, - Directional derivative, Irrotational and Solenoidal vector fields, Gauss Divergence Theorem and Stokes Theorem.

Text Books

1. Erwin Kreyszig, "Advanced Engineering Mathematics ", Wiley, 10th edition, 2019
2. B.V. Ramana," Higher Engineering Mathematics", Tata McGraw-Hill, New Delhi, 6th 2018
3. N.P. Bali and Manish Goyal, "A Text Book of Engineering Mathematics", Lakshmi Publications, New Delhi, 9th Edition, 2018

Reference Books

1. C W. Evans, "Engineering Mathematics", A Programmed Approach, 3th Edition, 2019
2. Singaravelu. A., "Engineering Mathematics - I", Meenakshi publications, Tamil Nadu, 2019

3. M.K. Venkataraman, “Engineering Mathematics (Third Year-Part A)”, The National Publishing Company, Madras, 2016.
4. S. Narayanan**,”** Differential Equations and Its Applications**”,** Viswanathan, S., Printers & Publishers Pvt Ltd, 2009
5. Dr. G. Balaji., “Engineering Mathematics-I”, G. Balaji publishers, 2017

Web References

1. http://www.yorku.ca/yaoguo/math1025/slides/chapter/kuttler-linear algebra –slides-systems of Equation-handout.pdf
2. http://www.math.cum.edu/~wn0g/2ch6a.pdf
3. https://nptel.ac.in/courses/122/104/122104017/
4. https://nptel.ac.in/courses/111/106/111106051/
5. https://nptel.ac.in/courses/111/108/111108081/

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	1	-	-	-	1	1	-	-	-	-	1	-	-	1
2	3	2	1	1	-	1	1	-	-	-	-	1	-	-	1
3	3	2	1	1	-	1	1	-	-	-	-	1	-	-	1
4	3	2	1	1	-	1	1	-	-	-	-	1	-	-	1
5	2	1	-	-	-	-	1	-	-	-	-	1	-	-	1

Correlation Level: 1-Low, 2-Medium, 3- High

		L	T	P	C	Hrs
U20BST105	**MATERIAL SCIENCE**	**3**	**0**	**0**	**3**	**45**

Course Objectives

- To familiarize the concept of Dielectric Materials.
- To introduce about the various magnetic materials and superconductors.
- To understand the concept of Semiconductor materials and its applications.
- To learn about the nuclear reactors and materials.
- To introduce the concepts of smart materials and nano materials.

Course Outcomes

After completion of the course, the students will be able to

CO1 - To understand the dielectric polarization. **(K1)**
CO2 - Learn the basics of various magnetic materials with its properties for various applications. **(K1)**
CO3 - Learn the basic principles of semiconductors. **(K3)**
CO4 - Understand the nuclear reactors and its materials. **(K3)**
CO5 - Exploring the concept of smart materials and nanomaterials. **(K3)**

UNIT I DIELECTRIC MATERIALS (9 Hrs)

Dielectric Polarization and its Mechanisms – Calculation of Polarizabilities (for electronic and ionic polarizations only) - Temperature dependence of polarization-Internal Field in solids - Clausius- Mossotti relation.– Elementary ideas of Piezo- Pyro- and Ferro-electric materials and Applications. NLO materials and piezoelectric actuators (introductory concepts).

UNIT II MAGNETIC MATERIALS AND SUPERCONDUCTORS (9 Hrs)

Magnetic Materials: Origin of atomic magnetic moment – Bohr magneton-classification of magnetic materials (Dia,Para, Ferro, antiferro&Ferri) – Domain Theory of Hysteresis – Structure and Properties of Ferrites – Properties of Soft & Hard Magnetic Materials – Applications. Magnetic Hard Disk. Ferro-fluids and applications.

Superconductors: Basic concepts – properties of superconductors –Meissner effect – Type I and II superconductors – BCS theory (qualitative) - High Temperature Superconductors– Qualitative ideas of Josephson effect, quantum interference and SQUID – their applications.

UNIT III SEMICONDUCTORS (9 Hrs)

Semiconductors –Concept of Fermi Distribution Function, Fermi Energy Level- Derivation of Carrier concentration in intrinsic Semiconductors –Basic ideas of Electrical conductivity in intrinsic and extrinsic semiconductors -temperature dependence of carrier concentration and electrical conductivity in semiconductors (qualitative ideas), Hall effect in Semiconductors -- Application of Hall Effect. Basic Ideas of Compound Semiconductors (II-VI & III-V).Photovoltaic Effect-Solar photovoltaic cells.

UNIT IV NUCLEAR REACTORS & MATERIALS (9 Hrs)

Mass Defect & Binding Energy of Nucleus - Disintegration in fission –Nuclear Reactors: BWR – FBR. Materials used in Nuclear Reactors; Materials for Moderator, coolant, reactor control elements containment shell. Nuclear Fuel materials and Fuel processing - Fuel enrichment. Nuclear fusion reactions for fusion reactors-D-D and D-T reactions, Basic principles of Nuclear Fusion reactors

UNIT V SMART MATERIALS AND NANOMATERIALS (9 Hrs)

Smart Materials: Introduction –definitions. Shape Memory alloys (SMA): One way and two way Shape memory effect, pseudo elasticity, Properties and applications of SMA- features of Ni-Ti SMA alloy. Liquid Crystals : Types –nematic, cholesteric, smectic- Application to Display Devices

Metallic Glasses: preparation by melt spinning. Properties and applications Nanomaterials : Introduction to Nanomaterials–Methods of synthesis (CVD, Laser Ablation, Solgel, Ball-milling Techniques), Properties and applications of nanomaterials.C60-Buck Minister Fullerence, carbon nanotubes– synthesis (Plasma arc, Pulsed Laserevaporation methods) Properties and applications.

Text Books

1. Avadhanulu M N, “Engineering Physics”, Vol.-II, S. Chand & Co, 2009.
2. Arthur Beiser, “Concepts of Modern Physics”, 6th Edition, TMH, New Delhi 2008. (For Unit V only)

Reference Books

1. V Rajendran, Engineering Physics, 2nd Edition, TMH, New Delhi 2011.
2. B.S. Murty, P. Shankar, Baldev Raj, B.B. Rath, and James Murday, Text book of Nanoscience and Nanotechnology, Universities Press, Hyderabad 2012.
3. Ali Omar M, Elementary Solid State Physics, Addison Wesley Publishing Co., 2009.
4. Pillai S.O, Solid State Physics, 6th Edition – New Age International, 2005.
5. Vijayamohanan K Pillai and MeeraParthasarathy, Functional Materials, Universities Press Hyderabad, 2012.
6. C.M. Srivastava and C. Srinivasan, Science of Engineering Materials, 2nd Edition, New Age Int. (P) Ltd, New Delhi, 1997.

Web References

1. https://nptel.ac.in/courses/122/102/122102008/
2. https://lecturenotes.in/subject/23/material-science-ms
3. http://people.virginia.edu/~lz2n/mse209/
4. https://www.youtube.com/playlist?list=PLE34EAAA410160DD6

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	2	-	-	-	-	-	-	-	-	-	3	-	**-**
2	3	2	2	-	-	-	-	-	-	-	-	-	3	-	**-**
3	3	2	2	-	-	-	-	-	-	-	-	-	3	-	**-**
4	3	-	1	-	-	-	-	-	-	-	-	-	3	-	**-**
5	3	2	1	-	-	-	-	-	-	-	-	-	3	-	**-**

Correlation Level: 1-Low, 2-Medium, 3- High

U20EST113	BASIC ELECTRONICS	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To acquaint the students with semiconductor diodes,
- To familiarize the students with Bipolar Transistors-
- To acquaint the students with Field effect Transistors
- To impart knowledge on special semiconductor devices.
- To familiarize the student with the design and analysis of Rectifiers and power supplies.

Course Outcomes

After completion of the course, the students will be able to

CO1 - Understand the principle and working of electrical measuring instruments. **(K2)**
CO2 - Develop knowledge to measure parameters like voltage, current, power, energy. **(K2)**
CO3 - To measure the electrical parameters of various circuits in measurements. **(K2)**
CO4 - Evaluate the performance of instruments under various operating conditions. **(K3)**
CO5 - Select instruments suitable for specific measurement applications. **(K3)**

UNIT I SEMICONDUCTOR DEVICES (9 Hrs)

Introduction. Intrinsic and Extrinsic semiconductor - charge density, Mobility and conductivity, Drift and diffusion current, Continuity equation, PN junction - Energy band diagram of PN junction, V-I characteristics, Current components in PN junction, Application of diode - Diode switch, Clipper, Clamper, Voltage Multiplier Zener Diode- V-I characteristics, Zener Regulator.

UNIT II BIPOLAR JUNCTION TRANSISTORS (9 Hrs)

Operation of NPN and PNP transistor - Current components in a transistor, Characteristics of CE, CB, CC configuration - Switching characteristics - Biasing of BJT- Types of Biasing- Analysis and design. Bias stability. Thermal runaway. Temperature compensation. Applications

UNIT III FIELD EFFECT TRANSISTORS (FET) (9 Hrs)

JFET- Construction, Operation and Characteristics, Expression for pinch off voltage and drain current - MOSFET- Enhancement and Depletion mode operation and characteristics- Biasing of FET- Comparison of BJT and FET. Applications

UNIT IV SPECIAL SEMICONDUCTOR DEVICES (9 Hrs)

SCR- UJT- DIAC- TRIAC - Varactor diode - PIN diode - Tunnel diode - Gunn diode - Principle of photo electronic devices - Solar cell, Photo diode and Photo transistor - LED, LCD, LASER diode.

UNIT V RECTIFIERS AND POWER SUPPLIES (9 Hrs)

Half Wave Rectifier - Full Wave Rectifier – Bridge Rectifier – Performance of Rectifiers – Filters – Types of Filters – L, C, LC, pi Filters – Regulators – Shunt and Series Voltage Regulator – IC Regulator – SMPS.

Text Books

1. Jacob Millman, Millman's Electronic Devices and Circuits, McGraw Hill Education; 4 edition 2015
2. G.K. Mithal, “Basic Electronic Devices and circuits”, 2nd Edition, G.K. Publishers Pvt. Ltd., 2004
3. David Bell, “Fundamentals of Electronic Devices and Circuits”, 5th Edition, Oxford University Press, 2012

Reference Books

1. Robert L. Boylestad, Louis Nashelsky, Electronic Devices and Circuits Theory, Prentice Hall,2013.
2. R.S. Sedha, A Text Book of Applied Electronics S. Chand Publications, 2014.
3. Salivahanan .S, Electronic Devices and Circuits, TMH, 2013.
4. Sedra and Smith," Microelectronic Circuits, Oxford University Press, 5th Edition, 2012
5. Schultz, Mitchel. Grob's basic electronics.McGraw-Hill, 2019.

Web References

1. https://wiki.analog.com/university/courses/electronics/text/electronics-toc
2. https://www.makerspaces.com/basic-electronics/
3. https://www.electronics-tutorials.ws/
4. https://nptel.ac.in/courses/117/103/117103063/

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	3	1	2	1	-	3	2	-	2	3	3	2	3
2	3	2	3	1	2	1	-	3	2	-	2	3	3	2	3
3	3	2	3	1	2	1	-	3	2	-	2	3	3	2	3
4	3	2	3	1	2	1	-	3	2	-	2	3	3	2	3
5	3	2	3	1	2	1	-	3	2	-	2	3	3	2	3

Correlation Level: 1-Low, 2-Medium, 3- High

U20EST115	ELECTRICAL TECHNOLOGY	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To provide an introduction about the magnetic circuits.
- To introduce the concepts of transformers.
- To introduce the principles of operations of DC machines.
- To introduce the principles of operations of Induction motors
- To study special machines and give an overview of domestic wiring.

Course Outcomes

After completion of the course, the students will be able to

CO1 - Gain Knowledge about the basic concepts of magnetic circuits. **(K2)**

CO2 - Describe the working of transformer, auto transformer and assess the regulation and efficiency of transformer. **(K2)**

CO3 - Demonstrate the operation of DC machines and their performance characteristics. **(K3)**

CO4 - Explain the working concept of single phase, three phase induction motor and analyse the operating behaviour of induction motor and special machines. **(K3)**

CO5 - Gain knowledge about stepper motor, servo motors and electric traction. **(K2)**

UNIT I MAGNETIC CIRCUITS (9 Hrs)

Definition of MMF, Flux and Reluctance - Leakage Factor - Reluctances in Series and Parallel (Series and Parallel Magnetic Circuits) - Electromagnetic Induction - Fleming's Rule - Lenz's Law - Faraday's laws - statically and dynamically induced EMF - Self and mutual inductance - Analogy of Electric and Magnetic Circuits.

UNIT II TRANSFORMERS (9 Hrs)

Construction and Principle of operation of Single Phase Transformer - EMF Equation - Phasor Diagram on No Load and Loaded Transformer –load test - Open Circuit and Short Circuit Test on Transformer- Equivalent Circuit - Regulation and Efficiency - Introduction to auto transformers- copper savings in auto transformers- 3-phase transformer – Types of connections

UNIT III D.C MACHINES (Qualitative Analysis Only) (9 Hrs)

Construction, Principles of operation of DC Generators - Types –EMF Equation - Performance Characteristics of Series and Shunt Generators - Armature Reaction. DC Motor - Torque Equation- Speed - Torque Characteristics of Series and Shunt Motors –Load Test – No Load Test -Speed Control methods and Applications. Need for starter – types.

UNIT IV INDUCTION MOTORS (Qualitative Treatment Only) (9 Hrs)

Constructional Details of Three Phase Induction Motor - Slip Ring and Squirrel Cage Rotor- Principle of operation- Torque Equation - Torque / Slip Characteristics - Starters - Applications Introduction to Single Phase Induction Motors - Capacitor Start Capacitor Run Motor -Shaded Pole Motor.

UNIT V SYNCHRONOUS MACHINES AND SPECIAL MACHINES (9 Hrs)
(Qualitative Treatment Only)

Principles of Alternator - Construction Details - Types Special Machines: Stepper motor- AC and DC Servomotor -Universal Motor - Hysteresis Motor -Permanent Magnet Synchronous Motor - Switched Reluctance Motor - Brushless D.C Motor - Construction, Working And Applications. **Utilization:** Domestic wiring – principle of electrical heating –laws of illumination – Electric lamps – Photometers – Electroplating – Electric Traction – Air conditioning – Earthing.

Text Books

1. J.B. Gupta, “Theory and Performance of Electrical Machines”, S.K.Kataria & Sons, 4th Edition, 2013.
2. B.L. Therajaand A.K.Theraja, “A TextBook of Electrical Technology, Vol.II”, S.Chand & Company Ltd., 2009.
3. R.K. Rajput, “Electrical Engineering” Lakshmi Publications Pvt Limited, 4th Edition, 2008.

Reference Books

1. S.K.Bhattacharya, “Electrical Machines”, Tata Mc Graw Hill Company Ltd, 4th Edition, 2014.
2. D P Kothari and I.J Nagarath, “Electrical Machines”, McGraw Hill Education (India) Private Limited, Fifth edition, 2017.
3. Edward Hughes “Electrical and Electronic Technology”, Pearson Education, 10th Edition, 2011.
4. R.K. Rajput, “Utilization of electrical power”, First edition, Lakshmi publications, 2006
5. Venkataratnam K., “Special Electrical Machines”, Universities Press Private Limited, 1st Edition, 2009.

Web References

1. https://www.electricaltechnology.org/
2. https://nptel.ac.in/courses/108105053/
3. https://www.youtube.com/watch?v=FAjM4C7dssM

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	-	-	-	-	-	-	3	2	-	2	3	3	2	3
2	3	-	-	2	3	-	-	3	2	-	2	3	3	2	3
3	3	2	1	2	3	-	-	3	2	-	2	3	3	2	3
4	3	2	1	2	3	-	-	3	2	-	2	3	3	2	3
5	3	2	1	2	3	-	-	3	2	-	2	3	3	2	3

Correlation Level: 1-Low, 2-Medium, 3- High

U20EST103	FUNDAMENTALS OF CIVIL AND MECHANICAL ENGINEERING	L	T	P	C	Hrs
		3	0	0	3	45

(Common to ECE, ICE, BME)

Course Objectives

- To be able to differentiate the type of buildings and construction materials.
- To understand about various building components and its function
- To understand the various infrastructure facilities and their importance
- To familiarize the working principles of IC engines and automobile systems
- To understand about the power generation systems and its components.
- To acquire knowledge about the various machining process such as lathe, drilling and boring machines.

Course Outcomes

After completion of the course, the students will be able to

CO1 -Gain knowledge on types of buildings and about various construction materials. **(K2)**

CO2 - To study about the components of buildings **(K2)**

CO3 - To identify the various infrastructure facilities **(K2)**

CO4 - Summarize the working principle of IC engines and energy systems. **(K2)**

CO5 - Explain the basic concepts and fundamentals of power generation, Refrigeration and Air Conditioning Systems **(K1)**

CO6 - To study the various machining process with tool materials. **(K2)**

Part A - CIVIL ENGINEERING

UNIT I BUILDINGS, BUILDING MATERIALS (8 Hrs)

Buildings – Definition –Classification According to NBC-plinth area, Floor area, carpet area, floor space index - Green building, Benefits from green building, Green rating system; Development of Smart cities - Construction Materials - stone, brick , cement, cement-mortar, concrete, steel - their properties and uses.

UNIT II BUILDINGS COMPONENTS AND FOUNDATION (8 Hrs)

Various Buildings Components and their functions. Soils and their classification - Foundation: function and types. Masonry: function and types - Floors: definition and types of floors - Roofs: definition and types.

UNIT III BASIC INFRASTRUCTURE (6 Hrs)

Surveying: Classification-Chain Survey-Ranging-Compass Survey-exhibition of different survey equipment-Roads - types: components, types and their advantage and disadvantages – Bridges- components and types of bridges -Sources of Water - Water Supply-Quality of Water-Wastewater Treatment – Sea Water Intrusion – Recharge of Ground Water – Dams- site selection for dam construction, types of dams

Part B - MECHANICAL ENGINEERING

UNIT IV INTERNAL AND EXTERNAL COMBUSTION SYSTEMS (8 Hrs)

IC engines – Classification – Working principles – Diesel and Petrol Engines: Two stroke and four stroke engines – merits and demerits.

Steam generators (Boilers) – Classification – Constructional features (of only low-pressure boilers) – Boiler mountings and accessories – Merits and demerits – Applications.

UNIT V POWER GENERATION SYSTEMS, REFRIGERATION AND AIR CONDITIONING SYSTEM (8 Hrs)

Power plants: Thermal – Nuclear, Hydraulic, Solar, Wind, Geothermal, Wave, Tidal and Ocean Thermal Energy Conversion systems - Functions, Applications- Schemes and layouts (Description only).

Refrigeration and Air Conditioning System: Terminology of Refrigeration and Air Conditioning. Principle of vapour compression and absorption system – Layout of typical domestic refrigerator–Window and Split type room Air conditioner

UNIT VI MACHINING PROCESS (7 Hrs)

Lathe - types, Specifications, Operations of a centre lathe. Casting- Pattern making, Allowances, Green sand and dry sand moulding, casting defects. Welding - Arc and Gas welding process, brazing and soldering (process description only).

Text Books

1. G Shanmugam, MS Palanichamy, Basic Civil and Mechanical Engineering,1st Edition, McGraw Hill Education, 2018.
2. R. Vaishnavi, M. Prabhakaran, V. Vijayan, Basic Civil and Mechanical Engineering, S. Chand Publisher, 2013.
3. Palanikumar, K. Basic Mechanical Engineering, ARS Publications, 2010.

Reference Books

1. M.P. Poonia, S.C. Sharma & T.R. Banga, Basic Mechanical Engineering, Khanna Publishing House 2018.
2. V. Rameshbabu, Basic Civil & Mechanical Engineering, VRB Publishers Private Limited, January 2017.
3. Serope Kalpakjian, Steven Schmid, Manufacturing Engineering and Technology,7th Edition, Pearson Publication, 2014.
4. S.S. Bhavikatti, Basic Civil engineering, New Age International Ltd. 2018.
5. Gopi Satheesh, Basic Civil engineering, Pearson Publications, 3rd Edition, 2015.

Web References

1. https://nptel.ac.in/courses/112107291/
2. https://nptel.ac.in/courses/112/103/112103262/
3. https://ocw.mit.edu/courses/mechanical-engineering/2-61-internal-combustion-engines-spring-2017/lecture-notes/
4. https://nptel.ac.in/courses/105102088/
5. https://nptel.ac.in/courses/105104101/

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	2	2	3	3	3	-	3	-	2	3	-	-	-
2	3	2	3	2	2	3	3	-	3	-	2	3	-	-	-
3	3	2	3	2	3	3	3	-	3	-	2	3	-	-	-
4	3	1	-	-	-	-	-	-	-	-	-	1	-	-	-
5	3	1	-	-	-	-	-	-	-	-	-	1	-	-	-
6	3	1	-	-	-	-	-	-	-	-	-	1	-	-	-

Correlation Level: 1-Low, 2-Medium, 3- High

U20ESP114	BASIC ELECTRONICS LAB	L	T	P	C	Hrs
		0	0	2	1	30

Course Objectives

- To give a basic introduction to electronic components
- To provide students knowledge about semiconductor diodes.
- To determine the V-I characteristics of transistor configurations.
- To determine the characteristics of thyristor circuits
- To explain the importance of transistors as switch

Course Outcomes

After completion of the course, the students will be able to

CO1 - Understand the basic circuit concepts. **(K2)**
CO2 - Analyze the functioning and characteristics of transistors.**(K3)**
CO3 - Demonstrate the understanding of special semiconductor diodes and its applications. **(K2)**
CO4 - Analyze the V-I characteristics of thyristors. **(K3)**
CO5 - Analyze the Switching characteristics of transistors. **(K3)**

List of Experiments

1. Study of circuit components and equipment (Component identification, Characteristics of Passive Circuit elements, Color coding, checking diode, BJT, FET, study of CRO, Function Generator, Multimeter, LCR meter).
2. Characteristics of Semiconductor diode and Zener diode
3. Analysis of transistor biasing circuits
4. Characteristics of LED/ LDR.
5. Characteristics of CE configuration
6. Characteristics of CB configuration
7. Characteristics of FET
8. Characteristics of SCR.
9. Characteristics of TRIAC.
10. Switching Characteristics of BJT.
11. Simulation using PSpice / Multisim.

Reference Books

1. Ravi kumar “Basic Electronics Engineering Handbook”;1st edition, June 27, 2019
2. Paul Scherz, Dr. Simon Monk “Practical Electronics”, McGraw-Hill Education TAB; 4th edition (March24, 2016)
3. Sedra and Smith, “Microelectronic Circuits”, Oxford University Press, 5th Edition, 2012
4. Schultz, Mitchel, “Grob's basic electronics”, McGraw-Hill, 2019.
5. Robert L. Boylestad, “Electronic Devices and Circuit Theory”, 11th Edition, 2015

Web References

1. https://www.makerspaces.com/basic-electronics/
2. https://www.electronics-tutorials.ws/
3. www.allaboutcircuits.com
4. www.circuitstoday.com

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
1	1	2	3	2	-	1	-	2	1	-	1	3	3	2	**3**
2	2	2	3	1	1	1	-	2	2	-	2	3	3	2	**3**
3	3	2	3	1	1	1	-	2	2	-	2	3	3	2	**3**
4	3	2	3	1	1	1	-	2	2	-	2	3	3	2	**3**
5	3	2	3	1	1	1	-	2	2	-	2	3	3	2	**3**

Correlation Level: 1-Low, 2-Medium, 3- High

U20ESP116	ELECTRICAL TECHNOLOGY LAB	L	T	P	C	Hrs
		0	0	2	1	30

Course Objectives

- To introduce practical knowledge on domestic wiring and analysis of electrical circuits.
- To provide the methods to test and evaluate the performance of electrical machines.
- To evaluate the open circuit and short circuit test on single phase transformer.
- To impart knowledge on speed control of DC shunts motor.
- To observe the performance of load test on single phase induction motor, three phase squirrel cage induction motor and single-phase alternator.

Course Outcomes

After completion of the course, the students will be able to

CO1 - Acquire knowledge on wiring electrical circuits such as domestic, Go-Down wiring and Doctor's Wiring. **(K2)**

CO2 - Apply proper measurement techniques for the calculation of power and calibration of meters. **(K2)**

CO3 - Estimate the performance of DC and induction motor by conducting load and no-load tests. **(K3)**

CO4 - Acquire hands on experience of conducting various tests on induction machines and obtaining their performance indices using standard analytical as well as graphical methods.**(K3)**

CO5 - Acquire hands on experience of conducting various tests on alternators. **(K3)**

List of Experiments

1. Wiring circuits for
   - A. Calling bell
   - B. Staircase
   - C. Ceiling fan and fluorescent lamp wiring
   - D. Go-Down wiring
   - E. Doctor's wiring
2. Load test on single phase transformer
3. Load test on three phase transformer
4. Open circuit and short circuit test on single phase transformer
5. Load characteristics of dc shunt motor
6. Speed control of dc shunt motor.
7. Load characteristics of dc series motor
8. Open circuit characteristics of separately excited dc shunt generator
9. Load test on single phase Induction motor
10. Load test on three phase squirrel cage induction motor
11. Load test on single phase Alternator

Reference Books

1. Umesh Agarwal, "Laboratory Manual Basic Electrical Engineering, 2019", Notion Press, 1st Edition, 2019.
2. P. Tiwari & S. Sairola S.K. Kataria & Sons, "Electrical Engineering Laboratory Practice ",Reprint 2010 Edition 2010.
3. Tarnekar S.G. & et Al, "Laboratory Courses in Electrical Engineering", S Chand & Company, Rep. Edition 2006.
4. R.K.Rajput, "Utilization of electrical power", First edition, Lakshmi publications, 2006
5. Venkataratnam K., "Special Electrical Machines", Universities Press Private Limited, 1st Edition, 2009.

Web References

1. https://nptel.ac.in/courses/108/108/108108076/
2. https://nptel.ac.in/courses/108/105/108105017/

3. http://www.cittumkur.org/eee/em.pdf

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	3	2	-	1	-	2	1	-	1	3	3	2	3
2	3	2	3	1	1	1	-	2	2	-	2	3	3	2	3
3	3	2	3	1	1	1	-	2	2	-	2	3	3	2	3
4	3	2	3	1	1	1	-	2	2	-	2	3	3	2	3
5	3	2	3	1	1	1	-	2	2	-	2	3	3	2	3

Correlation Level: 1-Low, 2-Medium, 3- High

U20ESP112	ENGINEERING GRAPHICS USING AUTOCAD (Common to ECE, IT, CSE, ICE, BME,CSBS, Mechatronics)	L	T	P	C	Hrs
		0	0	2	1	30

Course Objectives

- To develop graphic skills for communication of concepts, ideas and design of engineering products.
- To expose them to standardised technical drawings.
- To extend the skill to use software for creating 2D and 3D models.
- To draw a simple steel truss.
- To develop the isometric projection of simple objects.

Course Outcomes

After completion of the course, the students will be able to

CO1 - Familiarize with the fundamentals and standards of engineering graphics. **(K1, K2)**
CO2 - Perform freehand sketching of basic geometrical constructions and multiple views of objects. **(K2, K3)**
CO3 - Plan orthographic projections of lines and plane surfaces. **(K3)**
CO4 - Draw projections, solids and development of surfaces. **(K4)**
CO5 - Visualize the project isometric and perspective sections of simple solids. **(K4)**

List of Experiments

1. Study of capabilities of software for Drafting and Modelling – Coordinate systems (absolute, relative, polar, etc.) – Creation of simple figures like polygon and general multi-line figures.
2. Drawing of a Title Block with necessary text and projection symbol.
3. Drawing of curves like parabola, spiral, involute using B Spline or cubic spline.
4. Drawing of front view and top view of simple solids like prism, pyramid, cylinder, cone, etc., and Dimensioning.
5. Drawing front view, top view and side view of objects from the given pictorial views (eg. Vblock, Base of a mixie, Simple stool, Objects with hole and curves).
6. Drawing of a plan of residential building (Two bed rooms, kitchen, hall, etc.)
7. Drawing of a simple steel truss.
8. Drawing sectional views of prism, pyramid, cylinder, cone, etc,
9. Drawing isometric projection of simple objects.
10. Creation of 3-D models of simple objects and obtaining 2-D multiview drawings from 3-Dmodel.

Note: Plotting of drawings must be made for each exercise and attached to the records written byStudents.

Reference Books

1. James D. Bethune, Engineering Graphics with AutoCAD A Spectrum book 1st Edition, Macromedia Press, Pearson, 2020.
2. NS Parthasarathy and Vela Murali, Engineering Drawing, Oxford university press, 2015.
3. M.B Shah, Engineering Graphics, ITL Education Solutions Limited, Pearson **Education** Publication, 2011.
4. Bhatt N.D and Panchal V.M, Engineering Drawing: Plane and Solid Geometry, Charotar Publishing House, 2017.
5. Jeyapoovan T, Engineering Drawing and Graphics Using AutoCAD, Vikas Publishing House Pvt Ltd., 7th Edition, New Delhi, 2016.
6. C M Agrawal, Basant Agrawal, Engineering Graphics, McGraw Hill, 2012.
7. Dhananjay A. Jolhe, Engineering Drawing: With An Introduction To CAD McGraw Hill, 2016.
8. James Leach, AutoCAD 2017 Instructor, SDC Publications, 2016.

Web References

1. http://vlabs.iitb.ac.in/vlabs-dev/labs/mit_bootcamp/egraphics_lab/labs/index.php
2. http://www.nptelvideos.in/2012/12/computer-aided-design.html
3. https://mech.iitm.ac.in/meiitm/course/cad-in-manufacturing/
4. https://autocadtutorials.com
5. https://dwgmodels.com

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	1	-	-	3	-	-	-	3	-	-	2	1	-	-
2	3	1	-	-	3	-	-	-	3	-	-	3	1	-	-
3	3	1	-	-	3	-	-	-	3	-	-	2	1	-	-
4	3	1	-	-	3	-	-	-	3	-	-	2	1	-	-
5	3	1	-	-	3	-	-	-	3	-	-	3	1	-	-

Correlation Level: 1-Low, 2-Medium, 3- High

		L	T	P	C	Hrs
U20ICC1XX	**CERTIFICATION COURSE - I**	**0**	**0**	**4**	**-**	**50**

Students shall choose an International certification course offered by the reputed organizations like Google, Microsoft, IBM, Texas Instruments, Bentley, Autodesk, Eplan and CISCO, etc. The duration of the course is 40-50 hours specified in the curriculum, which will be offered through Centre of Excellence.

Pass /Fail will be determined on the basis of participation, attendance, performance and completion of the course. If a candidate Fails, he/she has to repeat the course in the subsequent years. Pass in this course is mandatory for the award of degree.

U20ICM101 INDUCTION PROGRAM

Induction program for students to be offered right at the start of the first year

Duration of the Program	3 Weeks
Induction program	• Physical Activity • Creative Arts and Culture • Mentoring and Universal Human Values • Familiarization with College, Dept./Branch • Literary Activity • Proficiency Modules • Lectures and Workshops by Eminent People • Visits in Local Area • Extra-Curricular Activities in College

1. Physical Activity

This would involve a daily routine of physical activity with games and sports. There would be games in the evening or at other suitable times according to the local climate. These would help develop team work besides health. Each student could pick one game and learn it for the duration of the induction program and hopefully, continue with it later.

2. Creative Arts

Every student would chose one skill related to the arts whether visual arts or performing arts. Examples are painting, music, dance, pottery, sculpture etc. The student would pursue it every day for the duration of the program. These would allow for creative expression. It would develop a sense of aesthetics and also enhance creativity which would, hopefully, flow into engineering design later.

3. Mentoring and Universal Human Values

Mentoring and connecting the students with faculty members is the most important part of student induction. Mentoring takes place in the context and setting of Universal Human Values. It gets the student to explore oneself and experience the joy of learning, prepares one to stand up to peer pressure and take decisions with courage, be aware of relationships and be sensitive to others, understand the role of money in life and experience the feeling of prosperity. Need for character building has been underlined by many thinkers, universal human values provide the base. Methodology of teaching this content is extremely important. It must not be through do's and dont's, but by getting the students to explore and think by engaging them in a dialogue. It is best taught through group discussions and real life activities rather than lecturing. The role of group discussions, however, with clarity of thought of the teachers cannot be over emphasized. It is essential for giving exposure, guiding thoughts, and realizing values. The teachers must come from all the departments rather than only one department like HSS or from outside of the Institute. Experiments in this direction at IIT(BHU) are noteworthy and one can learn from them. Discussions would be conducted in small groups of about 20 students with a faculty mentor each. It is to open thinking towards the self. Universal Human Values discussions could even continue for rest of the semester as a normal course, and not stop with the induction program. Besides drawing the attention of the student to larger issues of life, it would build relationships between teachers and students which last for their entire 4-year stay and possibly beyond.

4. Other Activity

Activities that are not there on a daily basis, but are conducted for 3-4 days (typically in the afternoons) and change thereafter.

4.1. Familiarization with College, Department/Branch

The incoming students should be told about the credit and grading system, and about the examinations.

They should be informed about how study in college differs from study in school. They should also be taken on a tour of the college and shown important points such as library, canteen, and other facilities. They should be shown their department, and told what it means to get into the branch or department. Describe what role the technology related to their department plays in society and after graduation what role the student would play in society as an engineer in that branch. A lecture by an alumnus of the Dept. would be very helpful in this regard. They should also be shown the laboratories, workshops and other facilities. The above should be done right in the first two days, and then over the afternoons thereafter, as appropriate.

4.2. Literary Activity

Literary activity would encompass reading a book, writing a summary, debating, enacting a play etc.

4.3. Proficiency Modules

The induction program period can be used to overcome some critical lacunas that students might have, for example, English, computer familiarity etc. These should run like crash courses, so that when normal courses start after the induction program, the student has overcome the lacunas substantially. We hope that problems arising due to lack of English skills, wherein students start lagging behind or failing in several subjects, for no fault of theirs, would, hopefully, become a thing of the past.

4.4. Lectures and Workshops by Eminent People

Lectures by eminent people should be organized, say, once a week. It would give the students exposure to people who are eminent, in industry or engineering, in social service, or in public life. Alumni could be invited as well. Motivational lectures about life, meditation, etc. by Ramakrishna Mission, Art of Living, Vivekanand Kendras, S-VYASA, etc. may be organized. Workshops which rejuvenate or bring relief to students would also be welcome, such as, Art of Living workshops (3 sessions, 9 hours).

4.5. Visits in Local Area

A couple of visits to the local landmarks including historical monuments should be organized. This would familiarize the students with the area together with bonding with each other, like in a picnic. Visits should also be organized to a hospital, orphanage or a village. These would expose them to people in suffering or to different lifestyles. This might also sensitize them to engineering needs in these areas.

4.6. Extra-Curricular Activities in College

The new students should be introduced to the extra-curricular activities at the college/university. They should be shown the facilities and informed about activities related to different clubs etc. This is when selected senior students involved in or leading these activities can give presentations, under faculty supervision.

U20BST215	ENGINEERING MATHEMATICS II MULTIPLE INTEGRALS AND TRANSFORMS (Common to all branches except CSBS)	L	T	P	C	Hrs
		2	2	0	3	60

Course Objectives

- To develop logical thinking and analytic skills in evaluating multiple integrals.
- To equip themselves familiar with Laplace transform and solve the differential equations using Laplace transform techniques.
- To enable the students to expand functions into Fourier series using change of intervals.
- To gain good knowledge in application of Fourier transform.
- To inculcate the computational knowledge in Z-transforms.

Course Outcomes

After completion of the course, the students will be able to

CO1 - Understand the concept of double and triple integrals. **(K2)**
CO2 - Find Laplace transform and inverse transform of simple functions. **(K5)**
CO3 - convert a periodic function into series form. **(K3)**
CO4 - Compute Fourier transforms of various functions. **(K3)**
CO5 - To solve difference equations using Z- transforms. **(K3)**

UNIT I MULTIPLE INTEGRALS (12 Hrs)

Multiple Integrals, change of order of integration and change of variables in double integrals (Cartesian to polar). Applications: Areas by double integration and volumes by triple integration (Cartesian and polar).

UNIT II LAPLACE TRANSFORMS AND INVERSE LAPLACE TRANSFORMS (12 Hrs)

Definition, Transforms of elementary functions, properties. Transform of derivatives and integrals. Multiplication by t and division by t. Transform of unit step function, transform of periodic functions. Initial and final value theorems, Methods for determining inverse Laplace Transforms, Convolution theorem, Application to differential equations and integral equations. Evaluation of integrals by Laplace transforms.

UNIT III FOURIER SERIES (12 Hrs)

Dirichlet's conditions – General Fourier series – Expansion of periodic function into Fourier series – Fourier series for odd and even functions – Half-range Fourier cosine and sine series – Change of interval – Related problems.

UNIT IV FOURIER TRANSFORMS (12 Hrs)

Fourier Integral theorem Fourier transform and its inverse, properties. Fourier sine and cosine transforms, their properties, Convolution and Parseval's identity.

UNIT V Z - TRANSFORMS (12 Hrs)

Difference equations, basic definition, z-transform - definition, Standard z-transforms, Damping rule, Shifting rule, Initial value and final value theorems and problems, Inverse z-transform. Applications of z - transforms to solve difference equations.

Text Books

1. Ravish R Singh and Mukul Bhatt, "Engineering Mathematics", Tata McGraw Hill, 1st Edition, New Delhi, 2016.

2. Sivaramakrishna Das P. and Vijayakumar C., “Engineering Mathematics”, Pearsons, New Delhi, 2017.
3. M.D.Petale, “A text book on Z- Transforms (Engineering Mathematics)”, Bames and Noble, New Edition, 2020.

Reference Books

1. H.K. Dass, “Advanced Engineering Mathematics”, S. Chand & Co.New Delhi, 2019.
2. N.P. Bali and Dr. Manish Goyal, “Engineering Mathematics”, Lakshmi Publications Pvt. Ltd., New Delhi, 9th Edition, 2015.
3. Erwin Kreyszig, “Advanced Engineering Mathematics”, John Wiley & Sons, New Delhi, 10th Edition 2019.
4. C. B. Gupta, Shree Ram Singh, M. Kumar, “Engineering Mathematics for semester I & II”, Tata McGraw Hill, New Delhi, 2016.
5. B.V. Ramana, “Higher Engineering Mathematics”, Tata McGraw Hill, New Delhi 2018.

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2. https://nptel.ac.in/courses/111105035/
3. https://nptel.ac.in/courses/111107119/
4. https://swayam.gov.in/nd1_noc20_ma17/preview
5. https://nptel.ac.in/courses/111/103/111103021/

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	1	-	-	-	-	-	-	-	-	-	1	-	-	1
2	3	2	1	1	-	1	-	-	-	-	-	1	-	-	1
3	3	2	1	1	-	1	-	-	-	-	-	1	-	-	1
4	3	2	1	1	-	1	-	-	-	-	-	1	-	-	1
5	3	2	1	1	-	1	-	-	-	-	-	1	-	-	1

Correlation Level: 1-Low, 2-Medium, 3- High

	PROGRAMMING IN C	L	T	P	C	Hrs
U20EST201	(Common to CSE, ECE, EEE, IT, ICE, MECH, CIVIL,BME,Mechatronics, CCE)	**3**	**0**	**0**	**3**	**45**

Course Objectives

- To understand the Fundamentals of Computers and introduction to C language.
- To study about the programs using Control structures.
- To understand programs using looping and arrays.
- To understand the concepts of Functions and Pointers.
- To study about Structure, Union and File Management Operations in C.

Course Outcomes

After completion of the course, the students will be able to

CO1 - Comprehend the basic constructs of C programming. **(K2)**

CO2 - Illustrate the concepts of sequential, selection and repetition control structures in C program. **(K2)**

CO3 - Implement simple programs using looping structure and arrays. **(K3)**

CO4 - Demonstrate programs using Functions and Pointers. **(K3)**

CO5 - Build programs using Structure, Union and understand the concept of File management Operations. **(K3)**

UNIT I INTRODUCTION TO C (9 Hrs)

C programming: Overview of C- Visual Studio code - Constants- Compiling a C Program -Variables and Data Types-Technical Difference between Keywords and Identifiers--Types of C Qualifiers and format specifies - Operators and Expressions-Operators Precedence-Type conversion-Input-Output Statements.

UNIT II DECISION MAKING (9 Hrs)

Decision making and branching- Relational operators – Logical operators-If – If else-If else If –Nested if.Switch-case.

UNIT III LOOPING ANDARRAYS (9 Hrs)

Looping: while - do while – for – break – continue - nested loop. Arrays: One Dimensional Arrays-Two-Dimensional Arrays-Multi-Dimensional Array-Dynamic arrays-Character Arrays and String-Sorting - Searching.

UNIT IV FUNCTIONS, POINTERS (9 Hrs)

Functions: Introduction - Definition – Declaration – Categories of Functions - Nesting of Functions, Recursive functions - Passing Arrays to Functions - Strings – String library function. Pointers: Introduction - Declaring Pointer Variables - Initialization of Pointer Variables - Accessing the address of a variable - Accessing a variable thorough Pointer - Chain of Pointers - Pointer Expressions - Pointers and arrays – Pointers and functions – Call by Reference - Pointers and character strings - Array of Pointers - Pointers and Structures.

UNIT V STRUCTURES AND UNIONS, FILE MANAGEMENT (9 Hrs)

User defined data types: Introduction – Structure: definition - declaration - Arrays of Structures – Nested structures – Passing structures to functions –– Union - Enumeration and Typedef. Introduction to File Handling in C, Input and Output operations on a file – Error Handling - Random access to files – command line arguments. Introduction to pre-processor – Macro substitution directives – File inclusion directives – conditional compilation directives – Miscellaneous directives.

Text Books

1. Balagurusamy. E, “Programming in ANSI C”, Tata McGraw Hill, 8th Edition, 2019.
2. Herbert Schildt, “C: The Complete Reference”, McGraw Hill, Fourth Edition, 2014.
3. YashvantKanetkar, “Let us C”, BPB Publications, 16th Edition, 2017.

Reference Books

1. Ashok N Kamthane, “Computer Programming”, Pearson education, Second Impression, 2012.
2. Vikas Verma, “A Workbook on C “, Cengage Learning, Second Edition, 2012.
3. Dr. P. Rizwan Ahmed, “Office Automation”, Margham Publications, 2016.
4. P.Visu, R.Srinivasan and S.Koteeswaran, “Fundamentals of Computing and Programming”, Fourth Edition, Sri Krishna Publications, 2012.
5. Pradip Dev, Manas Ghoush, “Programming in C”, Second Edition, Oxford University Press, 2011.

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2. https://www.geeksforgeeks.org/c-language-set-1-introduction/
3. https://www.tutorialspoint.com/cprogramming
4. https://www.assignment2do.wordpress.com/.../solution-programming-in-ansi-c
5. https://nptel.ac.in/courses/106/104/106104128/

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	1	-	-	3	-	-	-	-	-	-	-	-	2	2
2	2	1	-	-	3	-	-	-	-	-	-	-	-	2	2
3	3	2	1	1	3	-	-	-	-	-	-	-	-	2	2
4	3	2	1	1	3	-	-	-	-	-	-	-	-	2	2
5	3	2	1	1	3	-	-	-	-	-	-	-	-	2	2

Correlation Level: 1-Low, 2-Medium, 3- High

U20ICT201	CIRCUIT THEORY	L	T	P	C	Hrs
		2	2	0	3	60

Course Objectives

- To impart knowledge on the fundamental principles of Electrical circuits.
- To analyse circuits using various network theorems.
- To acquire knowledge about steady state analysis.
- To introduce the concepts of transient response Analysis.
- To acquaint about the resonance and Coupled Circuits.

Course Outcomes

After completion of the course, the students will be able to

CO1 - Analyse D.C and A.C. Circuits. **(K4)**
CO2 - Apply the Network Theorems. **(K3)**
CO3 - Analyse the steady state analysis of circuits. **(K3)**
CO4- Analyse the transient Circuits with respect to its Switching Conditions. **(K4)**
CO5 - Analyse the Resonance Conditions and analyse coupled circuits.**(K3)**

UNIT I DC AND AC CIRCUITS (12Hrs)

Electrical Quantities, Ohm's Law, Resistors -Series and parallel Combinations - voltage and current division, Kirchhoff's Laws. Mesh and node Analysis - A.C. circuits- Average and RMS value - Power, Power Factor and Energy.

UNIT II NETWORK REDUCTION AND THEOREMS (BOTH DCAND AC) (12Hrs)

Network reduction- source transformation – star delta conversion. Superposition Theorem, Thevenin's Theorem, Norton's Theorem, Maximum power transfer Theorem, Reciprocity Theorem.

UNIT III STEADY STATE ANALYSIS (12Hrs)

Sinusoidal Excitation applied to Purely Resistive - Inductive and Capacitive Circuits- RL, RC and RLC Series Circuits.

UNIT IV TRANSIENT RESPONSE ANALYSIS (12Hrs)

Time Domain Analysis - Transient response of RL, RC & RLC Networks with DC Input - Solution using Laplacetransforms.

UNIT V RESONANCE AND COUPLED CIRCUITS (12 Hrs)

Series and Parallel resonance - Quality factor and Bandwidth.Coupled circuits – Faraday's laws of electromagnetic induction - Self and mutual inductance – Dot convention - Coefficient of coupling – Tuned circuits – Single tuned circuits.

Text Books

1. Sudhakar and Shyam Mohan Palli, "Circuits and Networks; Analysis and Synthesis", 3rd Edition, Tata McGraw Hill, 2008
2. William H. Hayt, Jr. Jack E. Kemmerly and Steven M. Durbin, "Engineering Circuit Analysis", McGraw Hill Science Engineering, Seventh Edition, 2019.
3. M.E.VanValkenburg "Network Analysis", Third Edition, Prentice-Hall, 2019.

Reference Books

1. Joseph Ed minister and Mahmood Nahvi, "Electric Circuits", Schaum's Outline Series, Fourth Edition, Tata McGraw Hill Publishing Company, New Delhi, 2017.

2. P. Ramesh Babu, “Circuit theory” Second Edition, Scitech Publications Pvt. Ltd, 2014.
3. N.C. Jagan&C.Lakshminarayana, ‘Network Theory’ B.S Publications, 2006.
4. Kuriakose, “Circuit Theory”, PHI Learning, 2005.
5. Allan.H.Robbins, Wilhelm C.Miller, “Circuit Analysis Theory and Practice”, Cengage Learning India, 2013.

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1. http://bookboon.com/en/textbooks/electrical-electronics-engineering
2. http://www.freebookcentre.net/electronics-ebooks-download/Circuit-Theory-Lecture-Handouts.html
3. https://nptel.ac.in/courses/108/102/108102042/

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	3	3	-	-	-	1	-	-	-	-	3	1	2
2	3	3	3	3	-	-	-	1	-	-	-	-	3	1	2
3	3	3	3	3	-	-	-	1	-	-	-	-	3	1	2
4	3	3	3	3	-	-	-	1	-	-	-	-	3	1	2
5	3	3	3	3	-	-	-	1	-	-	-	-	3	1	2

Correlation Level: 1-Low, 2-Medium, 3- High

U20ICT202	ELECTRONIC CIRCUITS	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To understand the operations of BJT and FET.
- To familiarize the students with the analysis and design of basic transistor Amplifier circuits.
- To acquire the knowledge of feedback amplifiers and Oscillators.
- To understand the frequency response of amplifiers
- To understand the operations of Tuned amplifiers and Blocking oscillators.

Course Outcomes

After completion of the course, the students will be able to

CO1 - Understand the working principles, Frequency response characteristics of BJT and FET. **(K2)**
CO2 - Analyze the classification of amplifiers. **(K4)**
CO3 - Design and analyze the Feedback amplifiers. **(K4)**
CO4 - Analyze the frequency response of Wave shaping circuits and Multivibrators. **(K4)**
CO5 - Analyze the performance of Tuned Amplifiers. **(K4)**

UNIT I SMALL SIGNAL AMPLIFIERS (9 Hrs)

BJT amplifiers: CE, CB and CC amplifiers - multistage amplifiers - differential amplifier - designing BJT amplifier networks (analysis using hybrid -π model) FET amplifiers: CS, CG and CD amplifiers - designing FET amplifier networks Frequency response: low frequency response and high frequency response of BJT and FET amplifiers.

UNIT II LARGE SIGNAL AMPLIFIERS (9 Hrs)

Class A, B, C, AB and D type of operation - efficiency of class A amplifier with resistive and transformer coupled load, efficiency class B, complementary symmetry amplifiers - distortion in power amplifiers - Thermal stability of power amplifier.

UNIT III FEEDBACK AMPLIFIERS AND OSCILLATORS (Qualitative analysis) (9 Hrs)

Feedback Amplifiers: Classification, General characteristics of negative feedback amplifiers, Effect of Feedback on Amplifier characteristics, feedback topologies.
Oscillators: Barkhausen criteria, RC and LC oscillators using BJT – RC phase shift, Wien bridge oscillators, Hartley and Colpitt's oscillators. Frequency stability of oscillators. Crystal oscillators.

UNIT IV WAVE SHAPING CIRCUITS AND MULTIVIBRATORS (9 Hrs)

High Pass and Low Pass RC Circuits and their Response for Sine, Step, Pulse, Square, Ramp and Exponential Input. Multivibrators – Astable Multivibrators - Emitter and Collector Coupled - Monostable, Bistable Multivibrators, and Schmitt Trigger Circuits.

UNIT V TUNED AMPLIFIERS AND BLOCKING OSCILLATORS (9 Hrs) (Qualitative analysis)

Single tuned amplifier - Double tuned amplifier.- Bandwidth, Applications of tuned amplifier -Tuned Class C amplifiers - Stagger Tuned Amplifier- Blocking oscillator –Monostable and Astable blocking oscillator.

Text Books

1. J. Millman and C.C. Halkias, Integrated Electronics, Mc Graw-Hill, 2017.
2. S.Salivahanan, N. Suresh Kumar, A. Vallavaraj, "Electronic Devices and Circuits", TMH, 2nd Edition, 2017.
3. Theodore F. Bogart Jr., J.S. Beasley and G. Rico, Electronic Devices and Circuits, Pearson Edition, 6th Edition, 2004.

Reference Books

1. Robert L. Boylestad and Louis Nashelsky, Electronic Devices and Circuits Theory, Pearson/ Prentice Hall, 9th Edition, 2013.
2. Microelectronic Circuits – Sedra A.S. and K.C. Smith, Oxford University Press, 5th ed.,2013
3. Kumar and Jain, “Electronic devices and Circuits” PHI learning, 2016.
4. Bakshi, U. A., & Godse, A. P., “Electronic Devices and Circuits”, Technical Publications, 2008
5. Boylestad, R. L., & Nashelsky, L., “Electronic devices and circuits”, Prentice-Hall, 2013

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2. https://nptel.ac.in/courses/108108122/
3. https://www.electronics-tutorials.ws/

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	3	2	2	1	-	2	2	-	2	3	3	2	3
2	3	3	3	2	2	1	-	2	2	-	2	3	3	2	3
3	3	3	3	2	2	1	-	2	2	-	2	3	3	2	3
4	3	3	3	2	2	1	-	2	2	-	2	3	3	2	3
5	3	3	3	2	2	1	-	2	2	-	2	3	3	2	3

Correlation Level: 1-Low, 2-Medium, 3- High

		L	T	P	C	Hrs
U20ICT203	**SIGNALS AND SYSTEMS**	**2**	**2**	**0**	**3**	**60**

Course Objectives

- To study about the basic concepts of signals
- To know about continuous time signals like Laplace transform
- To study about the continuous time laplace transform
- To learn about the discrete time signals
- To Learn about the LTI systems and Z-Transforms

Course Outcomes

After completion of the course, the students will be able to

CO1 - Recall about the basic concepts of signals and systems. **(K1)**
CO2 - Illustrate the different types of relativity of fourier transform. **(K2)**
CO3- Knowing the linear invariant systems. **(K2)**
CO4 - Analyzing the discrete time signals. **(K3)**
CO5 - Knowing the Convolution sum and frequency response. **(K3)**

UNIT I CLASSIFICATION OF SIGNALS AND SYSTEMS (12 Hrs)

Continuous time signals (CT Signals) and Discrete time signals (DT Signals)- Step, Ramp, Pulse, Impulse, Exponential - Classification of CT and DT signals - Periodic, a periodic and Random signals - Energy and power signals – Representation of signals

Continuous time and discrete time systems: Classification of systems – Properties of systems.

UNIT II ANALYSIS OF CONTINUOUS TIME SIGNALS (12 Hrs)

Definition - Continuous time Fourier transform and Laplace transform analysis with examples - Decaying exponential - Rising exponential - Double exponential - Basic properties - Linearity - Convolution in time and frequency domain - Time shifting & Time reversal - Relation between Fourier transform and Laplace transform

UNIT III LINEAR TIME INVARIANT CONTINUOUS TIME SYSTEMS (12 Hrs)

CT systems - Linear time invariant systems - Basic properties of continuous time systems - Linearity, Causality, Time invariance, Stability - Frequency response of LTI systems - Analysis and characterization of LTI systems using Laplace transform - computation of impulse response and transfer function using Laplace transform.

UNIT IV ANALYSIS OF DISCRETE TIME SIGNALS (12 Hrs)

Discrete Time Fourier Transform (DTFT), Discrete Fourier Transform (DFT) - Z-Transform definition - Region of convergence - Properties of Z Transform - Inverse Z-Transform using - power series expansion and Partial fraction expansion.

UNIT V LINEAR TIME INVARIANT DISCRETE TIME SYSTEMS (12 Hrs)

LTI-DT systems - Characterization using difference equation - properties of convolution and interconnection of LTI systems - Causality and Stability of LTI Systems - Impulse response , convolution sum and Frequency Response - Computation of Impulse response and Transfer function using Z-Transform.

Text Books

1. Allan V. Oppenheim, Alan.S. Willsky, “Signals and systems”, Prentice Hall of India, 2013.
2. Roger E. Ziemer, “Signals and Systems Continuous and discrete”, McMillan, 2008.

3. Signals and Systems-Anandkumar, Ph Publications,2015

Reference Books

1. P. Ramesh Babu et al, 'Signals and Systems', 4th Edition, Scitech publishers, 2014.
2. Signals and Systems- Narayan Iyer and K Satya Prasad, Cenage Learning, 2011.
3. Signals and systems-Alan V. Oppenheim, Alan S. Willsky, Pearsen 2015
4. Barry Van Veen Simon Haykin, "Signals And Systems" by,2012
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3. http://www.ktunotes.in/ktu-s4-ece-signals-systems-notes/
4. https://ocw.mit.edu/resources/res-6-007-signals-and-systems-spring-2011/
5. https://www.khanacademy.org/science/electrical-engineering/ee-signals

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	3	3	-	-	-	-	1	-	1	1	3	-	3
2	3	3	3	3	-	-	-	-	1	-	1	1	3	-	3
3	3	3	3	3	-	-	-	-	1	-	1	1	3	-	3
4	3	3	3	3	-	-	-	-	1	-	1	1	3	-	3
5	3	3	3	3	-	-	-	-	1	-	1	1	3	-	3

Correlation Level: 1-Low, 2-Medium, 3- High

U20ICT204	TRANSDUCER ENGINEERING	L	T	P	C	Hrs
		3	0	0	3	45

- Get exposed to basic concepts of measurement.
- To acquire knowledge on different types of resistive transducer and their applications.
- To gain knowledge on capacitive and inductive transducer.
- To get introduced to miscellaneous transducer.
- To acquaint various sensors.

Course Outcomes

After completion of the course, the students will be able to

CO1 - Understand the basic concepts of measurement. **(K2)**
CO2 - Understand the concepts of Resistive transducers. **(K2)**
CO3 - Get familiar with various types of inductive and capacitive transducers. **(K2)**
CO4 - Understand the concept of various types of smart transducers **(K2)**
CO5 - Be familiar with the concept of Smart Sensor **(K3)**

UNIT I INTRODUCTION (9 Hrs)

Generalized scheme of a measurement system – Errors in measurements–types of errors- probability of errors –probable error, limiting errors. Reliability of measurement systems – failure rate–reliability improvement, Availability, redundancy. Difference between Sensors and Transducers, Classification, Active and Passive transducers, Different types of noises in measurements and its Suppression methods.

UNIT II RESISTIVE TRANSDUCERS (9 Hrs)

Resistive transducers: Potentiometers, loading effect – strain gauges – gauge factor – types of strain gauges – rosettes – semiconductor strain gauges, Resistance thermometers, materials, construction, characteristics – Thermistors and photo resistors (LDR) – hot wire anemometer – constant current and constant temperature operation – humidity sensors.

UNIT III INDUCTIVE AND CAPACITIVE TRANSDUCERS (9 Hrs)

Self and mutual inductive transducers, eddy current transducers, proximity sensors, tacho-generators and stroboscope. Capacitive transducers – variable area type – variable air gap type – variable permittivity type – signal conditioning circuit– Capacitor microphone – frequency response.

UNIT IV MISCELLANEOUS TRANSDUCERS (9 Hrs)

Piezoelectric transducers, photoelectric transducers, Hall effect transducers, Magnetostrictive transducers. Optical sensors, IC sensor for temperature – signal conditioning circuits, Introduction to Fiber optic sensors – Temperature, pressure, flow and level measurement using fiber optic sensors.

UNIT V SMART SENSORS (9 Hrs)

Introduction to Smart Sensors and Semiconductor sensors, MEMS, MOEMS, Nano-sensors, SQUID Sensors,- Environmental Monitoring sensors (Water Quality & Air Pollution)- Sensor for Motion and Position Measurement, GPS, INS, Doppler, SONAR, Thermal Sensors .

Text Books

1. S. Vijayachitra, Transducers engineering, 2nd edition, Prentice Hall of India, 2016. E.A.
2. D. Patranabis, Instrumentation and control, PHI, 2011
3. Murthy D.V.S., “Transducer and Instrumentation”, PHI, 2nd Edition, 2012.

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1. Jacob Fraden "Handbook of modern sensors physics, designs and applications", 5th edition, Springer, 2015.
2. PavelRipka "Modern sensors handbook", ISTE Ltd, 1st edition, 2007.
3. Sensors and transducers by Patranabis, 2nd Edition, 2003.
4. John G.Webster, Sensors and Signal Conditioning, Wiley Inter Science, 2nd Edition, 2008
5. Renganathan S., “Transducer Engineering” -Allied Publishers Limited, 2003

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COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	-	2	-	-	1	2	-	-	-	2	-	3	2	2
2	2	-	3	-	-	1	2	-	-	-	2	-	3	2	2
3	2	-	2	-	-	1	2	-	-	-	2	-	3	2	2
4	2	-	3	-	-	1	2	-	-	-	-	-	3	2	2
5	2	-	2	-	2	2	3	-	-	-	2	-	3	2	2

Correlation Level: 1-Low, 2-Medium, 3- High

U20ESP202	PROGRAMMING IN C LAB (Common to CSE, ECE, EEE, IT, ICE, MECH, CIVIL, BME Mechatronics, CCE)	L	T	P	C	Hrs
		0	0	2	1	30

Course Objectives

- To practice the fundamental programming methodologies in the C programming language.
- To apply logical skills for problem solving using control structures and arrays.
- To design, implement, test and debug programs that use different data types, variables, strings, arrays, pointers and structures.
- To design modular programming and provide recursive solution to problems.
- To understand the miscellaneous aspects of C and comprehension of file operations.

Course Outcomes

After completion of the course, the students will be able to

CO1 - Implement logical formulations to solve simple problems leading to specific applications **(K3)**
CO2 - Execute C programs for simple applications making use of basic constructs, arrays and strings **(K3)**
CO3 - Experiment C programs involving functions, recursion, pointers, and structures **(K3)**
CO4 - Demonstrate applications using sequential and random access file processing. **(K3)**
CO5 - Build solutions for online coding challenges. **(K3)**

List of Exercises

1. Simple programming exercises to familiarize the basic C language constructs.
2. Develop programs using identifiers and operators.
3. Develop programs using decision-making and looping constructs.
4. Develop programs using functions as mathematical functions.
5. Develop programs with user defined functions – includes parameter passing.
6. Develop program for one dimensional and two dimensional arrays.
7. Develop program for sorting and searching elements.
8. Develop program to illustrate pointers.
9. Develop program with arrays and pointers.
10. Develop program for dynamic memory allocation.
11. Develop programs for file operations.

Reference Books

1. Zed A Shaw," Learn C the Hard Way: Practical Exercises on the Computational Subjects You Keep Avoiding (Like C)", Addison Wesley, 2016.
2. Anita Goel and Ajay Mittal, "Computer Fundamentals and programming in C", First edition, Pearson Education , 2011.
3. Yashvanth Kanethkar, "Let us C", 13th Edition, BPB Publications, 2008.
4. Maureen Sprankle, Jim Hubbard, "Problem Solving and Programming Concepts", 9th Edition, Pearson, 2011.
5. B.W. Kernighan and D.M. Ritchie, "The C Programming language", 2nd Edition, Pearson Education, 2006.

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1. https://alison.com/course/introduction-to-c-programming
2. https://www.geeksforgeeks.org/c-programming-language/
3. http://cad-lab.github.io/cadlab_data/files/1993_prog_in_c.pdf
4. https://www.tenouk.com/clabworksheet/clabworksheet.html
5. https://fresh2refresh.com/c-programming/

COs/POs/PSOs Mapping

	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	1	1	3	-	-	-	-	-	-	-	-	2	2
CO2	3	2	1	1	3	-	-	-	-	-	-	-	-	2	2
CO3	3	2	1	1	3	-	-	-	-	-	-	-	-	2	2
CO4	3	2	1	1	3	-	-	-	-	-	-	-	-	2	2
CO5	3	2	1	1	3	-	-	-	-	-	-	-	-	2	2

Correlation Level: 1-Low, 2-Medium, 3- High

		L	T	P	C	Hrs
U20ICP201	**ELECTRONIC CIRCUITS LAB**	**0**	**0**	**2**	**1**	**30**

Course Objectives

- To design the rectifier circuits
- To design the voltage regulator circuits.
- To construct the amplifier circuits
- To design the oscillator circuits
- To design the circuits using PSPICE

Course Outcomes

After completion of the course, the students will be able to

CO1 - Design different rectifier circuits. **(K3)**
CO2 - Analyze the voltage regulator circuits. **(K4)**
CO3 - Interpret the amplifier circuits. **(K3)**
CO4 - Design the oscillator circuits. **(K3)**
CO5 - Evaluate the analog circuits using PSPICE. **(K3)**

List of Experiments

Hardware Experiments

1. Half wave Rectifier With and Without Filter.
2. Full Wave Rectifier With and Without Filter
3. Clippers and Clampers
4. Design and Testing of Hartley oscillators
5. Design and Testing Colpitts Oscillators
6. Design and Testing of Power Amplifier
7. Design and Testing of RC coupled amplifiers
8. Design and Testing of FET (common source) amplifiers

Software Experiments (PSPICE SIMULATION)

1. Design and Testing of Multivibrators.
2. Design and testing of Tuned amplifier
3. Design and testing of RC phase shift oscillator
4. Design and Testing of Feedback Amplifier
5. Design and Testing of Power Amplifier

Reference Books

1. J. Millman and C.C. Halkias, Integrated Electronics, McGraw-Hill, 2007.
2. Salivahanan, S. Electronic devices and circuits. Tata McGraw-Hill Education, 2011.
3. Robert L. Boylestad and Louis Nashelsky, “Electronic Devices and Circuits Theory”, Pearson/ Prentice Hall, 9th Edition, 2013.
4. Sedra and Smith,” Microelectronic Circuits”, Oxford University Press, 5th Edition, 2012.
5. Jacob Millman, Chritos C Halkias, “Electronic Devices and Circuits”, 4th edition. McGraw Hill Education India Private Ltd., 2015

Web References

1. https://www.electronics-lab.com/
2. http://vlabs.iitkgp.ernet.in/be/#
3. https://nptel.ac.in/courses/122/106/122106025/

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	-	-	2	2	1	-	2	2	-	2	3	3	2	3
2	3	-	-	2	2	1	-	2	2	-	2	3	3	2	3
3	3	-	-	2	2	1	-	2	2	-	2	3	3	2	3
4	3	-	-	2	2	1	-	2	2	-	2	3	3	2	3
5	3	-	-	2	2	1	-	2	2	-	2	3	3	2	3

Correlation Level: 1-Low, 2-Medium, 3- High

U20ICP202	TRANSDUCER ENGINEERING LAB	L	T	P	C	Hrs
		0	0	2	1	30

Course Objectives

- To experimentally verify the principle and characteristics of various transducers
- Obtain the knowledge about various types of Sensors & Transducers and their working principle
- Understand the various types of transducers like Resistive, Capacitive and Inductive
- Learn some of the miscellaneous transducers
- To select and design suitable instruments to meet the requirements of industrial applications.

Course Outcomes

After completion of the course, the students will be able to

CO1 - Know the standards to measure and to compute the statistical error analysis. **(K4)**

CO2 - An ability to analyze and understand various sensors based on its classification and working principle. **(K4)**

CO3 - Demonstrate the performance characteristics of various transducers. **(K3)**

CO4 - Acquire knowledge of analyzing different stages of signal conditioning units. **(K4)**

CO5 - Design a measurement system for an application. **(K3)**

List of Experiments

1. Characteristics of Strain gauge
2. Characteristics of potentiometer.
3. Measurement of force/load using a load cell.
4. Angular displacement Measurement usingcapacitive transducers.
5. Speed measurement using photoelectric tachometer.
6. Pressure measurement using piezoelectric transducers.
7. Static and Dynamic Characteristics of Hall Effect Sensor
8. Characteristics of LVDT.
9. Static and Dynamic characteristics of thermocouple, Thermistor and RTD
10. Characteristics of I /P Converters.
12. Characteristics of Optical Transducers.
13. Measurement of position using synchro transmitter and Receiver
14. Characteristics of Filled in system thermometer

Reference Books

1. Handbook of Laboratory Measurements and Instrumentation IFSA Publishing (2011)
2. Sawhney. A.K, “A Course in Electrical and Electronics Measurements and Instrumentation”, 18th Edition, Dhanpat Rai & Company Private Limited, 2017.
3. Renganathan. S, “Transducer Engineering”, 4th edition Allied Publishers, Chennai, 2003.
4. Sensors and transducers by Patranabis, 2nd Edition, 2003.
5. John G. Webster, Sensors and Signal Conditioning, Wiley Inter Science, 2nd Edition, 2008

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1. https://lecturenotes.in/subject/30/sensors-and-transducers-st
2. https://lecturenotes.in/notes/2143-notes-for-sensors-and-transducers-st-by-anita-mohanty
3. https://nptel.ac.in/content/storage2/courses/112103174/pdf/mod2.pdf

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	-	1	-	-	2	2	-	2	-	2	1	3	3	3
2	3	-	1	-	-	2	2	-	2	-	2	1	3	3	3
3	3	-	1	-	-	2	2	-	2	-	2	1	3	3	3
4	3	-	1	-	-	2	2	-	2	-	2	1	3	3	3
5	3	-	1	-	-	2	2	-	2	-	2	1	3	3	3

Correlation Level: 1-Low, 2-Medium, 3- High

U20ICC2XX	CERTIFICATION COURSE - II	L	T	P	C	Hrs
		0	0	4	-	50

Students shall choose an International certification course offered by the reputed organizations like Google, Microsoft, IBM, Texas Instruments, Bentley, Autodesk, Eplan and CISCO, etc. The duration of the course is 40-50 hours specified in the curriculum, which will be offered through Centre of Excellence.

Pass /Fail will be determined on the basis of participation, attendance, performance and completion of the course. If a candidate Fails, he/she has to repeat the course in the subsequent years. Pass in this course is mandatory for the award of degree.

		L	T	P	C	Hrs
U20ICS201	**SKILL DEVELOPMENT COURSE 1 DEMONSTRATION OF WORKSHOP PRACTICES**	**0**	**0**	**2**	**0**	**30**

Course Objectives

- To distinguish the type of buildings and construction materials.
- To understand about building components, infrastructure and their functions
- To familiarize the working principles of IC engines and automobile systems
- To understand about the power generation systems and its components.
- To acquire knowledge about the various machining process such as lathe, drilling and boring machines.

Course Outcomes

After completion of the course, the students will be able to

CO1 - Gain knowledge on types of buildings and about various construction materials.

CO2 - Understand the components of buildings and about various infrastructure facilities available in Civil engineering

CO3 - Evaluate the working principle of IC engines and Energy systems.

CO4 - Identify the basic concepts and fundamentals of power generation, Refrigeration and Air Conditioning systems

CO5 - Appreciate the process and materials in the various machining process.

List of Exercises – Civil Engineering

1. Calculate the area of a built-up space and a small parcel of land- Use standard measuring tape and digital distance measuring devices
2. Use screw gauge and vernier calliper to measure the diameter of a steel rod and thickness of a flat bar
3. Transfer the level from one point to another using a water level
4. Set out a one room building with a given plan and measuring tape
5. Find the level difference between any two points using dumpy level
6. Construct a 1 ½ thick brick wall of 50 cm height and 60 cm length using English bond. Use spirit level to assess the tilt of walls.
7. Estimate the number of different types of building blocks to construct this wall.
8. Introduce the students to plumbing tools, different types of pipes, type of connections, traps, valves, fixtures and sanitary fittings.
9. Install a small rainwater harvesting installation in the campus

List of Exercises – Mechanical Engineering

1. General: Introduction to workshop practice, Safety precautions, Shop floor ethics, Basic First Aid knowledge.
2. Study of mechanical tools, components and their applications:
    a. Tools: screw drivers, spanners, Allen keys, cutting pliers etc and accessories
    b. Bearings, seals, O-rings, circlips, keys etc.
3. Carpentry : Understanding of carpentry tools
    a. T –Lap joint
    b. Cross lap joint
    c. Dovetail joint
    d. Mortise joints
4. Foundry : Understanding of foundry tools
    a. Bench Molding
    b. Floor Molding
    c. Core making
    d. Pattern making

5. Sheet Metal : Understanding of sheet metal working tools
    a. Cylindrical shape
    b. Conical shape
    c. Prismatic shaped job from sheet metal
6. Fitting : Understanding of tools used for fitting
    a. Square Joint
    b. V- Joint
    c. Male and female fitting
7. Plumbing : Understanding of plumbing tools, pipe joints ,joining of pipes making use of minimum three types of pipe joints
8. Smithy: Understanding of tools used for smithy. Demonstrating the forge-ability of different materials (MS, Al, alloy steel and cast steels) in cold and hot states. Observing the qualitative difference in the hardness of these materials
    a. Square prism
    b. Hexagonal headed bolt
    c. Hexagonal prism
    d. Octagonal prism
9. Welding: Understanding of welding equipments
    a. Making Joints using electric arc welding. bead formation in horizontal, vertical and over head positions
10. Assembly: Dissembling and assembling of
    a. Cylinder and piston assembly
    b. Tail stock assembly
    c. Bicycle
    d. Pump or any other machine
11. Machines: Demonstration and applications of the following machines
12. Shaping and slotting machine; Milling machine; Grinding Machine; Lathe; Drilling Machine.
13. Modern manufacturing methods: Power tools, CNC machine tools, 3D printing, Glass cutting.

Text Books

1. G Shanmugam, MS Palanichamy, Basic Civil and Mechanical Engineering,1st Edition, McGraw Hill Education, 2018.
2. R. Vaishnavi, M. Prabhakaran, V. Vijayan, Basic Civil and Mechanical Engineering, S. Chand Publisher, 2013.
3. S.S. Bhavikatti, Basic Civil engineering, published by New Age International (P) Ltd. 2018.
4. Pravin Kumar, Basic Mechanical Engineering Pearson Publications, May 2018.

Reference Books

1. M.P. Poonia, S.C. Sharma & T.R. Banga, Basic Mechanical Engineering, Khanna Publishing House 2018.
2. V. Rameshbabu, Basic Civil & Mechanical Engineering, VRB Publishers Private Limited, January 2017.
3. SIA (Author), Basic Civil and Mechanical Engineering, SIA Publishers & Distributors Pvt., Ltd 2020.
4. RK Rajput, Basic Mechanical Engineering, Laxmi Publications; Third edition, 2015.
5. T.S. Rajan, Basic Mechanical Engineering, New Age International Pvt. Ltd, 2015.
6. M.S. Palanichamy, Basic Civil Engineering, McGraw Hill Education, 2017.

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1. https://nptel.ac.in/courses/112107291/
2. https://nptel.ac.in/courses/112/103/112103262/
3. https://ocw.mit.edu/courses/mechanical-engineering/2-61-internal-combustion-engines-spring-2017/lecture-notes/
4. https://nptel.ac.in/courses/105102088/
5. https://nptel.ac.in/courses/105104101/

U20ICM202	ENVIRONMENTAL SCIENCE	L	T	P	C	Hrs
		2	0	0	-	30

We as human being are not an entity separate from the environment around us rather, we are a constituent seamlessly integrated and co-exist with the environment around us. We are not an entity so separate from the environment that we can think of mastering and controlling it rather we must understand that each and every action of ours reflects on the environment and vice versa. Ancient wisdom drawn from Vedas about environment and its sustenance reflects this ethos. There is a direct application of this wisdom even in modern times. Idea of an activity-based course on environment protection is to sensitize the students on the above issues through following two type of activities.

(a) Awareness Activities:

i. Small group meetings about water management, promotion of recycle use, generation of less waste, avoiding electricity waste
ii. Slogan making event
iii. Poster making event
iv. Cycle rally
v. Lectures from experts

(b) Actual Activities:

i. Plantation
ii. Gifting a tree to see its full growth
iii. Cleanliness drive
iv. Drive for segregation of waste
v. To live some big environmentalist for a week or so to understand his work
vi. To work in kitchen garden for mess
vii. To know about the different varieties of plants
viii. Shutting down the fans and ACs of the campus for an hour or so

U20BST320	COMPLEX ANALYSIS AND APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS	L	T	P	C	Hrs
		2	2	0	3	60

(Common to EEE, ICE, MECH & Mechatronics)

Course Objectives

- To understand the analytic functions of complex variables.
- To apply the analytic function techniques to transform irregular geometry into regular geometry.
- Expose the concept of complex integration.
- To understand the nature of wave equations.
- To know the solutions of one dimensional and two dimensional heat flow equations.

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Course Outcomes

After completion of the course, the students will be able to

CO1 - Understand the concepts of function of a complex variable. **(K2)**
CO2 - Transform complex functions from one plane to another plane. **(K3)**
CO3 - Apply the concept of complex integration over contour. **(K3)**
CO4 - Understand the concept of initial and boundary value problems. **(K2)**
CO5 - Solve the one and two dimensional heat equation using Fourier series. **(K3)**

UNIT I FUNCTION OF A COMPLEX VARIABLE (12Hrs)

Continuity, derivative and analytic functions – Necessary conditions − Cauchy-Riemann equations and sufficient conditions – Harmonic and orthogonal properties of analytic function – Construction of analytic function.

UNIT II CONFORMAL MAPPINGS (12 Hrs)

Conformal mapping – Simple and standard transformations like $w = z+c$, cz, z^2, e^z, sinz, coshz and $z+1/z$ − Bilinear transformation and cross ratio property - Taylor's and Laurent's theorem − Series expansion of complex valued functions − classification of singularities.

UNIT III COMPLEX INTEGRATION (12 Hrs)

Cauchy's integral theorem and its application – Cauchy's integral formula and problems – Residues and evaluation of residues – Cauchy's residue theorem – Contour integration: Cauchy's and Jordan's Lemma− Application of residue theorem to evaluate real integrals – unit circle and semicircular contour.

UNIT IV APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS (12 Hrs)

Solution of partial differential equation by the method of separation of variables – Boundary value problems – Fourier series solutions of one dimensional wave equation– Transverse vibration of an elastic string.

UNIT V ONE AND TWO DIMENSIONAL HEAT EQUATIONS (12 Hrs)

Fourier series solutions of one dimensional heat flow equation – Fourier series solutions of two dimensional heat flow equation under steady state conditions.

Text Books

1. B.S.Grewal, "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 4th Edition, 2020.
2. N.P Bali. and Dr. Manish Goyal, "Engineering Mathematics", Lakshmi Publications Pvt. Ltd., New Delhi, 9th Edition, 2015.
3. P. Sivaramakrishna Das and C. Vijayakumari, "Engineering Mathematics", Pearsons Publications, New Delhi, 4th Edition, 2017.

Reference Books

1. C. Gupta, B. Shree Ram Singh, M. Kumar, “Engineering Mathematics for semester I & II”, Tata McGraw Hill, New Delhi, 1st Edition, 2015.
2. H.K. Dass & Dr. Rama Verma, “Introduction to Engineering Mathematics – Volume II”, S. Chand & Co, New Delhi, 9th Edition, 2019.
3. Erwin Kreyszig, “Advanced Engineering Mathematics”, John Wiley & Sons, New Delhi, 10th Edition, 2019.
4. Ravish R. Singh and Mukul Bhatt, “Engineering Mathematics”, Tata McGraw Hill, New Delhi, 1st Edition, 2016.
5. B.V Ramana, “Higher Engineering Mathematics”, Tata McGraw Hill, New Delhi, 3rd Edition, 2018.

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1. https://nptel.ac.in/courses/122107036/
2. https://nptel.ac.in/courses/111107119/
3. https://youtu.be/W3HXK1Xe4nc
4. https://youtu.be/Mwpz1zjPlzI
5. https://youtu.be/CnrAivf9I6o

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	1	-	-	-	-	-	-	-	-	-	1	-	-	1
2	3	2	1	1	-	-	-	-	-	-	-	1	-	-	1
3	3	2	1	1	-	-	-	-	-	-	-	1	-	-	1
4	2	1	-	-	-	1	-	-	-	-	-	1	-	-	1
5	3	2	1	1	-	1	-	-	-	-	-	1	-	-	1

Correlation Level: 1-Low, 2-Medium, 3- High

		L	T	P	C	Hrs
U20EST356	**DATA STRUCTURES** (Common to ECE, EEE, IT, ICE, MECH, CIVIL, BME, Mechatronics,CCE)	**3**	**0**	**0**	**3**	**45**

Course Objectives

- To impart the basic concepts of data structures and its terminologies
- To understand concepts about stack and queue operations.
- To understand basic concepts about linked list and its various operations.
- To understand concepts about Tree and its applications.
- To understand basic concepts about Sorting, Hashing and Graph.

Course Outcomes

After completion of the course, the students will be able to

CO1 - Compute time and space complexity for given problems. **(K3)**
CO2 - Demonstrate stack, queue and its operation. **(K3)**
CO3 - Illustrate the various operations of linked list. **(K3)**
CO4 - Use the concepts of tree for various applications. **(K3)**
CO5 - Outline the various sorting, hashing and graph techniques. **(K3)**

UNIT I BASIC TERMINOLOGIES OF DATA STRUCTURES (9 Hrs)

Introduction: Basic Terminologies: Elementary Data Organizations. Data Structure Operations: Insertion, Deletion, Traversal. Analysis of an Algorithm, Asymptotic Notations, Time-Space trade off. Array and its operations.Searching: Linear Search and Binary Search Techniques - complexity analysis.

UNIT II STACK AND QUEUE OPERATIONS (9 Hrs)

Stacks and Queues: ADT Stack and its operations. Applications of Stacks: Expression Conversion and evaluation. ADT Queue and its operations. Types of Queue: Simple Queue - Circular Queue- Priority Queue- Dequeue.

UNIT III LINKED LIST OPERATIONS (9 Hrs)

Linked Lists: Singly linked lists: Representation in memory. Algorithms of several operations: Traversing- Searching- Insertion- Deletion. Linked representation of Stack and Queue. Doubly linked list: operations. Circular Linked Lists: operations.

UNIT IV TREES (9Hrs)

Trees: Basic Tree Terminologies, Different types of Trees: Binary Tree, Threaded Binary Tree, Binary Search Tree, Binary Tree Traversals- AVL Tree. Introduction to B-Tree and B+ Tree.

UNIT V SORTING, HASHING AND GRAPHS (9Hrs)

Sorting: Bubble Sort- Selection Sort- Insertion Sort- Heap Sort- Shell Sort and Radix Sort.Performance and Comparison among the sorting methods. Hashing: Hash Table- Hash Function and its characteristics. Graph: Basic Terminologies and Representations-Graph traversal algorithms.

Text Books

1. Ellis Horowitz, Sartaj Sahni, “Fundamentals of Data Structures”, Illustrated Edition, Computer Science Press, Second Edition, 2018.
2. Thomas H. Coreman, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein, “Introduction to Algorithms”, PHI, Third Edition, 2010.
3. Alfred V. Aho, Jeffrey D. Ullman, John E. Hopcroft, “Data Structures and Algorithms”, 4th Edition, 2009.

Reference Books

1. Balagurusamy, “Data Structures”, Tata McGraw-Hill Education, 2019.
2. D. Samanta, “Classic Data Structures, Prentice-Hall of India, Second Edition, 2012.
3. Robert Kruse, C.L. Tondo and Bruce Leung, “Data Structures and Program Design in c”, Prentice-Hall of India, Second Edition, 2007.
4. Mark Allen Weiss, “Data Structures and Algorithm Analysis in C”, Pearson Education, Second Edition, 2006.
5. Mark Allen Weiss, “Algorithms, Data Structures and Problem Solving with C++”, Addison-Wesley Publishing Company, Illustrated Edition, 1995.

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1. https://www.geeksforgeeks.org/data-structures/
2. https://www.javatpoint.com/data-structure-tutorial/
3. https://www.studytonight.com/data-structures/
4. https://www.tutorialspoint.com/data_structures_algorithms/
5. https://www.w3schools.in/data-structures-tutorial/intro/

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	1	1	-	-	-	-	-	-	-	-	-	1	2
2	3	2	1	1	-	-	-	-	-	-	-	-	-	1	2
3	3	2	1	1	-	-	-	-	-	-	-	-	-	1	2
4	3	2	1	1	-	-	-	-	-	-	-	-	-	1	2
5	3	2	1	1	-	-	-	-	-	-	-	-	-	1	2

Correlation Level: 1-Low, 2-Medium, 3- High

		L	T	P	C	Hrs
U20EST361	**SOLID AND FLUID MECHANICS**	**2**	**2**	**0**	**3**	**60**

Course Objective

- To learn fundamental concepts of Stress, Strain and deformation of solids with applications.
- To know the method of finding slope and deflection of beams.
- To understand the effect of torsion on shafts.
- To understand the basic properties of the fluid, fluid kinematics, fluid dynamics and to analyse and appreciate the complexities involved in solving the fluid flow problems.
- To develop understanding about hydrostatic law, principle of buoyancy and stability of a floating body and application of mass, momentum and energy equation in fluid flow.

Course outcome

After completion of the course, the students will be able to

CO1 - Analyze the state of stress and strain at any point in a member. **(K2)**
CO2 - Identify, formulate, and solve structural engineering problems. **(K2)**
CO3 - Calibrate flow discharge measuring device used in pipes channels and tanks. **(K3)**
CO4 - Apply Hagen Poisueille's equation to solve numerical Problems. **(K3)**
CO5 - Characterize laminar and turbulent flows. **(K3)**

UNIT I DEFORMATION OF SOLIDS AND BENDING OF BEAMS (12 Hrs)

Concept of stress and strain– Normal and shear stresses – Simple and compound Stresses - Elasticity and elastic moduli –Poisson's ratio – Concept of Shear Force and Bending Moment – Bending moment and shear force diagrams for simply supported, cantilever and overhanging beams.

UNIT II SHAFTS AND SPRINGS (12Hrs)

Torsion – Shear stresses in circular solid and hollow shafts -Torque and power – Helical and leaf springs – Load, deflection, stress and stiffness relationships.

UNIT III FLUID PROPERTY AND FLOW CHARACTERISTICS (12Hrs)

Fluid Property - Newton's law of Viscosity – Fluid pressure and its measurement – Types of Flow– Reynolds number –Continuity equation - Euler's Equation of Motion.

UNIT IV FLOW DYNAMICS AND PIPE FLOW (12Hrs)

Bernoulli's Equations –Venturi meter and orifice meter - Pressure losses along the flow –Major and minor losses - Flow through circular pipes –Friction factor – Pipes in series and parallel - Hydraulic gradient.

UNIT V TURBINES AND PUMPS (12Hrs)

Introduction and Classification of Turbines – Specific Speed –Turbine characteristics, Speed Governance – Classification of Centrifugal Pumps – Pump characteristics – Efficiency – Reciprocating Pumps –Air vessels

Text Books

1. R. K. Rajput, Strength of Materials, S. Chand & Company Ltd., 2018.
2. R.K., Bansal, A text book on Fluid Mechanics & Hydraulic Machinery,- M/s. Lakshmi Publications (P) Ltd, 2018.
3. Junarkar S. B, "Mechanics of Structures", Vol. 2, 24th edition, Charotar Publising House, Anand, India, 2015.

Reference Books

1. William A. Nash, “Theory and problems of strength of materials”, Schaum’s Outline Series, McGraw-Hill International Editions, Sixth Edition (Paperback), 2013
2. Streeter, V.L., and Wylie, E.B. "Fluid Mechanics", McGraw-Hill, Ninth Edition (Paperback), 2017
3. White, F.M., "Fluid Mechanics", Tata McGraw-Hill, 5th Edition, New Delhi, 2003.
4. Som, S.K., and Biswas, G. "Introduction to Fluid Mechanics and Fluid Machines", Tata McGraw-Hill, 2nd Edition (Paperback), 2010
5. Kumar, K.L., "Engineering Fluid Mechanics", Eurasia Publishing House (P) Ltd, New Delhi (Reprint edition), 2010.

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2. https://nptel.ac.in/courses/105/103/105103095/
3. https://nptel.ac.in/courses/103/104/103104043/

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	2	-	-	-	-	-	-	-	-	-	1	-	2
2	3	2	2	-	-	-	-	-	-	-	-	-	1	-	2
3	3	2	2	-	-	-	-	-	-	-	-	-	1	-	2
4	3	2	2	-	-	-	-	-	-	-	-	-	1	-	2
5	3	2	2	-	-	-	-	-	-	-	-	-	1	-	2

Correlation Level: 1-Low, 2-Medium, 3- High

U20ICT305	ANALOG INTEGRATED CIRCUITS	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To study the IC fabrication procedure.
- To study characteristics; realize circuits; design for signal analysis using Op-amp ICs.
- To study the applications of Op-amp.
- To study internal functional blocks and the applications of special ICs like Timers, PLL.
- To study the different applications IC's.

Course Outcomes

After completion of the course, the students will be able to

CO1 - To understand the IC fabrication process. **(K2)**
CO2 - Analyse the characteristics of op-amp its significance. **(K4)**
CO3 - Gain knowledge on various applications of op-amp.**(K3)**
CO4 - Design and analyse the 555 timer and its application.**(K3)**
CO5 - Analyse different application IC's. **(K2)**

UNIT I IC FABRICATION (9 Hrs)

IC classification, fundamental of monolithic IC technology, epitaxial growth, masking and etching, diffusion of impurities.Realisation of monolithic ICs and packaging. Fabrication of diodes, capacitance, resistance and FETs

UNIT II INTRODUCTION TO OP- AMP (9 Hrs)

Ideal OP-AMP characteristics, DC characteristics, AC characteristics, differential amplifier; frequency response of OP-AMP; Basic applications of op-amp – Inverting and Non-inverting Amplifiers-V/I & I/V converters, summer, differentiator and integrator

UNIT III APPLICATIONS OF OP-AMP (9 Hrs)

Instrumentation amplifier, Log and Antilog Amplifiers, first and second order active filters, comparators, multivibrators, waveform generators, clippers, clampers, peak detector, S/H circuit, D/A converter (R- 2R ladder and weighted resistor types), A/D converters using opamps.

UNIT IV SPECIAL ICs (9 Hrs)

Functional block, characteristics and application circuits with 555 Timer IC-566 voltage controlled oscillator IC; 565-phase lock loop IC, Analog multiplier ICs.

UNIT V APPLICATION ICs (9 Hrs)

IC voltage regulators –LM78XX,79XX Fixed voltage regulators - LM317, 723 Variable voltage regulators, switching regulator- SMPS- LM 380 power amplifier- ICL 8038 function generator IC

Text Books

1. David A. Bell, 'Op-amp & Linear ICs', Oxford, 2013.
2. D. Roy Choudhary, SheilB.Jani, 'Linear Integrated Circuits', II edition, New Age, 2012.
3. Ramakant. Gayakwad, "Op-amps and Linear Integrated Circuits", IV Edition, Pearson Education, 2003 PHI. 2015

Reference Books

1. Fiore, "Op-amps & Linear Integrated Circuits Concepts & Applications", Cengage, 2010.

2. Floyd, Buchla, “Fundamentals of Analog Circuits”, Pearson, 2013.
3. Sergio Franco, “Design with operational amplifier and analog integrated circuits”, McGraw Hill, 2017
4. Robert F.Coughlin, Fredrick F. Driscoll, ‘Op-amp and Linear ICs’, PHI Learning, 6th edition, 2012
5. William D Stanely, “Operation Amplifier with integrated Circuits”, Pearson Education, 4th edition, 2001.

Web References

1. https://studentsfocus.com/ec8453-lic-notes-linear-integrated-circuits-notes-ece-4th-sem/
2. https://studentsfocus.com/ec6404-lic-notes-linear-integrated-circuits-lecture-notes-ece-4th-sem-anna university/
3. https://lecturenotes.in/subject/668/linear-integrated-circuits-lic

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	-	-	-	-	-	-	-	-	-	-	-	3	1	3
2	3	-	2	1	-	-	-	-	1	-	-	-	3	1	3
3	3	2	3	1	-	-	-	-	1	-	-	-	3	1	3
4	3	-	3	1	-	-	-	-	-	-	-	-	3	1	3
5	3	2	3	-	-	-	-	-	1	-	-	-	3	1	3

Correlation Level: 1-Low, 2-Medium, 3- High

		L	T	P	C	Hrs
U20ICT306	**DIGITAL LOGIC CIRCUITS**	**2**	**2**	**0**	**3**	**60**

Course Objectives

- To gain knowledge on number systems and boolean algebra
- To get the basic idea about combinational circuits.
- To design and develop combinational circuits.
- To study the operations of sequential circuits
- To acquire knowledge on memory devices

Course Outcomes

After completion of the course, the students will be able to

CO1 - Attain knowledge on basic binary systems. **(K3)**
CO2 - Analyse the combinational circuits. **(K4)**
CO3 - Gain knowledge on combinational logic design.**(K4)**
CO4 - Explore about the sequential Circuits and its applications. **(K3)**
CO5 - Acquire information about the memory devices. **(K2)**

UNIT I NUMBER SYSTEMS (12 Hrs)

Review of number Systems Binary arithmetic – Binary codes - BCD, Gray code, Excess 3 code, Error detection and correction codes - Parity, Hamming code, Boolean algebra - Basic postulates and theorems, De-Morgan's Theorem - Logic functions-Universal gate functions - Reduction of switching equations using Boolean algebra, Realization of switching function

UNIT II SIMPLIFICATION OF BOOLEAN FUNCTIONS (12Hrs)

Design procedure of Combinational Logic – Design of two level gate networks -Sum of Products (SOP) - Product of Sums(POS) - Canonical SOP - Canonical POS - Karnaugh Map - Simplifications of Boolean functions using Karnaugh Map and implementation using Logic function – Advantages and limitations of K-Map - Tabulation method - Simplifications of Boolean functions using Tabulation method

UNIT III COMBINATIONAL CIRCUITS (12 Hrs)

Half Adder, Full Adder - Half Subtractor, Full Subtractor- Parallel binary Adder, Parallel binary Subtractor - Carry look ahead Adder- BCD Adder- Decoders- Encoders - Priority Encoder- Multiplexers- MUX as universal combinational modules- Demultiplexers- Code convertors- Magnitude Comparator

UNIT IV SEQUENTIAL CIRCUITS (12 Hrs)

Introduction to Sequential circuits – Flip flops – SR, JK, D and T flip flops, Master Slave flip flop, Characteristic and excitation table – Realization of one flip flop with other flip flops – Registers – Shift registers – Counters – Synchronous and Asynchronous counters – Modulus counters – Ring Counter – Johnson Counter – State diagram, State table, State minimization – Hazards.

UNIT V MEMORY DEVICES (12 Hrs)

Classification of memories –ROM organization - PROM – EPROM – EEPROM – EAPROM, RAM organization – Write operation – Read operation – Memory cycle - Timing wave forms – Memory decoding – memory expansion – Static RAM Cell- Bipolar RAM cell – MOSFET RAM cell – Dynamic RAM cell– Programmable Logic Devices – Programmable Logic Array (PLA) - Programmable Array Logic (PAL) –Complex Programmable Logic Device (CPLD)- Field Programmable Gate Arrays (FPGA) - Implementation of combinational logic circuits using ROM, PLA, PAL.

Text Books

1. M. Morris Mano and Michael D. Cilette, Digital Designll, Prentice Hall, Fifth Edition, 2011
2. Thomas L Floyd, “Digital Fundamentals", Prentice Hall, 11th Edition, 2014.
3. R.P. Jain, Modern Digital Electronics, 4th Edition TMH, 2010.

Reference Books

1. Donald P. Leach and Albert Paul Malvino, Digital Principles and Applications, 6th Edition, TMH, 2003.
2. Charles H. Roth Larry L. Kinney, Raghunandan G. H. Fundamentals of Logic Design Cengage Learning India Pvt. Ltd.; 1 edition, 1 September 2019
3. William H. Gothmann, Digital Electronics Prentice Hall, 2001
4. John M. Yarbrough, Digital logic: Applications and Design Thomas Vikas Publishing House, 2002.
5. Anand Kumar Fundamentals of Digital Circuits Prentice Hall of India, Pvt Ltd, New Delhi, Second Edition, 2014.

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2. https://learn.ni.com/teach/resources/1104/digital-electronics
3. http://nptel.ac.in/courses/117/106/117106086/

COs/POs/PSOs Mapping

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1	3	3	3	3	-	-	-	-	-	1	-	1	3	1	3
2	3	3	3	3	-	-	-	-	-	1	-	1	3	1	3
3	3	3	3	3	-	-	-	-	-	1	-	1	3	1	3
4	3	3	3	3	-	-	-	-	-	1	-	1	3	1	3
5	2	3	3	3	-	-	-	-	-	1	-	1	3	1	3

Correlation Level: 1-Low, 2-Medium, 3- High

U20ICT307	ELECTRICAL AND ELECTRONIC MEASUREMENTS	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To give an overview of current, voltage, power and energy measuring instruments
- To give an overview of measurement of power and energy meters
- To expose the students to the design of bridges for the measurement of resistance, capacitance and inductance
- To give an idea about electronic and digital meters
- To study display devices, waveform generators and analysers.

Course Outcomes

After completion of the course, the students will be able to

CO1 - Understand the principle and working of electrical measuring instruments. **(K2)**
CO2 - Develop knowledge to measure parameters like voltage, current, power, energy.**(K3)**
CO3 - To measure the electrical parameters of various circuits. **(K3)**
CO4 - Evaluate the performance of instruments under various operating conditions. **(K3)**
CO5 - Select instruments suitable for specific applications. **(K3)**

UNIT I ELECTRICAL MEASUREMENTS (9 Hrs)

Basics of Measurements, General features and Classification of electro mechanical instruments. Principles of Moving coil, moving iron, dynamometer type, rectifier type, thermal instruments. Errors and compensation, Extension of instrument range: shunt and multipliers, calibration of voltmeter and ammeters, CT and PT.

UNIT II MEASUREMENT OF POWER AND ENERGY (9 Hrs)

Electro-dynamic wattmeter, Low Power Factor (LPF) wattmeter, errors, Single and three phase power measurement, Hall Effect wattmeter, thermal type wattmeter. Energy measurement - Single phase and polyphase induction type energy meter - theory and adjustments - Testing of energy meters - Calibration of wattmeter and energy meter.

UNIT III MEASUREMENT OF RESISTANCE, INDUCTANCE AND CAPACITANCE (9 Hrs)

Measurement of Resistance: Wheatstone's bridge, Sensitivity, Limitations. Kelvin's double bridge.Earth resistance measurement by fall of potential method and by using Megger.
Measurement of Inductance and Capacitance: Sources and detectors, Maxwell's inductance bridge, Maxwell's inductance and capacitance bridge, Hay's bridge, Anderson's bridge, Schering bridge.

UNIT IV ELECTRONIC AND DIGITAL MEASUREMENTS (9 Hrs)

Introduction essentials of electronic instruments, Advantages of electronic instruments.True RMS reading voltmeter.Electronic multimeters. Digital voltmeters (DVM) - Ramp type DVM, Integrating type DVM, Continuous – balance DVM and Successive - approximation DVM. Q meter. Principle of working of electronic energy meter (block diagram treatment), Extra features offered by present day meters and their significance in billing.

UNIT V DISPLAY DEVICES, WAVEFORM GENERATORS AND ANALYZERS (9 Hrs)

DSO, DPO, MSO, Analog Recorders – Strip Chart and X-Y recorders, Digital Recorders Function generators, Signal generators, Waveform analyzers, Spectrum analyzers, Distortion analyzers.

Text Books

1. Golding, E.W. and Widdis, F.C., "Electrical Measurements and Measuring Instruments", A.H. Wheeler and Co, 5th Edition, 2011.
2. David A. Bell, "Electronic Instrumentation and Measurements", Oxford University Press, 2013.
3. Shawney A K, "A course in Electrical and Electronic Measurements and Instrumentation", Dhanpat Rai and Sons.19th revised edition, 2014.

Reference Books

1. Kalsi.H.S, "Electronic Instrumentation", Tata McGraw Hill Education Private Limited,3rd Edition, 2012.
2. Patranabis, Principles of Electronic Instrumentation - PHI, 2008
3. Joseph. J. Carr, Elements of Electronic Instrumentation & Measurements, III edition, Pearson Education, 2003.
4. Electronics Instruments and Instrumentation Technology – Anand, PHI
5. Doebelin, E.O., Measurement systems, McGraw Hill, Fourth edition

Web References

1. https://lecturenotes.in/subject/265/electrical-measurement-and-instrumentation-emi
2. http://www.brainkart.com/subject/Measurements-and-Instrumentation_204/
3. https://onlinecourses.nptel.ac.in/noc19_ee44/preview
4. https://www.careerride.com/mcq/electrical-and-electronic-measurements-instrumentation-electrical-engineering-mcq-questions-and-answers-272.aspx

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	-	-	-	-	1	-	-	-	-	-	1	3	1	2
2	3	-	-	-	-	1	-	-	-	-	-	1	3	1	2
3	3	-	-	-	-	1	-	-	-	-	-	1	3	1	2
4	3	-	-	-	-	1	-	-	-	-	-	1	3	1	2
5	3	-	-	-	-	1	-	-	-	-	-	1	3	1	2

Correlation Level: 1-Low, 2-Medium, 3- High

U20HSP301	GENERAL PROFICIENCY–I (Common to all branches except CSBS)	L	T	P	C	Hrs
		0	0	2	1	30

Course Objectives

- To enrich strong vocabulary and decoding skills through comprehension analysis
- To advance communication and leadership skills pragmatically
- To pronounce English sounds in isolation and in connected speech
- To expand effective written communication skills to meet organizational goals
- To extend knowledge on verbal aptitude and prepare for interviews

Course Outcomes

After completion of the course, the students will be able to

CO1 - Interpret meaning and apply reading strategies in technical and non-technical context **(K2)**
CO2 - Develop interpersonal communication skills professionally **(K3)**
CO3 - Infer the distinct speech sounds and overcome native language influence **(K2)**
CO4 - Demonstrate various forms of formal writing **(K2)**
CO5 - Apply the techniques of verbal aptitude in competitive exams **(K3)**

UNIT I COMPREHENSION ANALYSIS (6Hrs)

Listening: Listening Comprehension (IELTS based) – **Speaking**: Break the iceberg - **Reading:** Reading technical passage (IELTS based) - **Writing:** Writing Task: 1 (IELTS:Graph/ Process /Chart Description) **Vocabulary:** Synonyms (IELTS)

UNIT II PERSONALITY DEVELOPMENT (6Hrs)

Listening: Interview Videos- **Speaking:** Extempore & Presentation (Soft Skills) - **Reading:** British & American Vocabulary, Read and review (Books, Magazines) - **Writing**: SWOT Analysis **Vocabulary:** Idioms (IELTS)

UNIT III INFERENTIAL LEARNING (6Hrs)

Listening: Listening Speech sounds to overcome Mother Tongue Influence, Anecdotes– **Speaking**: Interpersonal Interaction & Situational attribution–**Reading**: Distinguish between facts & opinions - **Writing:** Writing Conversation to different context **Vocabulary:** Phrasal Verbs (IELTS)

UNIT IV INTERPRETATION AND FUNCTIONAL WRITING (6Hrs)

Listening: Group Discussion videos - **Speaking:** Group Discussion Practice - **Reading:** Interpretation of data - Graph, table, chart, diagram (IELTS based) -**Writing**: Writing Task: 2 (IELTS) **Vocabulary:** Collocations (IELTS)

UNIT V APTITUDE (6Hrs)

Language Enhancement: Articles**,** Preposition, Tenses
Verbal Ability Enhancement: Blood Relation, Completing Statements- Cloze test, Spotting Errors –Sentence Improvement, One Word Substitution, Word Analogy, Word Groups (**GATE**)

Reference Books

1 Jeff Butterfield, “Soft Skills for Everyone”, Cengage Learning, New Delhi, 2012.
2 Mn,Taylor, and Grant Taylor. “English Conversation Practice”. Tata McGraw-Hill Education, 2004.
3 Bailey, Stephen. “Academic writing: A practical guide for students”. Psychology Press, 2003.
4 Aggarwal, R. S. “A Modern Approach to Verbal & Non Verbal Reasoning”. S. Chand, 2010.
5 Wren, Percival Christopher, and Wren Martin. “High School English Grammar and Composition”. S Chand, 2005.

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2. https://ieltsfocus.com/2017/08/02/collocations-ielts/
3. https://www.fresherslive.com/online-test/blood-relations-questions-and-answers
4. https://www.toppr.com/guides/english-language/reading-comprehension/cloze-test/
5. https://www.examsbook.com/word-analogy-test-questions-with-answers

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	1	-	-	-	-	-	-	-	-	3	-	2	1	-	-
2	1	-	-	-	-	-	-	1	-	3	-	2	1	-	-
3	1	-	-	-	-	-	-	-	-	3	-	2	-	-	-
4	1	-	-	-	-	-	-	-	-	3	-	2	1	-	-
5	1	-	-	-	-	-	-	-	-	3	-	2	-	-	-

Correlation Level: 1-Low, 2-Medium, 3- High

U20ESP357	DATA STRUCTURES LAB	L	T	P	C	Hrs
		0	0	2	1	30

(Common to CSE, ECE, EEE, IT, ICE, MECH, CIVIL, BME, Mechatronics, CCE)

Course Objectives

- To understand the basic concepts of Data Structures.
- To learn about the concepts of Searching Techniques.
- To explore about the concepts of Sorting Techniques.
- To know about the linear Data Structures.
- To study about non-linear Data Structures.

Course Outcomes

After completion of the course, the students will be able to

CO1 - Analyze the algorithm's / program's efficiency in terms of time and space complexity. **(K3)**
CO2 - Solve the given problem by identifying the appropriate Data Structure. **(K3)**
CO3 - Solve the problems of searching and sorting techniques. **(K3)**
CO4 - Solve problems in linear Data Structures. **(K4)**
CO5 - Solve problems in non-linear Data Structures. **(K4)**

List of Exercises

1. Write a C program to implement recursive and non-recursive i) Linear search ii) BinarySearch.
2. Write a C program to implement i) Bubble sort ii) Selection sort iii) Insertion sort iv) Shell sort v) Heapsort.
3. Write a C program to implement the following using an array. a) Stack ADT b) QueueADT
4. Write a C program to implement list ADT to perform following operations a)Insert an element into a list. b) Delete an element from list c) Search for a key element in list d) count number of nodes inlist.
5. Write a C program to implement the following using a singly linked list. a) Stack ADT b) QueueADT.
6. Write a C program to implement the dequeue (double ended queue) ADT using a doubly linked list and an array.
7. Write a C program to perform the following operations:
   a) Insert an element into a binary searchtree.
   b) Delete an element from a binary search tree.
   c) Search for a key element in a binary searchtree.
8. Write a C program that use recursive functions to traverse the given binary treein
   a) Preorder b) Inorderand c) Postorder.
9. Write a C program to perform the AVL tree operations.
10. Write a C program to implement Graph Traversal Techniques.

Reference Books

1. Yashavant Kanetkar, "Data Structures through C", BPB Publications, 3rd Edition, 2019.
2. Gav.pai, "Data Structures and Algorithms", McGraw-Hill India, 1st Edition, 2013.
3. Manjunath Aradhya M and Srinivas Subramiam, "C Programming and Data Structures", Cengage India 1st Edition, 2017.
4. Reema Thareja, "Data structures using C", 2nd Edition, Oxford University, 2014.
5. Tenebaum Aaron M, "Data Structures using C", Pearson Publisher, 1st Edition, 2019.

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2. https://www.w3schools.in/data-structures-tutorial/intro/
3. https://nptel.ac.in/courses/106103069/

4. https://swayam.gov.in/nd1_noc20_cs70/preview
5. https://nptel.ac.in/courses/106103069/

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	1	1	-	-	-	-	-	-	-	-	-	1	2
2	3	2	1	1	-	-	-	-	-	-	-	-	-	1	2
3	3	2	1	1	-	-	-	-	-	-	-	-	-	1	2
4	3	2	1	1	-	-	-	-	-	-	-	-	-	1	2
5	3	2	1	1	-	-	-	-	-	-	-	-	-	1	2

Correlation Level: 1-Low, 2-Medium, 3- High

U20ICP362	SOLID AND FLUID MECHANICS LAB	L	T	P	C	Hrs
		0	0	2	1	30

Course Objectives

- Define the nature of a fluid.
- Show where fluid mechanics concepts are common with those of solid mechanics and indicate some fundamental areas of difference.
- Introduce viscosity
- Define the appropriate physical properties and show how these allow differentiation between solids and fluids
- Gain a fundamental understanding of the concepts of stress and strain by analysis of solids and structures

Course Outcomes

After completion of the course, the students will be able to

CO1 - Analyse determinate and indeterminate bars, beams, and determinate trusses to determine axial forces, torques, shear forces, and bending moments. **(K2)**

CO2 - Understand the concepts of stress and strain in mechanics of solids and structures and material Properties. **(K2)**

CO3 - Perform experiments to determine the coefficient of discharge of flow measuring devices. **(K3)**

CO4 - Conduct experiments on hydraulic turbines and pumps to draw characteristics. **(K2)**

CO5 - Test basic performance parameters of hydraulic turbines and pumps **(K3)**

List of Experiments

Part – A: Fluid Mechanics Laboratory

1. Determination of Coefficient of discharge of Venturimeter, Orifice meter, Mouthpiece and Orifice.
2. Determination of Losses through pipes and pipe specials.
3. Determination of metacentric height of floating bodies.
4. Determination of force due to impact of jet on Vanes
5. Characteristic study on turbines.
6. Characteristic study on pumps.

Part – B: Strength of Materials Laboratory

1. Tension test and Young's modulus of steel.
2. Hardness test: Rockwell, Brinell and Vicker's.
3. Torsion test: Rods and Flats.
4. Impact test: Charphy and Izod on metals.
5. Ductility test: Sheet metals (AI,GI and MS)

Reference Books

1. R.K., Bansal, Strength of Materials, M/s. Lakshmi Publications (P) Ltd, 2008.
2. R. K. Rajput, Fluid Mechanics and Hydraulic Machineries, S. Chand & Company Ltd., 2008
3. R.S. Khurmi, Strength of Materials, S. Chand & company, 24th Edition, 2006

Web References

1. https://www.iitk.ac.in/me/fluid-mechanics-laboratory
2. https://fm-nitk.vlabs.ac.in/
3. https://rc.library.uta.edu/uta-ir/bitstream/handle/10106/28623/Applied-Fluid-Mechanics-Lab-Manual-1565646222.pdf?sequence=1&isAllowed=y

COs/POs/PSOs Mapping

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1	2	1	2	-	-	-	-	-	-	-	-	-	2	-	2
2	2	1	2	-	-	-	-	-	-	-	-	-	2	-	2
3	2	1	2	-	-	-	-	-	-	-	-	-	2	-	2
4	2	1	2	-	-	-	-	-	-	-	-	-	2	-	2
5	2	1	2	-	-	-	-	-	-	-	-	-	2	-	2

Correlation Level: 1-Low, 2-Medium, 3- High

U20ICP303	ANALOG AND DIGITAL CIRCUITS LAB	L	T	P	C	Hrs
		0	0	2	1	30

Course Objectives

- To design and test the basic application of op-amp
- To design an Filter circuit.
- To design an Oscillator circuit
- To design an 555 timer,PLL and VCO
- To design and test the digital circuits

Course Outcomes

After completion of the course, the students will be able to

CO1 - Design various sequential digital circuits like shift registers, counters. **(K3)**
CO2 - Design asynchronous sequential circuits. **(K3)**
CO3 - Design various applications of op-amp. **(K4)**
CO4 - Able to design signal conditioning circuits necessary for instrumentation, PLL, VCO. **(K3)**
CO5 - Evaluate the analog and digital circuits using PSPICE. **(K2)**

LIST OF EXPERIMENTS

PART A

1. Implementation of Boolean Functions, Adder/ Subtractor circuits.
2. Code converters: Excess-3 to BCD and Binary to Gray code converter and vice-versa Parity generator and parity checking
3. Encoders and Decoders
4. Counters: Design and implementation of 4-bit modulo counters as synchronous and Asynchronous types using FF IC's and specific counter IC.
5. Shift Registers: Design and implementation of 4-bit shift registers in SISO, SIPO, PISO, PIPO modes using suitable IC's.
6. Study of multiplexer and demultiplexer

PART B

7. Application of Op-Amp: inverting and non-inverting amplifier, Adder, comparator, Integrator and Differentiator.
8. Timer IC application: Study of NE/SE 555 timer in Astable, Monostable operation.
9. Study of VCO and PLL ICs:
   i. Voltage to frequency characteristics of NE/ SE 566 IC.
   ii. Frequency multiplication using NE/SE 565 PLL IC.
10. First order active filters (LPF, HPF and BPF).

Reference Books

1. M. Morris Mano and Michael D. Cilette, Digital Design ǁ, Prentice Hall, Fifth Edition, 2012
2. Thomas L Floyd, "Digital Fundamentals", Prentice Hall, 11th Edition, 2014.
3. R.P. Jain, "Modern Digital Electronics", 4th Edition, TMH, 2010.
4. Anand Kumar, —Fundamentals of Digital Circuits ǁ, Prentice Hall of India, Pvt Ltd, New Delhi, 4th Edition, 2016.
5. Donald P. Leach and Albert Paul Malvino, Digital Principles and Applications, 8th Edition, TMH,2016.

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2. https://studentsfocus.com/ec6404-lic-notes-linear-integrated-circuits-lecture-notes-ece-4th-

sem-anna university/

3. https://lecturenotes.in/subject/668/linear-integrated-circuits-lic

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	3	-	-	-	-	-	3	-	-	-	3	1	3
2	3	-	3	-	-	-	-	-	2	-	-	-	3	1	3
3	3	2	3	-	-	-	-	-	2	-	-	-	3	1	3
4	3	-	3	-	-	-	-	-	3	-	-	-	3	1	3
5	3	-	3	-	2	-	-	-	3	-	-	-	3	1	3

Correlation Level: 1-Low, 2-Medium, 3- High

U20ICC3XX	CERTIFICATION COURSE - III	L	T	P	C	Hrs
		0	0	4	-	50

Students shall choose an International certification course offered by the reputed organizations like Google, Microsoft, IBM, Texas Instruments, Bentley, Autodesk, Eplan and CISCO, etc. The duration of the course is 40-50 hours specified in the curriculum, which will be offered through Centre of Excellence.

Pass /Fail will be determined on the basis of participation, attendance, performance and completion of the course. If a candidate Fails, he/she has to repeat the course in the subsequent years. Pass in this course is mandatory for the award of degree.

U20ICS302	SKILL DEVELOPMENT COURSE 2 (Choose anyone of the below three courses)	L	T	P	C	Hrs
		0	0	2	-	30

1. TROUBLESHOOTING OF ELECTRONIC EQUIPMENTS

Course Content:

1. Reliability Aspects of Electronic Equipment.
2. Fundamental Troubleshooting Procedures.
3. Electronic Test Equipment.
4. Tools and Aids for Servicing and Maintenance.
5. PCB Testing and Soldering Techniques.
6. Power Supply and Subsystems Troubleshooting.
7. Mechanical and Electro-mechanical Components.
8. Passive Components and Their Testing.
9. Testing of Semiconductor Devices.
10. Troubleshooting Digital Circuits.
11. Troubleshooting Microprocessor-Based Systems.

(OR)

2. OFFICE AUTOMATION

Course Content:

1. Basics of Computer
2. Operating Systems Ms-Windows & Linux
3. Office Applications – i MsOffice: Ms-Word Open Office: Writer
4. Office Applications - ii MsOffice :Ms-Excel Open Office: Calc& Math
5. Office Applications -iii MsOffice: Ms-Access Open Office: Base
6. Office Applications - iv MsOffice: Ms-Power Point Open Office: Impress
7. Internet & Advanced Communication

(OR)

3. MOBILE PHONE SERVICING

Course Content:

1. How to remove and fix mobile speaker and ringer
2. How to repair and tracing battery connector supply
3. Mobile not charging and charging/discharging problem solution
4. Soldering and disordering of mobile components
5. Mobile phone fingerprint related problem solution
6. Mobile phone assembling & dissembling
7. What is GSM and CDMA generation
8. How to remove and fix headphone jack
9. How to remove damage and fix on/off switch
10. Mobile charging circuit repair
11. Mobile network circuit repair
12. Mobile repair with miracle box
13. Mobile repair with z3x box

		L	T	P	C	Hrs
U20ICM303	**PHYSICAL EDUCATION**	**0**	**0**	**2**	**-**	**30**

Physical Education is compulsory for all the Undergraduate students and Pass in this course is mandatory for the award of degree. Physical Education activities will include games and sports/extension lectures. The student participation shall be for minimum period of 30 hours. Physical Education activities will be monitored by the Director of Physical Education. Pass/Fail will be determined on the basis of participation, attendance, performance and conduct. If a candidate fails, he/she has to repeat the course in the subsequent years.

U20BST430	PROBABILITY AND STATISTICS	L	T	P	C	Hrs
		2	2	0	3	60

(Common to EEE & ICE)

Course Objectives

- To acquire skills in handling situation including more than one random variable
- To familiarize the student about the continuous random variables and their Applications.
- To study the basic concepts of Statistics.
- To learn the concept of testing of hypotheses using statistical analysis.
- To learn the concept of Small sampling.

Course Outcomes

After completion of the course, the students will be able to

CO1 - Apply the concept of probability in random variables. **(K3)**
CO2 - Apply the Basic rules of Continuous random variables. **(K3)**
CO3 - Understand the basic concepts of Statistics. **(K2)**
CO4 - Derive the inference for various problems using testing of hypothesis in large samples. **(K3)**
CO5 - Solve the problems related to testing of hypothesis in small samples. **(K3)**

UNIT I DISCRETE RANDOM VARIABLES (12Hrs)

Random Variables and their event spaces – The probability mass function – Distribution functions – Binomial –Geometric – Negative Binomial and Poisson.

UNIT II CONTINUOUS RANDOM VARIABLES (12Hrs)

Some important distributions – Exponential distribution –Gamma –Weibull – Gaussian distributions. Application of distribution – Reliability – Failure density and Hazard function.

UNIT III STATISTICS (12 Hrs)

Measures of central tendency – Arithmetic Mean, Median and Mode – Measures of dispersion and Standard deviation –Skewness and Measures of Skewness – Pearson's coefficient of Skewness – Moments – Correlation – Rank correlation and regression.

UNIT IV LARGE SAMPLES (12 Hrs)

Curve fitting by the method of least squares – Fitting of straight lines – Second degree parabolas and more general curves – Test of significance: Large samples test for single proportions, differences of proportions, single mean, difference of means and standard deviations.

UNIT V SMALL SAMPLES (12 Hrs)

Test for single mean – Difference of means and correlations of coefficients – Test for ratio of variances – Chi-square test for goodness of fit and independence of attributes.

Text Books

1. B.S. Grewal, "Higher Engineering Mathematics", KHANNA PUBLISHERS - Paperback – 3rd Edition, 2017.
2. Veerarajan. T, "Probability, Statistics and Random Processes", Tata McGraw-Hill Education, 2008.
3. Dr. A. Singaravelu, "Probability and Statistics", Meenakshi Agency, Paperback – 1 January 2019.

Reference Books

1. Ravish R. Singh, Mukul Bhatt "Engineering Mathematics", McGraw-Hill, 1st Edition, August 2017.
2. William Mendenhall, Robert J. Beaver, Barbara M. Beaver: "Introduction to Probability & Statistics", Cengage Learning; 15th Edition 2019.
3. Richard .A. Johnson, Irwin Miller and John E. Freund," Probability and Statistics for Engineers",

Pearson Education, Asia, 9th Edition, 2018.
4. Vijay K. Rohatgi and A.K. Md. Ehsanes Saleh, “An Introduction to Probability and Statistics”, Wiley 2008.
5. E. Rukmangadachari, “Probability and Statistics”, Pearson Education India 2012.

Web References

1. http:// www.stat110.net
2. http://www.nptel.ac.in/courses/111105035 (R.V)
3. http:// www.probabilitycourse.com.
4. www.edx.org/Probability
5. http://www2.aueb.gr/users/demos/pro-stat.pdf

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	1	1	-	-	-	-	-	-	-	1	-	-	1
2	3	2	1	1	-	-	-	-	-	-	-	1	-	-	1
3	2	1	-	-	-	1	-	-	-	-	-	1	-	-	1
4	3	2	1	1	-	1	-	-	-	-	-	1	-	-	1
5	3	2	1	1	-	1	-	-	-	-	-	1	-	-	1

Correlation Level: 1-Low, 2-Medium, 3- High

	PROGRAMMING IN JAVA	L	T	P	C	Hrs
U20EST467	(Common to CSE, ECE, EEE, IT, ICE, MECH, CIVIL, BME, MECHTRONICS, CCE)	**3**	**0**	**0**	**3**	**45**

Course Objectives

- To gain and explore the knowledge of java programming
- To know the principles of inheritances, packages, interfaces
- To get familiarized to generic programming, multi threading concepts.
- To gain and explore the advanced concepts in Java.
- To explore database connectivity

Course Outcomes

After completion of the course, the students will be able to

CO1 - Write a maintainable java Program for a given algorithm and implement the same. **(K2)**

CO2 - Demonstrate the use of inheritance, interface and package in relevant applications. **(K3)**

CO3 - Create java applications using exception handling, thread and generic programming. **(K3)**

CO4 - Build java distributed applications using Collections and IO streams. **(K3)**

CO5 - Exemplify simple graphical user interfaces using GUI components and database programs. **(K3)**

UNIT I INTRODUCTION TO JAVA PROGRAMMING (9 Hrs)

The History and Evolution of Java – Byte code – Java buzzwords – Data types – Variables – Arrays – operators – Control statements – Type conversion and casting. Concepts of classes and objects: Basic Concepts of OOPs – constructors – static keyword –Final with data –Access control –This key word – Garbage collection – Nested classes and inner classes – String class

UNIT II INHERITANCE, PACKAGES AND INTERFACES (9 Hrs)

Inheritance: Basic concepts – Forms of inheritance – Super key word – method overriding – Abstract classes – Dynamic method dispatch – The Object class. Packages: Defining – Creating and Accessing – importing packages. Interfaces: Defining –Implementing –Applying –Variables and extending interfaces

UNIT III EXCEPTION HANDLING, MULTITHREADING (9 Hrs)

Concepts of Exception handling –Types of exceptions –Creating own exception – Concepts of Multithreading – creating multiple threads – Synchronization –Inter thread communication. Enumeration: Autoboxing– Generics.

UNIT IV COLLECTIONS, I/O STREAMS (9 Hrs)

Collections: List –Vector – Stack – Queue – Dequeue –Set – Sorted Set. Input / Output Basics – Streams – Byte streams and Character streams – Reading and Writing Console – Reading and Writing Files.

UNIT V EVENT DRIVEN PROGRAMMING AND JDBC (9 Hrs)

Events – Delegation event model – Event handling – Adapter classes. AWT: Concepts of components – Font class – Color class and Graphics. Introduction to Swing: Layout management - Swing Components. Java Database Connectivity.Develop real time applications.

Text Books

1. Herbert Schildt, “Java: The Complete Reference”, TMH Publishing Company Ltd,11th Edition,2018.
2. Sagayaraj, Denis, Karthik, Gajalakshmi, “JAVA Programming for core and advanced learners”, Universities Press Private Limited, 2018.
3. Herbert Schildt, “The Complete Reference JAVA 2”, TMH, Seventh Edition, 2006.

Reference Books

1. H.M. Dietel and P.J. Dietel, “Java How to Program”, 11th Edition, Pearson Education/PHI, 2017.
2. Nageshvarrao, “Core Java and Integrated Approach”, 1st Edition, Dreamtech, 2016.
3. Cay S. Horstmann, Gary cornell, “Core Java Volume –I Fundamentals”, Prentice Hall, 9th Edition, 2013.
4. P.J. Dietel and H.M Dietel, “Java for Programmers”, Pearson Education, 9th Edition, 2011.
5. Cay.S.Horstmann and Gary Cornell, “Core Java 2”, Pearson Education, 8th Edition, 2008.

Web References

1. http://www.ibm.com/developerworks/java/
2. http://docs.oracle.com/javase/tutorial/rmi/.
3. IBM’s tutorials on Swings, AWT controls and JDBC.
4. https://www.edureka.co/blog
5. https://www.geeksforgeeks.org

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
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2	3	2	1	1	3	-	-	-	-	-	-	-	-	2	-
3	3	2	1	1	3	-	-	-	-	-	-	-	-	2	-
3	3	2	1	1	3	-	-	-	-	-	-	-	-	2	-
3	3	2	1	1	3	-	-	-	-	-	-	-	-	2	-

Correlation Level: 1-Low, 2-Medium, 3- High

U20ICT408	LINEAR CONTROL SYSTEMS	L	T	P	C	Hrs
		2	2	0	3	60

Course Objectives

- To understand the methods of representation of systems and their transfer function models.
- To provide adequate knowledge in time response of systems and steady state error analysis.
- To give basic knowledge in obtaining the open loop and closed–loop frequency responses of systems.
- To understand the concept of stability of the control system and methods of stability analysis.
- To study the three ways of designing compensators for a control system.

Course Outcomes

After completion of the course, the students will be able to

CO1 - Categorize different types of systems and identify a set of algebraic equations to represent and model a complicated system into a more simplified form. **(K2)**

CO2 - Analyse the response of any linear time invariant system. **(K4)**

CO3 - Perform the analysis of the control system in both time and frequency domains. **(K4)**

CO4 - Determine and analyse the stability of the system. **(K2)**

CO5 - Design the compensation technique that can be used to stabilize control systems. **(K3)**

UNIT I SYSTEM CONCEPTS (12 Hrs)

Types of System - Open Loop Systems, Closed Loop Systems, Basic Elements in Control System - Electrical Analogy of Mechanical and thermal systems -Transfer function - D.C and A.C Servo Motor - Block Diagram Reduction Techniques - Signal Flow Graphs.

UNIT II TIME RESPONSE ANALYSIS (12 Hrs)

Standard Test Signals -Time Response of First and Second Order System, Time Domain- Specifications - Generalized Error Series - Steady State Error - Static and Dynamic Error Constants.

UNIT III FREQUENCY RESPONSE ANALYSIS (12 Hrs)

Frequency Response of the System - Correlation between Time and Frequency Response - Gain and Phase Margin - Bode Plot - Nyquist Plot (Polar Plot).

UNIT IV STABILITY OF CONTROL SYSTEM (12 Hrs)

Characteristics Equation - Location of Roots in S Plane for Stability - Routh Hurwitz Criterion - Root Locus Analysis - Effect of Pole Zero Additions on Root Locus - Nyquist Stability Criterion.

UNIT V COMPENSATION NETWORKS. (12 Hrs)

Introduction to compensation networks - Lag, Lead and Lag Lead networks - Effect of providing Lag, Lead and Lag-Lead compensation on system performance and design using bode plot - P, PI, PID Controllers design

Text Books

1. Nagrath I J and Gopal M, Control System Engineering, New Age International Pvt Ltd, Sixth Edition, 2017
2. Ogata K, ―Modern Control Engineering‖, Prentice-Hall of India Pvt Ltd., New Delhi, Fifth Edition, 2015.
3. Benjamin C Kuo, ―Automatic Control Systems‖, Prentice Hall India Pvt. Ltd, Ninth Edition,

Reference Books

1. Norman S Nise, Control System Engineering , John Wiley and sons, inc., Seventh Edition, 2015
2. Smarajith Ghosh, ―Control Systems Theory and Applications‖, Pearson Education, Singapore, Sixth Edition, 2015

3. Richard C. Dorf, Robert H Bishop, —Modern Control Systemsll, Pearson Education, Twelfth Edition, 2017.
4. Gopal, M., "Control Systems, Principles and Design", Tata McGraw-Hill Pub. Co.,2nd Edition, New Delhi, 2006.
5. Raymond T. Stefani & Co., 'Design of Feed back Control systems', Oxford University, 2002.

Web References

1. https://lecturenotes.in/notes/6579-note-for-control-system-engineering-cse-by-gyana-ranjan-biswal
2. https://www.smartzworld.com/notes/control-systems-pdf-notes-cs.
3. https://easyengineering.net/control-systems-engineering-by-nagoor-kani/
4. https://civildatas.com/download/control-systems-engineering-by-i-j-nagrath
5. https://www3.nd.edu/~pantsakl/Publications/348A-EEHandbook05.pdf.

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	2	-	-	-	-	-	-	-	-	-	3	1	1
2	3	2	2	-	-	-	-	-	-	-	-	-	3	1	1
3	3	2	2	-	-	-	-	-	-	-	-	-	3	1	1
4	3	-	1	-	-	-	-	-	-	-	-	-	3	1	1
5	3	2	1	-	-	-	-	-	-	-	-	-	3	1	1

Correlation Level: 1-Low, 2-Medium, 3- High

U20ICT409	MICROCONTROLLER BASED SYSTEM DESIGN	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To study architecture and programming of 8085 microprocessor
- To study architecture and programming of 8051 microcontroller
- To learn Arduino platform and hardware features
- To study the interfacing of hardware.
- To learn about design of real time microcontroller based systems

Course Outcomes

After completion of the course, the students will be able to

CO1 - Elucidate the architecture and addressing modes of 8-bit microprocessor. **(K2)**
CO2 - Elucidate the architecture and addressing modes of 8051 microcontroller. **(K2)**
CO3 - Gain conceptual understanding of Arduino Platform**. (K3)**
CO4 - Gain knowledge about hardware interfacing**. (K2)**
CO5 - Learn about design of real time microcontroller based systems**. (K4)**

UNIT I 8085 MICROPROCESSOR (9 Hrs)

Evolution of microprocessor, Types of various architectures; Harvard and Von-Neumann, RISC and CISC,8085 microprocessor- Pin Functions, Architecture, Timing Diagrams, Interrupts, Programming Examples, Direct Memory Access, I/O Mapping.

UNIT II 8051 MICROCONTROLLER (9 Hrs)

Architecture – Memory Organization – Structure of Ports – Addressing modes – Instruction set – Timers – Serial Port – Interrupts- Power Saving Modes - Assembly Language Programming.

UNIT III INTRODUCTION TO ARDUINO (9 Hrs)

Introduction to Arduino platform- Hardware features – Types of Arduino boards – Features of Arduino Uno - pin details - Arduino IDE – configuration settings - basic sketch in Arduino – compiling and downloading sketches

UNIT IV HARDWARE INTERFACING (9 Hrs)

I/O Port programming, Bit manipulation, Interfacing to a LED, LCD, Keyboard, ADC, DAC, Stepper Motors, UART, and Sensors. Introduction to Raspberry pi.

UNIT V DESIGN OF MICROCONTROLLER BASED SYSTEMS (9 Hrs)

Study of temperature control system – Robotic system using DC motors – Ultrasonic Range system – Security system using sensors – weather monitoring system – Street light control system – GSM based systems – WiFi and Bluetooth based systems – PC based Measurement and Control

Text Books

1. Mohammed Ali Mazidi and Janice Gillispie Mazidi, “The 8051 Microcontroller and Embedded System”, Pearson Education Asia, New Delhi, 2012.
2. Simon Monk, Programming Arduino Next Steps: Going Further with Sketches, McGraw Hill Education-2019.
3. Michael Margolis, Arduino Cook Book, O'reilly-2011.
4. Mark Geddes, Arduino Project Handbook: Volume one: Complete Guide to Creating with the Arduino, Sketch Publishing-2014.

Reference Books

1. N. Senthil Kumar, M. Saravanan and S. Jeevananthan, Microprocessor and Microcontrollers, OXFORD UNIVERSITY PRESS, November, 2010.
2. Jeremy Blum, Exploring Arduino, Wiley-2012.
3. Muhammad Ali Mazidi, Shujen Chen, Eshragh Ghaemi, Arduino Programming from Beginning to Advanced, MicroDigital-Ed-2018.
4. David E Simon, "An embedded software primer ", Pearson education Asia, 2001.
5. Raymond J.A. Bhur and Donald L. Bialey, " An Introduction to real time systems: Design to networking with C/C++ "Prentice Hall Inc. New Jersey, 2019

Web References

1. https://www.elprocus.com/8051-microcontroller-architecture-and-applications/
2. https://www.tutorialspoint.com/microprocessor/microcontrollers_8051_architecture.htm
3. https://www.arduino.cc/
4. https://nptel.ac.in/courses/108/105/108105102/

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	1	2	-	-	-	-	-	-	-	-	-	2	2	2
2	2	1	2	-	-	-	-	-	-	-	-	-	2	2	2
3	2	1	2	-	-	-	-	-	-	-	-	-	2	2	2
4	2	1	2	-	-	-	-	-	-	-	-	-	2	2	2
5	2	1	2	-	-	-	-	-	-	-	-	-	2	2	2

Correlation Level: 1-Low, 2-Medium, 3- High

U20HSP402

GENERAL PROFICIENCY–II

(Common to all branches except CSBS)

L	T	P	C	Hrs
0	0	2	1	30

Course Objectives

- To examine various standardized test in English language
- To recognize the key features of various technical writing
- To integrate LSRW skills to endorse multifarious skill set in practical situation
- To understand the factors that influence the usage of grammar
- To understand the basic concepts of logical reasoning skills

Course Outcomes

After completion of the course, the students will be able to

- Infer ideas to attend international standardized test by broadening receptive and productive skills **(K2)**
- Interpret the types of writing in different state of affairs **(K2)**
- Develop language skills professionally to groom the overall personality through sensitizing various etiquettes in real time situation **(K3)**
- Identify the rules of grammar in academic discourse settings **(K3)**
- Extend the skills to compete in various competitive exams like GATE, GRE, CAT, UPSC, etc. **(K2)**

UNIT I CAREER SKILLS (6Hrs)

Listening: Listening at specific contexts **Speaking:** Mock interview (Personal & Telephonic)-**Reading**: Read and Review -Newspaper, Advertisement, Company Handbooks, and Guidelines (IELTS based) **Writing:** Essay Writing (TOEFL) **Vocabulary:** Words at specified context (IELTS)

UNIT II CORPORATE SKILLS (6Hrs)

Listening: Listening and replicating **Speaking**: Team Presentation (Work Place Etiquettes) **Reading:** Short texts (signs, emoticons, messages) **Writing:** E-mail writing- Hard skills -Resume' Writing, Job Application Letter, Formal Letter **Vocabulary:** Glossary (IELTS)

UNIT III FUNCTIONAL SKILLS (6Hrs)

Listening: Listening TED Talks – **Speaking:** Brainstorming & Individual Presentation, Persuasive Communication –- **Reading:** Text Completion (GRE Based) **Writing:** Expansion of Compound Words **Vocabulary:** Expansion of vocabulary (IELTS)

UNIT IV TRANSFERABLE SKILLS (6Hrs)

Listening: Listening Documentaries and making notes –**Speaking:** Conversation practice at formal & informal context **Reading:** Read and transform- report, memo, notice and advertisement, **Writing:** Euphemism, Redundancy, and Intensifiers **Vocabulary:** Refinement of vocabulary (IELTS)

UNIT V APTITUDE (6 Hrs)

Transformational Grammar: Phrases & Clauses, Concord, Conditional Clauses, Voice, Modals

Verbal Ability Enhancement: Letter Series, Coding & Decoding**,** Sentence Completion (GATE), Critical Reasoning & Verbal Deduction (GATE), Syllogism

Reference Books

1. Lougheed, Lin. "Barron's Writing for the TOEFL IBT: With Audio CD". Barron's Educational series, 2008.

2. Tulgan, Bruce**.** “Bridging the soft skills gap: How to teach the missing basics to today’s young talent”. John Wiley & Sons, 2015.
3. Sherfield, Robert M. “Cornerstone: Developing Soft Skills”. Pearson Education India, 2009.
4. Cullen, Pauline, Amanda French, and Vanessa Jakeman**.** “The official Cambridge guide to IELTS for academic & general training”. Cambridge, 2014.
5. Ramesh, Gopalaswamy. “The ace of soft skills: attitude, communication and etiquette for success”. Pearson Education India, 2010.

Web References

1. https://www.englishclub.com/grammar/nouns-compound.htm
2. https://lofoya.com/Verbal-Test-Questions-and-Answers/Sentence-Completion/l3p1
3. https://www.grammarwiz.com/phrases-and-clauses-quiz.html
4. https://www.clarkandmiller.com/25-english-euphemisms-for-delicate-situations/
5. http://www.englishvocabularyexercises.com/general-vocabulary/

COs/POs/PSOs Mapping

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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	1	-	-	-	-	-	-	1	-	3	-	1	1	-	-
2	1	-	-	-	-	-	-	1	-	3	-	1	1	-	-
3	1	-	-	-	-	-	-	-	-	3	-	1	-	-	-
4	1	-	-	-	-	-	-	1	-	3	-	1	-	-	-
5	1	-	-	-	-	-	-	-	-	3	-	1	1	-	-

Correlation Level: 1-Low, 2-Medium, 3- High

U20ESP468	PROGRAMMING IN JAVA LAB	L	T	P	C	Hrs
		0	0	2	1	30

(Common to CSE, ECE, EEE, IT, ICE, MECH, CIVIL, BME, MECHTRONICS, CCE)

Course Objectives

- To acquire programming skill in core java.
- To learn how to design java program and applications.
- To acquire object oriented skills in java.
- To develop the skill of designing applications.
- To explore database connectivity.

Course Outcomes

After completion of the course, the students will be able to

CO1 - Apply and practice logical formulations to solve simple problems leading to specific applications. **(K3)**

CO2 - Demonstrate the use of inheritance, interface and package in relevant applications**. (K2)**

CO3 - Create java applications using exception handling, multithread. **(K3)**

CO4 - Build java distributed applications using Collections and IO streams**. (K3)**

CO5 - Develop simple database programs**. (K3)**

List of Exercises

1. Develop simple programs using java technologies and testing tools.
2. Develop a java program that implements class and object.
3. Write a java program to demonstrate inheritance.
4. Develop a simple real life application program to illustrate the use of Multi Threads.
5. Implement simple applications using Collections.
6. Develop a simple application and use JDBC to connect to a back-end database.
7. Create a student application with Add, Edit, Delete, Show functions using JDBC.
8. Create a Bill Application to store sales details using JDBC.
9. Create java applications using Exception Handling for error handling.
10. Develop a java program that implements the Packages.

Reference Books

1. E. Balaguruswamy, “Programming with Java”, TMH Publ, 2nd Edition, 2005.
2. JAVA How to programming by DIETEL & DIETEL.
3. Herbert Schildt, “The Complete Reference JAVA 2”, TMH, Seventh Edition, 2006.
4. Cay. S. Horstmann and Gary Cornell, “Core Java 2”, Vol 2, Advanced Features, Pearson Education, Seventh Edition, 2010.
5. Sagayaraj, Denis, Karthik, Gajalakshmi, “JAVA Programming for core and advanced learners”, Universities Press Private Limited, 2018.

Web References

1. http://www.ibm.com/developerworks/java/
2. http://docs.oracle.com/javase/tutorial/rmi/.
3. IBM’s tutorials on Swings, AWT controls and JDBC.
4. https://www.edureka.co/blog
5. ttps://www.geeksforgeeks.org.

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2	3	2	1	1	3	-	-	-	-	-	-	-	-	2	-
3	3	2	1	1	3	-	-	-	-	-	-	-	-	2	-
4	3	2	1	1	3	-	-	-	-	-	-	-	-	2	-
5	3	2	1	1	3	-	-	-	-	-	-	-	-	2	-

Correlation Level: 1-Low, 2-Medium, 3- High

U20ICP404	MICROCONTROLLER BASED SYSTEM DESIGN LAB	L	T	P	C	Hrs
		0	0	2	1	30

Course Objectives

- To familiarize the students with interfacing of various peripheral devices with 8051 Microcontrollers
- To gain conceptual understanding of using Arduino Uno.
- The students will become knowledgeable about Digital and Analog I/O of Arduino
- The students will gain knowledge about Sensor Interfacing with Arduino.
- The students will learn about design of communication interfaces with Arduino and 8051microntroller.

Course Outcomes

After completion of the course, the students will be able to

CO1 - Gain conceptual understanding of using a8085 microprocessor and 8051 microcontroller. **(K2)**
CO2 - Learn about interfacing of various peripheral devices with 8051 Microcontrollers**. (K3)**
CO3 - Gain conceptual understanding of using Arduino Uno. **(K3)**
CO4 - Gain knowledge about Sensor Interfacing with Arduino. **(K3)**
CO5 - Learn about design of communication interfaces with Arduino and 8051 microntroller. **(K4)**

List of Experiments

1. Study of 8085 microprocessor Programming
2. Interfacing of switches and display devices using 8051 Microcontrollers
3. Interfacing of interrupt using 8051 Microcontrollers
4. PC interface using 8051 Microcontrollers
5. ADC interface using 8051 Microcontrollers
6. LCD interface using 8051 Microcontrollers
7. UART communication using Arduino. PC based control systems.
8. Sensor Interfacing with Arduino. Design of real world systems.
9. Character and Graphical LCD display interfacing with Arduino.
10. Interfacing DC and Servo motors with Arduino.
11. SPI and I2C communication using Arduino
12. Interfacing GSM and Bluetooth systems with Arduino.
13. Design of Internet of Things (IoT) using Arduino.

Reference Books

1. N. Senthil Kumar, M. Saravanan and S. Jeevananthan, Microprocessor and Microcontrollers, OXFORD UNIVERSITY PRESS, November, 2010
2. Jeremy Blum, Exploring Arduino, Wiley-2012
3. Muhammad Ali Mazidi, Shujen Chen, Eshragh Ghaemi, Arduino Programming From Beginning to Advanced, MicroDigital-Ed-2018
4. David E Simon, “An embedded software primer”, Pearson education Asia, 2001
5. Raymond J.A. Bhur and Donald L. Bialey, “An Introduction to real time systems: Design to networking with C/C++” , Prentice Hall Inc. New Jersey, 2019

Web References

1. https://www.elprocus.com/8051-microcontroller-architecture-and-applications/
2. https://www.tutorialspoint.com/microprocessor/microcontrollers_8051_architecture.htm
3. https://www.arduino.cc/
4. https://nptel.ac.in/courses/108/105/108105102/

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	1	2	-	-	-	-	-	-	-	-	-	2	2	2
2	2	1	2	-	-	-	-	-	-	-	-	-	2	2	2
3	2	1	2	-	-	-	-	-	-	-	-	-	2	2	2
4	2	1	2	-	-	-	-	-	-	-	-	-	2	2	2
5	2	1	2	-	-	-	-	-	-	-	-	-	2	2	2

Correlation Level: 1-Low, 2-Medium, 3- High

U20ICP405	SIMULATION LAB	L	T	P	C	Hrs
		0	0	2	1	30

Course Objectives

- To provide knowledge on design of process control by using MATLAB
- To provide knowledge in process analysis by MATLAB tools.
- To give basic knowledge in describing function analysis
- Get adequate knowledge MATLAB tool sets and Simulink
- Get adequate knowledge MATLAB Data Acquisition

Course Outcomes

After completion of the course, the students will be able to

CO1 - To describe basics of MATALB. **(K2)**
CO2 - Get adequate knowledge on MATLAB tool sets. **(K3)**
CO3 - To determine step and impulse response for first, second order and type 0, 1, 2 systems. **(K4)**
CO4 - To obtain plots using bode, root locus and Nyquist plot. **(K4)**
CO5 - To understand effect of PI and PD controller. **(K3)**

List of Experiments

1. Matrix Manipulation, Numerical solution of differential equations using MATLAB software.
2. Determination of (i) Transfer Functions and (ii) Poles and Zeros of the system.
3. Determination of Step & Impulse Response For A First Order Unity Feedback System
4. Determination of Step & Impulse Response for a Second Order Unity Feedback System.
5. Stability analysis using MATLAB.
6. Compensation of Closed Loop System using MATLAB.
7. Determination of Bode Plot Using Matlab Control System Toolbox For 2nd Order System & Obtain Controller Specification Parameters.
8. Determination of Root Locus Plot Using Matlab Control System Toolbox For 2nd Order System & Obtain Controller Specification Parameters.
9. Determination of Nyquist Plot Using Matlab Control System Toolbox.
10. Study The Effect of Pi & Pd Controller on System Performance.
11. Time domain Analysis using Simulink blocks.
12. Study the Effect of Addition of Poles to the Forward Path Transfer Function of a Closed Loop System.

Reference Books

1. Robert L. Boylestad and Louis Nashelsky, Electronic Devices and Circuits Theory, Pearson/ Prentice Hall, 9th Edition, 2013.
2. Microelectronic Circuits – Sedra A.S. and K.C. Smith, Oxford University Press, 5th ed.,2013
3. Nagrath I J and Gopal M, Control System Engineering, New Age International Pvt Ltd, Sixth Edition, 2017.
4. DingyüXue, YangQuan Chen, Modeling, Analysis and Design of Control Systems in MATLAB and Simulink, World Scientific Publishing,2014
5. Liuping Wang,PID Control System Design and Automatic Tuning Using MATLAB/Simulink, Wiley, 2020

Web References

1. https://in.mathworks.com/products/matlab.html
2. https://nptel.ac.in/courses/108108122/
3. https://www.smartzworld.com/notes/control-systems-pdf-notes-cs/

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	1	3	3	2	-	-	-	-	-	-	-	2	2	2
2	3	1	3	3	3	-	-	-	-	-	-	-	2	2	2
3	3	-	-	3	2	-	-	-	-	-	-	-	2	3	2
4	3	-	-	3	2	-	-	-	-	-	-	-	2	3	3
5	3	-	-	3	2	-	-	-	-	-	-	-	2	3	3

Correlation Level: 1-Low, 2-Medium, 3- High

U20ICC4XX	CERTIFICATION COURSE - IV	L	T	P	C	Hrs
		0	0	4	-	50

Students shall choose an International certification course offered by the reputed organizations like Google, Microsoft, IBM, Texas Instruments, Bentley, Autodesk, Eplan and CISCO, etc. The duration of the course is 40-50 hours specified in the curriculum, which will be offered through Centre of Excellence.

Pass /Fail will be determined on the basis of participation, attendance, performance and completion of the course. If a candidate Fails, he/she has to repeat the course in the subsequent years. Pass in this course is mandatory for the award of degree.

U20ICS403	SKILL DEVELOPMENT COURSE 3 (Choose anyone of the below three courses)	L	T	P	C	Hrs
		0	0	2	-	30

1. CALIBRATION OF MEASURINGINSTRUMENTS

Course Content:

1. Parts of the Typical Control Loop
2. Process& Instrument Diagrams (P&ID's).
3. Introduction to Measurement System.
4. Commonly used process control signals.
5. Signal quality terminology (accuracy, linearity, span, etc.)
6. System standards and instrument calibration.
7. Study of measurement errors-zero, span, hysteresis, non-linear, dead-band errors.
8. Sensor/Transducer and Transmitter principles
9. Pressure Instruments – Principle, construction and operation
10. Calibration of low and high Pressure Bourden's Gauges.
11. Principle and operation of Strain gauge Pressure Sensors.
12. Principle and operation of Strain gauge Pressure Transmitters. (2 wire and 4 wire configuration).
13. Operation and calibration of Differential Pressure Switch & Safety Valve.
14. Calibration of Temperature Indicators (RTD & Thermocouple).

(OR)

2. INTRODUCTION TO ROBOTICS

Course Content:

1. Robot kinematics: position analysis, differential motions and velocities.
2. Trajectory planning. Actuators, sensors and simple sensor processing algorithms.
3. Robot programming and control architectures.
4. Selected topics from mobile robotics (localization, mapping, navigation and motion planning).

(OR)

3. LABVIEW IMPLEMENTATION

Course Content:

1. Basics of LABVIEW
2. Data handling instruction

Hardware Interface

3. Process 1: – Acquiring and generation of Digital signals
4. Process 2: – Acquiring analog values in DE and RSE method
5. Process 3: – Generating analog output
6. Process 4: – Integration of DAQ card with embedded devices
7. Embedded device with LABVIEW
8. Matrix
9. Remote panel creation and testing
10. Webserver monitoring with LABVIEW
11. Hardware interfacing with LABVIEW

U20ICM404	NSS	L	T	P	C
		0	0	2	-

NCC/NSS training is compulsory for all the Undergraduate students

1. The above activities will include Practical/field activities/Extension lectures.
2. The above activities shall be carried out outside class hours.
3. In the above activities, the student participation shall be for a minimum period of 30 hours.
4. The above activities will be monitored by the respective faculty in-charge.
5. Pass /Fail will be determined on the basis of participation, attendance, performance and behavior. If a candidate Fails, he/she has to repeat the course in the subsequent years. Pass in this course is mandatory for the award of degree

U20ICE401	DIGITAL SIGNAL PROCESSING	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To impart knowledge on the discrete-time system for different inputs
- To provide the concepts of DTFT and Z-Transform
- To familiarize and impart knowledge on DFT and FFT
- To design the digital filters
- To impart knowledge on digital control techniques.

Course Outcomes

After completion of the course, the students will be able to

CO1 – Analyse the response of a discrete-time system for different inputs. **(K3)**

CO2 – Plot the frequency response of a discrete time system and analyse the discrete-time systems using Z-transform. **(K3)**

CO3 – Analyze the frequency spectrum of discrete-time signals using FFT. **(K3)**

CO4 – Design IIR and FIR digital filters for the given application. **(K3)**

CO5 – Analyse finite word length effects in digital filter. **(K3)**

UNIT I Discrete-Time Signals and Linear Systems (9 Hrs)

Classification of signals: continuous and discrete, energy and power -representation of discrete-time signals, elementary discrete-time signals, classification of discrete-time signals, Classification of systems, Representation of a system with difference equation, impulse response and step response, FIR and IIR systems, Convolution sum and correlation, sampling techniques, quantization, quantization error, Nyquist rate, aliasing effect, reconstruction of analog signal from its samples

UNIT II DTFT and Z-Transform (9 Hrs)

Discrete-time Fourier series, Frequency range, Discrete-time Fourier transform-properties, Frequency response, ideal filters, Z-transform and its properties- inverse z-transforms- system function- stability criterion- Solving difference equations using Z-transform.

Realization of IIR systems- direct form-I, direct form –II, cascade form and parallel forms. Realization of FIR systems-direct form, linear phase realization, cascade and parallel forms.

UNIT III DFT and FFT (9 Hrs)

Discrete Fourier Transform, Relationship of the DFT to other transforms, Properties of DFT, circular convolution, filtering long duration sequences, parameter selection to calculate DFT. Computation of DFT using FFT algorithm – DIT & DIF - FFT using radix 2 – Butterfly structure- FFT applications.

UNIT IV Design of Digital Filters (9 Hrs)

FIR filter design: Linear phase characteristics- Windowing technique of designing FIR filter–Need and choice of windows, frequency sampling method.

IIR filter design: Analog filter design - Butterworth and Chebyshev filters, digital design usingimpulse invariant and bilinear transformation – War ping effect, prewarping.

UNIT V Finite Word Length Effects in Digital Filters (9 Hrs)

Number representation, quantization, rounding truncation. Input quantization error, Product quantization error, Coefficient quantization error, Overflow limit cycle oscillations, Zero input limit cycle oscillation, Scaling. Finite word length effects in computation of DFT using direct evaluation and FFT algorithms.

Text Books

1. Rafael C. Gonzales, Richard E. Woods, “Digital Image Processing”, Third Edition, Pearson Education, 2010.
2. Anil Jain K. “Fundamentals of Digital Image Processing”, PHI Learning Pvt. Ltd., 2011.

3. Willliam K Pratt, “Digital Image Processing”, John Willey, 2002.

Reference Books

1. P. Ramesh Babu, Digital Signal Processing, Seventh edition, Scitech publications, 2017.
2. Alan V. Oppenheim, Ronald W. Schafer and John R. Buck, Discrete – Time Signal Processing, Pearson Education, New Delhi, 2003.
3. Johny R. Johnson : Introduction to Digital Signal Processing, Prentice Hall, 2004.
4. J.GProakis and D.G.Manolakis, Digital Signal Processing Principles, Algorithms and Applications, Pearson Education/ PHI, New Delhi, 2011.
5. Malay K. Pakhira, “Digital Image Processing and Pattern Recognition”, First Edition, PHI Learning Pvt. Ltd., 2011.

Web References

1. http://eeweb.poly.edu/~onur/lectures/lectures.html.
2. http://www.caen.uiowa.edu/~dip/LECTURE/lecture.html
3. https://nptel.ac.in/courses/117/105/117105079/

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	2	3	-	-	-	-	-	-	-	-	3	-	1
2	3	2	3	3	-	-	-	-	-	-	-	-	3	-	1
3	3	3	3	3	-	-	-	-	-	-	-	-	3	-	1
4	3	2	3	3	-	-	-	-	-	-	-	-	3	-	1
5	3	3	3	3	-	-	-	-	-	-	-	-	3	-	1

Correlation Level: 1-Low, 2-Medium, 3- High

U20ICE402	ELECTRIC AND HYBRID VEHICLES	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To expose the working of different configurations of electric vehicles
- To incorporate different energy storage technologies used for hybrid electric vehicles and their control
- To provide a comprehensive overview of a electric and hybrid electric vehicle
- To impart knowledge on the sources utilized for hybrid electric vehicle.
- To impart knowledge on the electric propulsion system

Course Outcomes

After completion of the course, the students will be able to

CO1 - Understand the architecture of electric vehicles. **(K2)**

CO2 - Understand the basic concept of Hybrid electric vehicles **(K2)**

CO3 - Critically evaluate the strength and limitations of electric propulsion systems.**(K3)**

CO4 - Examine various storage technologies and sizing of storage for independent systems. **(K2)**

CO5 - Design and develop a solar based vehicle with suitable techniques and ability to acknowledge the society about the need of hybrid vehicle system. **(K3)**

UNIT I ELECTRIC VEHICLES (9 Hrs)

Architecture of an electric vehicle, impact of modern drive, essentials and performance of electric vehicles – Traction motor characteristics, attractive effort, transmission requirements, vehicle performance, energy consumption, advantage and limitations.

UNIT II HYBRID VEHICLES (9 Hrs)

Hybrid electric drive trains – Basic concepts of hybrid traction, Introduction to various hybrid drive-train topologies, Power flow control in hybrid drive-train topologies, fuel efficiency analysis, Merits and Demerits.

UNIT III ELECTRIC PROPULSION SYSTEMS (9 Hrs)

DC motor drives, induction motor drives, permanent magnet motor drives and switched reluctance motor drives. Basic concept of electric traction, introduction to various electric drive-train topologies, power flow control in electric drive-train topologies, fuel efficiency analysis

UNIT IV ENERGY STORAGE DEVICES (9 Hrs)

Introduction to Energy Storage Requirements in Hybrid and Electric Vehicles -Electrochemical batteries – Reactions, thermodynamic voltage, lead-acid batteries, nickel-based batteries, lithium-based batteries, flywheel and ultra-capacitors, Battery management systems.

UNIT V HYBRID SOLAR VEHICLES (9 Hrs)

Impact on hybrid Solar vehicles, Fuel cell thermodynamics, operating principle, fuel cell technologies, fuel reforming, hydrogen production and storage. Photovoltaic cell, maximum power point tracking, solar powered accessories, hybrid solar vehicles.

Text Books

1. MehrdadEhsani, Yimin Gao, sebastien E. Gay and Ali Emadi, —Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Designǁ, CRC Press, second edition,2010.
2. Iqbal Husain, —Electric and Hybrid Vehicles: Design Fundamentals, CRC Press, 2011.
3. Chris Mi, M. AbulMasrur, David WenzhongGao, Hybrid Electric Vehicles Principles And Applications With Practical Perspectives, Wiley Publication, 2011.

Reference Books

1. Seref Soylu —Electric Vehicles - The Benefits and Barriers ll, InTech Publishers, Croatia, 2011.
2. Aulice Scibioh M. and Viswanathan B., —Fuel Cells – Principles and Applicationsll, University Press, India, 2007
3. James Larminie, John Lowry, Electric Vehicle Technology Explained, Wiley, 2003.
4. Mehrdad Ehsani, Yimi Gao, Senastian E. Gay, Ali Emandi, Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design, CRC Press, 2004.
5. M. Ehsani, Y. Gao, S. Gay and Ali Emadi, Modern Electric, Hybrid Electric, and Fuel Cell Vehicles: Fundamentals, Theory, and Design, CRC Press, 2005

Web References

1. https://nptel.ac.in/courses/108103009/
2. http://ceb.ac.in/knowledge-center/E-BOOKS/Modern%20Electric%2C%20Hybrid%20Electric%20%26%20Fuel%20Cell%20Vehicles%20-%20Mehrdad%20Ehsani.pdf
3. https://www.youtube.com/watch?v=uoBuOQn9XAQ

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	1	2	-	-	2	2	-	1	-	1	1	2	-	1
2	3	1	3	-	-	2	2	-	1	-	1	1	2	-	1
3	3	1	3	-	-	2	2	-	1	-	1	1	2	-	1
4	3	1	3	-	-	2	2	-	1	-	1	1	2	-	1
5	3	1	3	-	-	2	2	-	1	-	1	1	2	-	1

Correlation Level: 1-Low, 2-Medium, 3- High

U20ICE403	COMMUNICATION SYSTEMS	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To introduce different methods of analog communication and their significance
- To introduce Digital Communication methods for high bit rate transmission.
- To impart knowledge on the concepts of source and line coding techniques for enhancing rating of transmission of minimizing the errors in transmission.
- To enhance knowledge on Fiber optical communications
- To enhance the knowledge on mobile communication.

Course Outcomes

After completion of the course, the students will be able to

CO1 - Ability to understand and analyze, linear and digital electronic circuits. **(K2)**
CO2 - Understand the Pulse and digital modulation systems. **(K2)**
CO3 - Use data and pulse communication techniques in microwave and satellite communication systems. **(K1)**
CO4 - Understand the importance of fiber optic technics in communication field. **(K2)**
CO5 - Apply the concepts and techniques in real time applications. **(K3)**

UNIT I ANALOG MODULATION SYSTEMS (9 Hrs)

Need for modulation - Amplitude modulation – Frequency spectrum of AM wave – Representation of AM – Power relation –Frequency modulation – Frequency spectrum of FM wave –AM transmitter – FM transmitter – Super heterodyne AM receiver –FM receivers.

UNIT II PULSE AND DIGITAL MODULATION SYSTEMS (9 Hrs)

Principles of pulse modulation – sampling theorem, PAM – PWM – PPM– Conversion of PWM wave to PPM wave – Generation of PAM, PPM and PWM waves – Demodulation of PAM, PWM, PPM – An introduction to digital modulation systems – PCM, ASK, FSK and PSK.

UNIT III MICROWAVE AND SATELLITE COMMUNICATION SYSTEMS (9 Hrs)

Microwave communication systems: advantage, block diagram of a microwave radio system, microwave radio stations-Terminal station and repeater station. Satellite Communication system: Satellite Orbits, launch vehicles, look angles, satellite parameters, satellite link model, personal communication systems- GPS services

UNIT IV FIBER OPTICAL COMMUNICATION SYSTEMS (9 Hrs)

Need for fiber optics, introduction to optical fiber, principle of light transmission through a fiber, fiber characteristics and classification, various fiber losses- Light sources and photo detectors- Block diagram of a fiber optic system- Power budget analysis for a optical link-Recent applications of fiber optics

UNIT V CELLULAR MOBILE COMMUNICATION (9 Hrs)

Cellular concept, basic cellular concept and its operation, uniqueness of mobile radio environment- Performance metrics in cellular system-Elements of cellular mobile radio-Handoff- Frequency management and channel assignment- Introduction to various cellular standards like AMPS, GSM, GPRS, IS-95A, IS-95B, CDMA-2000 and WCDMA

Text Books

1. Kennedy Davis, “Electronic Communication Systems”, Tata McGraw Hill Publishing Company Limited, New Delhi, 1999.
2. Wayne Tomasi, “Electronic Communication Systems”, Pearson education Private Limited, Delhi, 2004.

3. Taub & Schiling “Principles of Communication Systems” Tata McGraw Hill 2007.

Reference Books

1. Roddy D and Coolen J, “Electronic Communications”, Prentice Hall of India Private Limited, fourth edition, 2007.
2. William C.Y. Lee, “Mobile Cellular Telecommunication Systems”, McGraw Hill International Edition, Second edition, 2006.
3. Gerd Keiser, “Optical fiber Communications”, McGraw Hill International Edition, Fourth edition, 2006
4. Sklar “Digital Communication Fundamentals and Applications” Pearson Education, 2001.
5. Bary le, Memuschmidt, Digital Communication, Kluwer Publication, 2004.

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1. https://easyengineering.net/ec6651-communication-engineering/
2. https://lecturenotes.in/subject/50/communication-engineering-ce
3. https://nptel.ac.in/courses/117102059/

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	-	1	-	-	2	1	-	-	-	-	-	2	-	-
2	3	-	1	-	-	2	1	-	-	-	-	-	2	-	-
3	3	-	1	-	-	2	2	-	-	-	-	-	2	-	-
4	3	-	1	-	-	2	2	-	-	-	-	-	2	-	-
5	3	-	1	-	-	2	2	-	-	-	-	-	3	-	-

Correlation Level: 1-Low, 2-Medium, 3- High

U20ICE404	ELECTRIC DRIVES AND CONTROL	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To impart basic knowledge on the development of drives and the types of control
- To expose students to the operation, application electric drives to cater the industrial needs.
- To familiarize the operation principles, and design of starting, braking, and speed control arrangements for electric motors and their applications
- To provide a strong foundation to assess performance of different industrial drives considering issues such as, energy efficiency, power quality, economic justification, environmental issues, and practical viabilities.
- To impart knowledge on digital control techniques.

Course Outcomes

After completion of the course, the students will be able to

CO1 - Understand the basics of electric drive to handle it in industrial areas where use of electric drives is essential. **(K2)**

CO2 - Examine the induction motor and DC drives in the aspects of control techniques.**(K5)**

CO3 - Understand the operation of synchronous and BLDC motor drives **(K2)**

CO4 - Elucidate the principle and working of Reluctance Motor drives **(K2)**

CO5 - Acquaintance knowledge on digital control and drive applications.**(K3**)

UNIT I INTRODUCTION TO ELECTRIC DRIVES (9 Hrs)

History and development of electric drives, Characteristics of Electrical & mechanical loads, Classification of electric drives, Basic elements & advantages of variable speed drives. Modes of operation, closed loop control of drives - Selection of power rating for drive motors with regard to thermal overloading and load variation.

UNIT II DC Drives and INDUCTION MOTOR DRIVES (9 Hrs)

DC Drives: Speed control of DC motors - Chopper fed DC drives - Single, two and four quadrant operations Induction Motor Drives**:** Speed control of 3 phase Induction Motors - Stator control: PWM &V/f control, rotor control: Rotor resistance control - Static control of rotor resistance using DC chopper - Static Krammer and Scherbius drives – Introduction to Vector Controlled Induction Motor Drives.

UNIT III SYNCHRONOUS MOTOR AND BLDC MOTOR DRIVES (9 Hrs)

Speed control of 3 phase Synchronous Motors - True synchronous and self-controlled modes of operation - PMSM: principle-flux density distribution-Types. BLDC motor: Principle-drive scheme - converter topologies.

UNIT IV RELUCTANCE MOTOR DRIVES (9 Hrs)

DC servo drives -principle of operation - AC servo drives- principle of operation - Stepper motor –principle of operation –SRM drives - principle of operation - drives. Introduction to synRM drives.

UNIT V DIGITAL CONTROL AND DRIVE APPLICATIONS (9 Hrs)

Digital techniques in speed control - Advantages and limitations - Microprocessor/Microcontroller and PLC based control of drives, networking of drives - Selection of drives and control schemes for Steel rolling mills, Paper mills, Cement mills, Machine tools, Lifts and Cranes. Solar and battery powered drives.

Text Books

1. Dubey G K, "Fundamentals of Electrical Drives", Narosa Publishing House, New Delhi, 2012.
2. Bose B K, —Modern Power Electronics and AC Drives", Pearson Education, New Delhi, 2009.

3. Nagrath .I.J. and Kothari .D.P, Electrical Machines, Tata McGraw-Hill, 2006

Reference Books

1. Ion Boldea and Nasar S All, Electric Drives ll, CRC Press LLC, New York, 2005.
2. Krishnan R, —Electric Motor Drives: Modeling, Analysis and Control, Prentice Hall of India, New Delhi, 2010.
3. Frank D. Petruzella, Industrial Electronics, McGraw Hill International Editions, 1996
4. S.K. Bhattacharya and S. Chatterjee, Industrial electronics and control, Tata Me Graw Hill 1995
5. Pillai. S.K A First Course on Electric Drives, Wiley Eastern Limited, 2012

Web References

1. https://learnengineering.in/ee6351-electrical-drives-and-controls/
2. https://easyengineering.net/ee6351-electrical-drives-and-controls/
3. https://lecturenotes.in/subject/655/electrical-drives-and-controls-edc

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	1	2	-	-	-	-	-	-	-	-	-	2	-	1
2	3	1	2	-	-	-	-	-	-	-	-	-	2	-	1
3	3	1	1	-	-	-	-	-	-	-	-	-	2	-	1
4	3	1	2	-	-	-	-	-	-	-	-	-	2	-	1
5	3	1	2	-	-	-	-	-	-	-	-	-	2	-	1

Correlation Level: 1-Low, 2-Medium, 3- High

U20ICE405	MECHATRONICS AND INSTRUMENTATION	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To learn the basics of mechatronics.
- To create a strong base on the various sensors and transducers in mechanical system.
- To learn interdisciplinary applications of Electronics, Electrical, Mechanical and Computer Systems for the Control of Mechanical and Electronic Systems.
- To design control system for computer application like CNC.
- To create a base for recent advancement in various fields.

Course Outcomes

After completion of the course, the students will be able to

CO1 - Illustrate the approach of Mechatronics to engineering concepts. **(K2)**
CO2 - Classify the different types of sensors, transducers. **(K2)**
CO3 - Select an actuator and use of robot kinematics. **(K2)**
CO4 - Distinguish the different control and interfacing techniques. **(K2)**
CO5 - Compare the applications of mechatronics in the fields of automobile, robotics, medicine, manufacturing, office automation through case studies and also to formulate the design for mechatronics for industrial application. **(K3)**

UNIT I INTRODUCTION (9 Hrs)

Mechatronics: Definition & Key Issues - Evolution - Elements - Mechatronics Approach to Modern Engineering, Industrial design and safety Design

UNIT II SENSORS AND TRANSDUCERS (9 Hrs)

Introduction and background, difference between transducer and sensor, transducers types, transduction principle, photoelectric transducers- thermistors, thermodevices, thermocouple, inductive transducers capacitive transducers, piezoelectric transducers, piezoelectric transducers. Hall Effect transducers, Fiber optic transducers, Signal Processing - Data Display.

UNIT III ACTUATION SYSTEMS (9 Hrs)

Introduction to Mechanical Types and Electrical Types - Pneumatic & Hydraulic Systems - Applications - Selection of Actuators, Kinematics of robot manipulator links.

UNIT IV DIGITAL AND CONTROL SYSTEMS (9 Hrs)

Digital logic neuron system, Types of Controllers - Programmable Logic Controllers - applications - ladder diagrams - Microprocessor Applications in Mechatronics: Temperature measurement system, Domestic washing machine - Programming Interfacing - Computer Applications: CNC drilling machine.

UNIT V RECENT ADVANCES (9 Hrs)

Manufacturing Mechatronics - Automobile Mechatronics - Medical Mechatronics - Office Automation – Case Studies.

Text Books

1. Paul P.L. Regtien, Edwin Dertien, "Sensors for Mechatronics", Second edition, Elsevier, 2018.
2. Robert H. Bishop, "Mechatronic Systems, Sensors, and Actuators: Fundamentals and Modeling
3. The Mechatronics Handbook", Second Edition, CRC Press, 2017.
4. Bolton W., "Mechatronics", 2nd Edition, Pearson education, 5th Indian Reprint, 2003.

Reference Books

1. Clarence W. de Silva, FarbodKhoshnoud, Maoqing Li, Saman K. Halgamuge, “Mechatronics: Fundamentals and Applications”, CRC press, 2016..
2. TeodorPiatek, “Mechatronic Systems Applications”, Scitus Academics LLC, 2016.
3. Ganesh S. Hegde, “Mechatronics Engineering series Infinity Science Series”, Jones & Bartlett Learning, 2010.
4. Rajput R.K., “A Textbook of Mechatronics”, S. Chand & Co, 2007.

Web References

1. https://lecturenotes.in/subject/137/mechatronics-mech
2. http://www.nptelvideos.in/2012/11/process-control-and-instrumentation.html
3. https://www.cet.edu.in/noticefiles/259_Lecturer%20Note%20on%20Mechatronics-ilovepdf-compressed.pdf

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	-	-	-	2	-	-	-	-	2	-	-	1	-	1
2	2	-	-	-	2	-	-	-	-	2	-	-	1	-	1
3	2	1	1	-	2	-	-	-	-	2	-	-	1	-	1
4	2	-	-	-	2	-	-	-	-	2	-	-	1	-	1
5	2	1	1	-	2	-	-	-	-	2	-	-	1	-	1

Correlation Level: 1-Low, 2-Medium, 3- High

U20EEO401	SOLAR PHOTOVOLTAIC FUNDAMENTALS AND APPLICATIONS (Common to ECE, ICE, MECH, CIVIL, Mechatronics)	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To impart fundamental knowledge of solar cell formation and its properties.
- To understand the various technologies used to improve solar cells.
- To discuss the various components in On-grid connected systems.
- To gain knowledge on components in Off-grid connected systems using Solar PV.
- To design the PV systems for various real load applications with cost benefits.

Course Outcomes

After completion of the course, the students will be able to

CO1 - Explain the fundamentals of solar cells. **(K2)**
CO2 - Recognize the various solar PV technologies and their up gradations along with their benefits. **(K2)**
CO3 - Design and analyze on–grid PV applications. **(K4)**
CO4 - Design and analyze off–grid PV applications. **(K4)**
CO5 - Realize cost benefit analysis of PV installations. **(K4)**

UNIT I ESSENTIAL BASICS OF SOLAR CELL (9 Hrs)

Solar cell – physics – Photovoltaics in Global Energy Scenario – Fundamentals of Semiconductors, Energy band, Charge carriers – Motion, PN Junction diode, Solar cells – Design characteristics, Solar radiation.

UNIT II COMMERCIAL AND DEVELOPING TECHNOLOGIES (9 Hrs)

Commercial technologies – Mono crystalline and Multi crystalline, Silicon – Wafer based Solar cell, Thin film solar cells – A–Si, Cd–Te and CIGS, Concentrated PV cells, Developing technologies – Organic cells, Dye sensitized cells.

UNIT III SOLAR PV FOR ON-GRID APPLICATIONS (9 Hrs)

Solar cells to solar array – On–Grid PV system – With and Without storage – Balance of system – DC–DC converters – Inverters – Net Metering – Design and analysis – Performance evaluation and monitoring – Field visit – Grid tied PV power plant.

UNIT IV SOLAR PV FOR OFF–GRID APPLICATIONS (9 Hrs)

Off–Grid stand alone PV system – System sizing – Module and Battery – Storage – Batteries for PV systems – Sun Tracking mechanism – Types of tracking – One–axis, Two–axis – Maximum power point tracking – Design and analysis – Performance evaluation and monitoring – Field visit – Off–grid PV system

UNIT V COST BENEFIT ANALYSIS FOR SOLAR PV INSTALLATIONS (9 Hrs)

Cost and manufacturability – Manufacturing economics – Scaling – Pricing – Trends in retail pricing – Energy economics – Grid tied power plant – Solar street lighting system

Text Books

1. C.S. Solanki, “Solar Photovoltaics – Fundamentals, Technologies and Applications”, PHI Learning Pvt. Ltd., 2nd Edition, 2011.
2. Martin A. Green, “Solar Cells Operating Principles, Technology, and System Applications”, Prentice - Hall, 1st Edition, 2008.

Reference Books

1. J. Nelson, “The Physics of Solar Cells”, Imperial College Press, 1st Edition, 2003.
2. Thomas Markvart, “Solar Electricity”, John Wiley and Sons, 2nd Edition, 2000.
3. Stuart R. Wenham, Martin A. Green, Muriel E. Watt, Richard Corkish , “Applied Photovoltaics”, Earthscan, 3rd Edition, 2011.

4. Michael Boxwell, “The Solar Electricity Handbook”, Green stream Publishing, 10th Edition, 2016.
5. RikDe Gunther, “Solar Power-Your Home for Dummies”, Wiley Publishing Inc, 2nd Edition, 2010.

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1. https://swayam.gov.in/nd1_noc20_ph21/preview
2. https://swayam.gov.in/nd2_nou20_ag13/preview
3. https://www.studentenergy.org/topics/solar-pv
4. https://www.eia.gov/energyexplained/solar/photovoltaics-and-electricity.php
5. https://www.energysage.com/solar/
6. https://www.bca.gov.sg/publications/others/handbook_for_solar_pv_systems.pdf
7. http://www.oas.org/dsd/publications/unit/oea79e/ch05.htm

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	3	3	2	-	3	-	-	-	-	3	1	-	1
2	3	3	3	3	2	-	3	-	-	-	-	3	1	-	1
3	3	3	3	3	2	-	3	-	-	-	-	3	3	3	3
4	3	3	3	3	2	-	3	-	-	-	-	3	3	3	3
5	3	3	3	3	2	-	3	-	-	-	-	3	-	-	1

Correlation Level: 1-Low, 2-Medium, 3- High

		L	T	P	C	Hrs
U20EEO402	**ELECTRICAL SAFETY** (Common to ECE, ICE, MECH, CIVIL, Mechatronics, BME, IT, CSE)	**3**	**0**	**0**	**3**	**45**

Course Objectives

- To familiarize the Indian Electricity Rules and Act related with electrical safety.
- To provide a knowledge about electrical shocks and safety precautions.
- To create awareness of the electrical safety associated with installation of electrical equipment.
- To analyze different Hazardous areas for electrical safety.
- To expose knowledge about necessity of safety policy and safety management.

Course Outcomes

After completion of the course, the students will be able to

CO1 - Describe the Indian Electricity (IE) acts and various rules for electrical safety. **(K2)**
CO2 - Expose safety measures to prevent electrical shock in handling of domestic electrical appliances**. (K3)**
CO3 - Evaluate the safety aspects during installation of plant and equipment**. (K3)**
CO4 - Describe the various hazardous area and application of electrical safety in various places**. (K3)**
CO5 - Acquire knowledge about importance of electrical safety training to improve quality management in electrical systems**. (K3)**

UNIT I CONCEPTS AND STATUTORY REQUIREMENTS (9 Hrs)

Objective and scope of electrical safety - National electrical Safety code - Statutory requirements – Indian Electricity acts related to electrical Safety - Safety electrical one line diagram - International standards on electrical safety safe limits of current and voltage - Grounding of electrical equipment of low voltage and high voltage systems - Safety policy - Electrical safety certificate requirement

UNIT II ELECTRICAL SHOCKS AND THEIR PREVENTION (9 Hrs)

Primary and secondary electrical shocks - Possibilities of getting electrical shock and its severity - Effect of electrical shock of human being - Shocks due to flash/ Spark over's - Firing shock - Multi storied building - Prevention of shocks - Safety precautions - Safe guards for operators - Do's and Don'ts for safety in the use of domestic electrical appliances - Case studies on electrical causes of fire and explosion

UNIT III SAFETY DURING INSTALLATION, TESTING AND COMMISSIONING, OPERATION AND MAINTENANCE (9 Hrs)

Need for inspection and maintenance - Preliminary preparations - Field quality and safety - Personal protective equipment - Safe guards for operators - Safety equipment - Risks during installation of electrical plant and equipment - Effect of lightning current on installation and buildings - Safety aspects during installation -Safety during installation of electrical rotating machines - Importance of earthing in installation– Agricultural pump installation

UNIT IV HAZARDOUS ZONES (9 Hrs)

Primary and secondary hazards - Hazardous area classification and of electrical equipments (IS, NFPA, API and OSHA standards) - Explosive gas area classifications: Class I(Division 1) - Zone 0, Zone 1, zone 2 classified locations, Design Philosophy for Equipment and installations-Classification of equipment enclosure for various hazardous gases and vapors - flash hazard calculation and approach distances- calculating the required level of arc protection

UNIT V SAFETY MANAGEMENT OF ELECTRICAL SYSTEMS (9 Hrs)

Principles of Safety Management - Occupational safety and health administration standards - Safety organization - Safety auditing - Employee electrical safety teams - Electrical safety training to improve Quality management - Total quality control and management – Importance of high load factor - Causes of low power factor - Disadvantages of low power factor - Power factor improvement - Importance of P.F. improvement - Case studies of electrical

workplace safety practices.

Text books

1. John Cadick, Mary CapelliSchellpfeffer, Dennis Neitzel, Al Winfield, “Electrical Safety Handbook”, McGraw-Hill Education, 4th Edition, 2012.
2. Madden, M. John, “Electrical Safety and the Law: A Guide to Compliance”, Wiley publications, 4th Edition, 2002.
3. Mohamed A. El-Sharkawi, “Electric Safety: Practice and Standards”, CRC Press; 1st Edition, 2013.

Reference books

1. Rob Zachariason, “Electrical Safety”, Delmar Cengage Learning, 1st Edition, 2011.
2. Peter E. Sutherland, “Principles of Electrical Safety”, Wiley-IEEE Press; 1st Edition, 2014.

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1. https://www.apeasternpower.com/downloads/elecact2003.pdf
2. https://safetyculture.com/topics/electrical-hazards/
3. https://www.jove.com/science-education/10114/electrical-safety-precautions-and-basic-equipment
4. https://electrical-engineering-portal.com/21-safety-rules-for-working-with-electrical-equipment
5. https://www.electrical4u.com/safety-precautions-for-electrical-system/
6. https://www.constellation.com/energy-101/electrical-safety-tips.html

COs/POs/PSOs Mapping

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1	3	3	3	2	-	2	-	-	-	-	-	-	1	2	1
2	3	3	3	2	-	2	-	-	-	-	-	-	1	2	1
3	3	3	3	2	-	2	-	-	-	-	-	-	1	2	1
4	3	3	3	2	-	2	-	-	-	-	-	-	1	2	1
5	3	3	3	2	-	2	-	-	-	-	-	-	1	2	1

Correlation Level: 1-Low, 2-Medium, 3- High

		L	T	P	C	Hrs
U20ECO401	**ENGINEERING COMPUTATION WITH MATLAB** (Common to ICE, EEE, MECH, CIVIL, BME, Mechatronics)	**3**	**0**	**0**	**3**	**45**

Course Objectives

- To understand basic representation of Matrices and vectors in MATLAB
- To learn various programming structures in MATLAB
- To study built in and user defined functions in MATLAB.
- To become conversant with 2D as well as 3D graphics in MATLAB
- To make a Graphical User Interface (GUI) in MATLAB in order to achieve interactivity

Course Outcomes

After completion of the course, students will be able to

CO1 - State the basics of MATLAB (K1)
CO2 - Explain how to work with matrices, and their operations (K2)
CO3 - Use the MATLAB functions relevant to communication engineering, (K3)
CO4 - Demonstrates various file operations in MATLAB (K3)
CO5 - Applying the plotting capabilities of MATLAB effectively to various systems. (K3)

UNIT I INTRODUCTION TO MATLAB
(9Hrs)

Menus & Tool bars, Variables - Matrices and Vectors - initializing vectors - Data types- Functions – User defined functions - passing arguments - writing data to a file-reading data from a file - using functions with vectors and matrices- cell arrays & structures - Strings - 2D strings-String comparing - Concatenation - Input and Output statements - Script files .

UNIT II LOOPS& CONTROL STATEMENTS (9 Hrs)

Introduction; Relational & Logical operations - Example programs - Operator precedence - Control & Decision statements- IF - IF ELSE - NESTED IF ELSE - SWITCH - TRY & CATCH - FOR -WHILE - NESTED FOR - FOR with IF statements, MATLAB program organization, Debugging methods - Error trapping using eval&lastern commands.

UNIT III PLOTS IN MATLAB & GUI (9 Hrs)

Basic 2D plots, Labels, Line style, Markers, plot, subplot, LOG, LOG-LOG, SEMILOG-POLARCOMET, Grid axis, labeling, fplot, ezplot, ezpolar, polyval, exporting figures, HOLD, STEM, BAR, HIST, Interactive plotting, Basic Fitting Interface – Polyfit - 3D plots – Mesh - Contour - Example programs. GUI - Creation Fundamentals – Capturing mouse actions

UNIT IV MISCELLANEOUS TOPICS (9 Hrs)

File & Directory management - Native Data Files - Data import & Export - Low Level File I/O – Directory management - FTP File Operations - Time Computations -Date & Time – Format Conversions - Date & Time, Functions - Plot labels - Optimization - zero Finding - Minimization in one Dimension - Minimization in Higher Dimensions- Practical Issues. Differentiation & Integration using MATLAB, 1D & 2D Data Interpolation

UNIT V SIMULINK & APPLICATIONS (9 Hrs)

How to create & run Simulink, Simulink Designing - Using SIMULINK Generating an AM signal & 2nd order systems - Designing of FWR & HWR using Simulink - Creating a subsystem in Simulink. Applications Programs -Frequency response of filters. Open Loop gain of OPAMP, I/P characteristics of BJT, Plotting the graph between Breakdown voltage & Doping Concentration.

Text Books

1. RudraPratap, Getting Started with MATLAB 6.0 ,1st Edition, Oxford University Press-2004.
2. Duane Hanselman ,Bruce LittleField, "Mastering MATLAB 7", Pearson Education Inc, 2005
3. William J.Palm, "Introduction to MATLAB 6.0 for Engineers", McGraw Hill & Co, 2001.

Reference Books

1. M.Herniter, "Programming in MATLAB", Thomson Learning, 2001
2. John OkyereAltla, "Electronics and circuit analysis using MATLAB", CRC press, 1999
3. K.K.Sharma, "MATLAB Demustifyied", Vikas Publishing House Pvt Ltd. 2004

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1. https://www.mathworks.com/products/matlab.html
2. https://www.tutorialspoint.com/matlab/index.htm
3. https://www.cmu.edu/computing/software/all/matlab/
4. https://ctms.engin.umich.edu/CTMS/index.php?aux=Home

COs/POs/PSOs Mapping

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2	2	2	-	2	3	-	-	-	-	-	-	-	2	2	3
3	2	2	-	2	3	-	-	-	-	-	-	-	2	2	3
4	2	2	-	2	3	-	-	-	-	-	-	-	2	2	3
5	2	2	-	2	3	-	-	-	-	-	-	-	2	2	3

Correlation Level: 1-Low, 2-Medium, 3- High

	CONSUMER ELECTRONICS	L	T	P	C	Hrs
U20ECO402	(Common to EEE, ICE, CSE, MECH, IT, CIVIL, BME, Mechatronics)	**3**	**0**	**0**	**3**	**45**

Course Objectives

- To enable the troubleshoot of different types of microphones and loudspeakers
- To make the students to analyze the working of digital console, digital FM tuner and troubleshoot audio systems
- To train to test the working of various colour TV
- To empower them to troubleshoot colour TV receivers
- To equip them to maintain various electronic home and office appliances

Course Outcomes

After completion of the course, students will be able to

CO1- Describe the fundamental audio characteristics and measurements, operating principles of microphone and loudspeaker **(K1)**

CO2 - Explain the working of digital console, digital FM tuner and troubleshoot the audio systems **(K2)**

CO3 - Distinguish the salient features of colour TV and Monochrome and troubleshoot TV camera **(K2)**

CO4 - Demonstrate various interfaces in digital TV, the working of DTH receiver, CD/DVD players **(K3)**

CO5 - Explain the working of FAX, Microwave oven, Washing machine, Air conditioner, Refrigerators and camera **(K2**)

UNIT I AUDIO FUNDAMENTALS AND DEVICES (9 Hrs)

Basic characteristics of sound signal, Microphone- working principle, sensitivity, nature of response. Types of Microphone, Loud speaker- working principle, Woofers and Tweeters, characteristics. Types of Loudspeaker. Sound recording

UNIT II AUDIO SYSTEMS (9 Hrs)

Introduction to audio system, Digital Console- Block diagram, working principle, applications, FM tuner- concepts of digital tuning, ICs used in FM tuner TD702IT, PA address system- Planning, speaker impedance matching, characteristics, Power amplifier specification

UNIT III TELEVISION SYSTEMS (9 Hrs)

Monochrome TV standards, Components of TV system, scanning process, aspect ratio, persistence of vision and flicker, interlace scanning, picture resolution. Composite video signal,Colour TV standards, colour theory, hue, brightness, saturation, luminance and chrominance. Different types of TV camera.

UNIT IV TELEVISION RECEIVERS AND VIDEO STANDARDS (9 Hrs)

Colour TV receiver- block diagram, Digital TVs- LCD, LED , PLASMA, HDTV, 3-D TV, projection TV, DTH receiver, Video interface: Composite, Component, Separate Video, Digital Video, SDI, HDMI, Digital Video Interface, CD and DVD player: working principles, interfaces

UNIT V HOME AND OFFICE APPLIANCES (9 Hrs)

Microwave Oven: Types, technical specifications. Washing Machine: hardware and software. Air conditioner and Refrigerators: Components features, applications, and technical specification. Digital camera and cam coder: - pick up devices, picture processing, picture storage

Text Books

1 Bali S.P. , 'Consumer Electronics', **copyright 2008**,Pearson Education India
2 Bali R and Bali S.P. 'Audio video systems : principle practices & troubleshooting', Khanna Book Publishing Co. (P) Ltd
3 Gulati R.R., 'Modern Television practices', 5th edition, 2015, New Age International Publication (P) Ltd

Reference Books

1 Gupta R.G., 'Audio video systems', 2nd edition,2017, Tata Mcgraw Hill, New Delhi, India
2 Whitaker Jerry & Benson Blair, 'Mastering Digital Television', McGraw-Hill Professional, 2006
3 Whitaker Jerry & Benson Blair, 'Standard handbook of Audio engineering', 2nd edition,2002, McGraw-Hill Professional

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2 http://www.cosc.brocku.ca/Offerings/3P92/seminars/HDTV.ppt
3 http://www.circuitstoday.com/blu-ray-technology-working
4 http://www.freevideolectures.com

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
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1	2	-	2	1	-	1	-	-	-	-	-	-	2	1	1
2	2	-	2	1	-	1	-	-	-	-	-	-	2	1	1
3	2	-	2	1	-	1	-	-	-	-	-	-	2	1	1
4	2	-	2	1	-	1	-	-	-	-	-	-	2	1	1
5	2	-	2	1	-	1	-	-	-	-	-	-	2	1	1

Correlation Level: 1-Low, 2-Medium, 3- High

		L	T	P	C	Hrs
U20CSO401	**WEB DEVELOPMENT** (Common to EEE, ECE, ICE, MECH, CIVIL, BME, Mechatronics)	**3**	**0**	**0**	**3**	**45**

Course Objectives

- To study the fundamentals of web application development
- To understand the design components and tools using CSS
- To learn the concepts JavaScript and programming fundamentals.
- To study about advance scripting and Ajax applications.
- To understand the working procedure of XML

Course Outcomes

After the completion of the course, the students will be able to

CO1 - Develop basic web applications. **(K5)**
CO2 - Design the web applications using CSS. **(K5)**
CO3 - Validate the web pages using javascripts functions. **(K5)**
CO4 - Demonstrate the web 2.0 application to advance scripts. **(K3)**
CO5 - Update the knowledge of XML Data. **(K4)**

UNIT I INTRODUCTION TO WWW & HTML (9 Hrs)

Protocols – Secure Connections – Application and development tools – Web browser – Server definition – Dynamic IP. Web Design: Web site design principles – Planning the site and navigation. HTML: Development process – Html tags and simple HTML forms – Web site structure.

UNIT II STYLE SHEETS (9 Hrs)

Introduction to CSS: Need for CSS – Basic syntax and structure using CSS – Background images – Colors and properties – Manipulating texts using fonts, borders and boxes – Margins, padding lists, positioning using CSS – CSS2.

UNIT III JAVASCRIPTS (9 Hrs)

Client side scripting: Basic JavaScript – Variables – Functions – Conditions – Loops. Applications: Page Validation – Reporting.

UNIT IV ADVANCE SCRIPT (9 Hrs)

JavaScript and objects – DOM and Web browser environments – Forms and Validations – DHTML. AJAX: Introduction – Web applications – Alternatives of AJAX.

UNIT V XML (9 Hrs)

Introduction to XML – Uses of XML – Simple XML – XML key components – DTD and Schemas – Well-formed XML document – Applications of XML – XSL and XSLT.

Text Books

1. Keith Wald, Jason Lengstorf," Pro PHP and jQuery", Paperback, 2016.
2. Semmy Purewal, "Learning Web App Development", O'Reilly Media, 2014.

3. P.J. Deitel AND H.M. Deitel," Internet and World Wide Web - How to Program", Pearson Education, 2009.

Reference Books

1. Yakov Fain, Victor Rasputnis, Anatole Tartakovsky and Viktor Gamov, "Enterprise Web Development ", O'Reilly Media, 2014.
2. Steven Suehring, Janet Valade, "PHP, MySQL, JavaScript & HTML5 All-in-One", John Wiley & Sons, Inc, 2013.
3. Uttam K. Roy, "Web Technologies", Oxford University Press, 2010.
4. Rajkamal, "Web Technology", Tata McGraw-Hill, 2009.
5. Shklar, Leon, Rosen, Rich, "Web Application Architecture: Principles, Protocols and Practices", Wiley Publication, 2009.

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3. https://www.guru99.com/cakephp-tutorial.html
4. https://www.ithands.com/blog/cms-or-php-framework-which-technology-is-better-for-my-business
5. http://Oriel.ly/learning-web-app

COs/POs/PSOs Mapping (ICE)

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	3	3	3	3	3	3	-	-	3	-	-	-	-
2	2	2	2	2	-	2	-	2	-	2	-	2	-	-	-
3	3	3	3	3	3	3	3	3	-	-	3	-	-	-	-
4	2	2	2	2	-	2	-	2	-	2	-	2	-	-	-
5	2	2	2	2	-	2	-	2	-	2	-	2	-	-	-

Correlation Level: 1-Low, 2-Medium, 3- High

		L	T	P	C	Hrs
U20CSO402	**ANALYSIS OF ALGORITHMS** (Common to EEE, ECE, ICE, MECH, CIVIL, BME, Mechatronics)	**3**	**0**	**0**	**3**	**45**

Course Objectives

- To analyze the performance of algorithms in terms of time and space complexity.
- To understand the performance of the algorithms such as divide and conquer, greedy method
- To solve problems using Dynamic Programming and derive the time complexity.
- To solve problems using Backtracking technique and derive the time complexity.
- To solve problems using Branch and Bound technique and derive the time complexity.

Course Outcomes

Upon completion of the course, students shall have ability to

CO1 - Choose the appropriate data structure and algorithm design method for a specified application. **(K2)**
CO2 - Ability to understand the design technique such as divide and conquer, greedy method applied to realistic problems and analyse them. **(K3)**
CO3 - Ability to understand the dynamic programming design technique and how it is applied to realistic problems and analyze them. **(K3)**
CO4 - Ability to understand the backtracking design technique and how it is applied to realistic problems and analyze them. **(K3)**
CO5 - Ability to understand Branch and Bound design technique and how it is applied to realistic problems and analyze them. **(K2)**

UNIT I INTRODUCTION (9 Hrs)

Introduction: Algorithm, Pseudo code for expressing algorithms, Performance Analysis – Time complexity, Space complexity, Asymptotic Notation – Big oh notation, Omega notation, Theta notation and Little oh notation.

UNIT II DIVIDE AND CONQUER METHOD AND GREEDY METHOD (9 Hrs)

Divide and Conquer method: Applications – Binary search, Merge sort, Quick sort. Greedy method: General method, applications – Knapsack problem, Minimum cost spanning trees, Single source shortest path problem.

UNIT III DYNAMIC PROGRAMMING (9 Hrs)

Dynamic Programming: Applications - Multistage graphs, 0/1 knapsack problem, All pairs shortest path problem, Traveling salesperson problem, Reliability design.

UNIT IV BACKTRACKING (9 Hrs)

Backtracking: General method, Applications – N-queen problem, Sum of subsets problem, Graph Coloring – Hamiltonian Cycles.

UNIT V BRANCH AND BOUND (9 Hrs)

Branch and Bound**:** General method, Applications – Traveling sales person problem, 0/1 Knapsack problem, LC Branch and Bound solution, FIFO Branch and Bound solution.

Text Books

1. E. Horowitz and S.Sahni, “Fundamentals of Algorithms”, Galgotia Publications, 2nd Edition, 2010.
2. T.H.Cormen, C.E.Leiserson, R.L.Rivest, and C.Stein, “Introduction to Algorithms”, PHI/Pearson Education, 3rdEdition, 2009.
3. Anany Levitin, “Introduction to the Design and Analysis of Algorithms”, Pearson Education, Third Edition, 2012.

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1. Michael T. Goodrich and Roberto Tamassia, “Algorithm Design: Foundations, Analysis and Internet Examples”, Wiley India, 2006.
2. Sara Baase and Allen Van Gelder, “Computer Algorithms Introduction to Design and Analysis”, Pearson Education Asia, 3rd Edition, 2010.
3. Donald E Knuth, “The Art of Computer Programming, Volume I & II”, Addison Wessely, Third Edition, 2011.
4. Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman, “Data Structures and Algorithms”, Pearson Education, 2006.
5. Harsh Bhasin, ”Algorithms Design and Analysis”, Oxford university press, 2016.

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3. https://www.javatpoint.com/daa-tutorial
4. https://www.guru99.com/design-analysis-algorithms-tutorial.html
5. https://www.geeksforgeeks.org/fundamentals-of-algorithms/

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	2	3	2	2	1	-	-	-	-	-	-	-	-
2	3	2	3	3	2	2	1	-	-	-	-	-	-	-	-
3	3	3	3	3	2	2	2	-	2	-	-	-	-	-	-
4	3	2	3	3	3	2	2	-	-	-	3	-	-	-	-
5	3	3	3	3	2	2	2	-	-	-	3	2	-	-	-

Correlation Level: 1-Low, 2-Medium, 3- High

U20ITO401	DATABASE SYSTEM: DESIGN & DEVELOPMENT (Common to EEE, ECE, ICE, CCE, BME)	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- Understand the various data models, conceptualize E-R diagram and depict using relational model
- Gain knowledge about database languages and frame query using Relational Algebra and SQL
- Understand and design an efficient database schema using the various normal forms
- Impart knowledge on data storage and transaction processing, concurrency control techniques and recovery procedures
- Explore knowledge on tools and practice case studies

Course Outcomes

After completion of the course the students will be able to:

CO1 - Explain the concepts of Database Management System and develop Entity Relationship model and Relational Models for a given application**(K2)**

CO2 - Manipulate and build database queries using Structured Query Language and relational algebra**(K2)**

CO3 - Apply data normalization principles to develop a normalized database for a given application.**(K3)**

CO4 - Explain various storage & indexing techniques, transactions and recovery techniques**(K2)**

CO5 - Apply tools like NoSQL, MongoDB, Cassandra on real time applications**(K3)**

UNIT I INTRODUCTION (9 Hrs)

Database Systems– Data Models – Database System Architecture - Entity-Relationship Model - ER Diagram-Extended ER Model –ER into Relational Model - **Relational Model**: Structure of Relational Databases, Database Schema,Keys,Tables

UNIT II DATABASE LANGUAGES (9 Hrs)

Relational Algebra – Extended-Relational Algebra Operations –**SQL**: Introduction – DDL – DML –Integrity Constraints-Set Operations-Joins – Nested Queries -View- Trigger - Stored Procedures

UNIT III RELATIONAL-DATABASE DESIGN (9 Hrs)

Introduction to Schema Refinement – Decomposition – Lossless Decomposition – Functional Dependencies – Normal Forms - First Normal Form, Second Normal Form, Third Normal Form, Boyce-Codd Normal Form, Fourth Normal Form.

UNIT IV DATA STORAGE (9 Hrs)

RAID - File Organization - Indexing, Ordered Index, Index files, Hashing - Static and dynamic hashing.

Transactions: Transaction concepts and states– Concurrent Execution-Serializability-Concurrency Control: Lock based Protocol - Timestamp based Protocol - **Recovery System**: – Log-Based Recovery – Shadow Paging

UNIT V CASE STUDY (9 Hrs)

NoSQL – Document Database : MongoDB - Multi-dimensional: Cassandra

Text Books

1. Silberschatz, Korth, Sudarshan, *Database System Concepts*, 7thEdition – McGraw-Hill Higher Education, International Edition, 2019.
2. RamezElmasri, and Shamkant B. Navathe, Fundamentals of Database Systems (7th edition), Publisher:

Pearson,2016

Reference Books

1. Raghu Ramakrishnan, —Database Management Systems, Fourth Edition, McGraw-Hill College Publications, 2015.
2. Date C J, Kannan A and Swamynathan S, —An Introduction to Database Systems‖, 8th Edition, Pearson Education, New Delhi, 2006.
3. Alan Beaulieu, Mastering SQL Fundamentals, Second Edition, O'Reilly,2009
4. Kristina Chodorow; Shannon Bradshaw MongoDB: The Definitive Guide, 3rd Edition, O'Reilly Media, Inc., 2018.
5. Pramod J. Sadalage (Author), Martin Fowler, NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence 1stEdition, Kindle Edition

Web References

1. http://www.database.com/
2. http://cassandra.apache.org/
3. https://www.mongodb.com/

CO-POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	1			-	-	-	-	-	-	-	-	-	-	-
2	3	2	1	1	-	-	-	-	-	-	-	-	-	-	-
3	3	2	1	1	-	-	-	-	-	-	-	-	-	-	-
4	2	1			-	-	-	-	-	-	-	-	-	-	-
5	3	2	1	1	-	-	-	-	-	-	-	-	-	-	-

Correlation Level: 1-Low, 2-Medium, 3- High

		L	T	P	C	Hrs
U20ITO402	**R PROGRAMMING** (Common to EEE, ECE, ICE, CCE, BME, Mech, Mechatronics)	**3**	**0**	**0**	**3**	**45**

Course Objectives

- To understand the basics in R programming in terms of constructs, control statements, string functions
- To learn to apply R programming for Text processing
- To understand the use of data frames and tables
- To able to appreciate and apply the R programming from a statistical perspective
- To understand the interface model

Course Outcomes

After completion of the course the students will be able to:

CO1 - Create artful graphs to visualize complex data sets and functions.**(K3)**
CO2 - Write more efficient code using parallel R and vectorization. **(K3)**
CO3 - Create data frames and working with tables.**(K3)**
CO4 - Interface R with C/C++ and Python for increased speed or functionality.**(K2)**
CO5 - Find new packages for text analysis, image manipulation &perform statistical analysis.**(K4)**

UNIT I INTRODUCTION (9 Hrs)

Introducing to R – R Data Structures – Help functions in R – Vectors – Scalars – Declarations – recycling – Common Vector operations – Using all and any – Vectorized operations – NA and NULL values – Filtering – Vectorised if-then else – Vector Equality – Vector Element names

UNIT II MATRICES AND ARRAYS (9 Hrs)

Matrices, Arrays And Lists Creating matrices – Matrix operations – Applying Functions to Matrix Rows and Columns – Adding and deleting rows and columns – Vector/Matrix Distinction – Avoiding Dimension Reduction – Higher Dimensional arrays – lists – Creating lists – General list operations – Accessing list components and values – applying functions to lists – recursive lists.

UNIT III DATA FRAMES (9 Hrs)

Data Frames Creating Data Frames – Matrix-like operations in frames – Merging Data Frames – Applying functions to Data frames – Factors and Tables – factors and levels – Common functions used with factors – Working with tables - Other factors and table related functions

UNIT IV FUNCTIONS AND ARGUMENTS (9 Hrs)

Control statements – Arithmetic and Boolean operators and values – Default values for arguments - Returning Boolean values – functions are objects – Environment and Scope issues – Writing Upstairs - Recursion – Replacement functions – Tools for composing function code – Math and Simulations in R Creating Graphs – Customizing Graphs – Saving graphs to files – Creating three-dimensional plots

UNIT V INTERFACING (9 Hrs)

Interfacing R to other languages – Parallel R – Basic Statistics – Linear Model – Generalized Linear models – Non-linear models – Time Series and Auto-correlation – Clustering.

Text Books

1. Norman Matloff, “The Art of R Programming: A Tour of Statistical Software Design”, No Starch Press, 2011.

2. Jared P. Lander, “R for Everyone: Advanced Analytics and Graphics”, Addison-Wesley Data & Analytics Series, 2013.

Reference books

1. Mark Gardener, “ Beginning R – The Statistical Programming Language”, Wiley, 2013
2. Robert Knell, “Introductory R: A Beginner's Guide to Data Visualisation, Statistical Analysis and Programming in R”, Amazon Digital South Asia Services Inc, 2013.

Web References

1. https://www.coursera.org/learn/r-programming
2. https://www.r-project.org/

CO-POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	3	2	1	1	-	-	-	-	-	-	-	-	-	-	-
3	3	2	1	1	-	-	-	-	-	-	-	-	-	-	-
4	3	2	1	1	-	-	-	-	-	-	-	-	-	-	-
5	2	1	-	-	-	-	-	-	-	-	-	-	-	-	-

Correlation Level: 1-Low, 2-Medium, 3- High

U20MEO401	RAPID PROTOYPING (Common to EEE, ECE, ICE, CIVIL, BME, FT)	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To understand the development of RP systems
- To learn the classification of liquid based and solid based rapid prototyping systems
- To understand the powder based rapid prototyping systems
- To learn about the materials for rapid prototyping systems
- To discuss about the reverse engineering and new technologies

Course Outcomes

After completion of the course the students will be able to:

CO1 - Acquire knowledge about the product development **(K1)**
CO2 - Analyse the classification of liquid based and solid based rapid prototyping systems **(K4)**
CO3 - Analyse the powder based rapid prototyping systems **(K4)**
CO4 - Acquire knowledge about the materials for rapid prototyping systems **(K1)**
CO5 - Acquire knowledge about reverse engineering and new technologies **(K1)**

UNIT I INTRODUCTION (9 Hrs)

History – Development of RP systems – Applications in Product Development, Reverse Engineering, Rapid Tooling, Rapid Manufacturing- Principle – Fundamental – File format– Other translators – medical applications of RP - On demand manufacturing – Direct material deposition - Shape Deposition Manufacturing.

UNIT II LIQUID BASED AND SOLID BASED RAPID PROTOTYPING SYSTEMS (9 Hrs)

Classification – Liquid based system – Stereo lithography Apparatus (SLA), details of SL process, products, Advantages, Limitations, Applications and Uses. Solid based system- Fused Deposition Modeling, principle, process, products, advantages, applications and uses - Laminated Object Manufacturing**.**

UNIT III POWDER BASED RAPID PROTOTYPING SYSTEMS (9 Hrs)

Selective Laser Sintering – principles of SLS process, principle of sinter bonding process, Laser sintering materials, products, advantages, limitations, applications and uses. Three Dimensional Printing – process, major applications, research and development. Direct shell production casting – key strengths, process, applications and uses, case studies, research and development. Laser Sintering System, e-manufacturing using Laser sintering, customized plastic parts, customized metal parts, e-manufacturing - Laser Engineered Net Shaping (LENS).

UNIT IV MATERIALS FOR RAPID PROTOTYPING SYSTEMS (9 Hrs)

Nature of material – type of material – polymers, metals, ceramics and composites liquid based materials, photo polymer development – solid based materials, powder based materials - case study.

UNIT V REVERSE ENGINEERING AND NEW TECHNOLOGIES(9 Hrs)

Introduction, measuring device- contact type and non-contact type, CAD model creation from point clouds-preprocessing, point clouds to surface model creation, medical data processing - types of medical imaging, software for making medical models, medical materials, other applications - Case study.

Text Books

1. Rafiq I. Noorani, Rapid Prototyping – Principles and Applications, Wiley & Sons, 2006.
2. 2. Chua C.K, Leong K.F and Lim C.S, Rapid Prototyping: Principles and Applications, second edition,

World Scientific, 2003.
3. Amitav Ghosh Introduction to Rapid Prototyping, North West Publication, New Delhi, 2008.

Reference Books

1. Hopkinson N, R.J.M, Hauge, P M, Dickens, “Rapid Manufacturing – An Industrial revolution for the digital age”, Wiley, 2006
2. Ian gibson, “Advanced Manufacturing Technology for Medical applications: Reverse Engineering, Software conversion and Rapid Prototying”, Wiley, 2006
3. Paul F. Jacobs, Rapid Prototyping and Manufacturing, “Fundamentals of Stereolithography”, McGraw Hill 1993.
4. Pham D.T and Dimov, “Rapid Manufacturing”, Springer Verlog 2001.
5. Liou W. Liou, Frank W. Liou ,”Rapid Prototyping and Engineering applications : A tool box for prototype development”, CRC Press, 2007.

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2. https://www.digimat.in/nptel/courses/video/112104265/L01.html
3. https://nptel.ac.in/courses/112/107/112107078/
4. https://www.youtube.com/watch?v=oDdOqLblmVQ
5. https://www.youtube.com/watch?v=OhNnKTaciVI

CO-POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	3	3	1	-	-	-	-	-	-	2	3	2	2
2	3	3	3	3	1	-	-	-	-	-	-	2	3	2	2
3	3	3	3	3	1	-	-	-	-	-	-	2	3	2	2
4	3	3	3	3	1	-	-	-	-	-	-	2	3	2	2
5	3	3	3	3	1	-	-	-	-	-	-	2	3	2	2

Correlation Level: 1-Low, 2-Medium, 3- High

U20MEO402 **MATERIAL HANDLING SYSTEM** **L T P C Hrs**

(Common to EEE, ICE, CIVIL, Mechatronics) **3 0 0 3 45**

Course Objectives

- To understand the principal groups of material handling equipment's
- To learn about the Flexible hoisting appliances
- To learn about the material handling attachments, hook bearings, crane attachment
- To understand about the basic material handling system, selection
- To introduce concepts of ergonomics of material handling equipment and safety in handling

Course Outcomes

After completion of the course the students will be able to:

CO1 - Describe the principal groups of material handling equipment's.**(K2)**
CO2 - Describe about the flexible hosting appliances.**(K2)**
CO3 - Explains about the material handling attachments, hook bearings, crane attachment.**(K1)**
CO4 - Illustratethe basic material handling system, selection.**(K1)**
CO5 - Define theergonomics related to material handling equipment.**(K1)**

UNIT I MATERIAL HANDLING EQUIPMENTS (9 Hrs)

Types of intraplant transporting facility - principal groups of material handling equipments - choice of material handling equipment - hoisting equipment, screw type, hydraulic and pneumatic conveyors- - general characteristics of hoisting machines, surface and overhead equipments, general characteristics of surface and overhead equipments and their applications - Introduction to control of hoisting equipments.

UNIT II FLEXIBLE HOSTING APPLIANCES (9 Hrs)

Flexible hoisting appliances like ropes and chains, welded load chains, roller chains - selection of hemp rope chains and steel wire rope - selection of ropes - fastening of chain sand ropes - different types of load suspension appliances - fixed and movable pulleys, different types of pulley systems, multiple pulley systems - Chain and rope sheaves and sprockets.

UNIT III MATERIAL HANDLING ATTACHMENTS (9 Hrs)

Load handling attachments - standard forged hook, hook weights, hook bearings, cross piece and casing of hook - crane grab for unit and piece loads - carrier beams and clamps - load platforms and side dump buckets- electric lifting magnets - grabbing attachments for loose materials - crane attachments for handling liquid materials.

UNIT IV MATERIAL HANDLING SYSTEMS (9 Hrs)

Basic Material Handling systems - Selection, Material Handling method - path, Equipment - function oriented systems.

UNIT V METHODS TO MINIMIZE COST OF MATERIAL HANDLING (9 Hrs)

Methods to minimize cost of material handling- Maintenance of Material Handling Equipments - Safety in handling - Ergonomics of Material Handling equipment - Design, Miscellaneous equipment

Text Books

1. Rudenko N , Materials Handling Equipment , Envee Publishers, New Delhi, 2017
2. Alexandrov M.P Materials Handling Equipment, Mie publications, Moscow, 2013
3. **White**, John A., **Pence**, Ira W, Materials handling and logistics,Envee Publishers, New Delhi, 2016

Reference Books

1. K.C, AroraVikas, V. Shinde, Aspects of Material handling, Laxmi Publications; First edition, 2015.
2. Siddhartha Ray, Introduction to Material Handling, New Age International, Edition: 2, 2017.
3. RB Chowdary , G. R. N. Tagore,Plant Layout and Material Handling-, Khanna publishers; 2nd edition 2016.
4. James A Apple, Plant layout and Material Handlin, Krieger Pub Co, 2016.
5. P.B Mahapatra, Operations Management, PHI, 2016.

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2. https://nptel.ac.in/courses/112/107/112107142/
3. https://nptel.ac.in/courses/112/107/112107143/
4. https://www.youtube.com/watch?v=WXmIdbVDJqE
5. https://www.youtube.com/watch?v=BBWPIByOEfI

COs Mapping with POs and PSOs

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	3	3	-	-	-	-	-	-	-	1	3	1	2
2	3	3	3	3	-	-	-	-	-	-	-	1	2	1	2
3	3	3	3	3	-	-	-	-	-	-	-	1	2	1	2
4	3	3	3	3	-	-	-	-	-	-	-	1	3	1	2
5	3	3	3	3	-	-	-	-	-	-	-	1	3	1	2

Correlation Level: 1-Low, 2-Medium, 3- High

		L	T	P	C	Hrs
U20BMO401	**MEDICAL ELECTRONICS** (Common to EEE, ECE, CSE, IT, ICE, MECH, Mechatronics, AI&DS)	**3**	**0**	**0**	**3**	**45**

Course Objectives

- To gain knowledge about the various physiological parameters measurements
- To understand the various biochemical and nonelectrical sensors
- To study about the assist devices
- To gain knowledge on surgical equipments and telemetry in healthcare
- To understand the concepts of recent advancements in healthcare

Course Outcomes

After completion of the course, the students will be able to

CO1 - Explain the electro- physiological parameters and bio-potentials recording **(K2)**
CO2 - Measure the biochemical and non-electrical physiological parameters **(K2)**
CO3 - Interpret the various assist devices used in the hospitals **(K3)**
CO4 - Identify physical medicine methods and biotelemetry **(K3)**
CO5 - Analyse recent trends in medical instrumentation **(K3)**

UNIT I ELECTRO-PHYSIOLOGY AND BIO-POTENTIAL RECORDING (9 Hrs)

Sources of bio medical signals, Bio-potentials, Bio potential electrodes, biological amplifiers, ECG, EEG, EMG, PCG, typical waveforms and signal characteristics

UNIT II BIO-CHEMICAL AND NON ELECTRICAL PARAMETER MEASUREMENT (9 Hrs)

pH, PO2, PCO2, Colorimeter, Blood flow meter, Cardiac output, respiratory, blood pressure, temperature and pulse measurement, Blood Cell Counters.

UNIT III ASSIST DEVICES (9 Hrs)

Artificial kidney, Dialysis action, hemodialyser unit, membrane dialysis, portable dialyser monitoring and functional parameters, Heart-Lung Machine.

UNIT IV PHYSICAL MEDICINE AND BIOTELEMETRY (9 Hrs)

Diathermies - Shortwave, ultrasonic and microwave type and their applications, Surgical Diathermy, Biotelemetry - Single Channel and Multiple Channel.

UNIT V RECENT TRENDS IN MEDICAL INSTRUMENTATION (9 Hrs)

Telemedicine, Insulin Pumps, Radio pill, Endo-microscopy, Brain machine interface, Lab on a chip, Cryogenic Technique.

Text Books

1. Leslie Cromwell, “Biomedical Instrumentation and Measurement”, Prentice Hall of India, New Delhi, 2011.
2. Khandpur, R.S., “Handbook of Biomedical Instrumentation”, TATA McGraw-Hill, New Delhi, 2017.
3. John G.Webster, “Medical Instrumentation Application and Design”, Third Edition, Wiley India , 2012.

Reference Books

1. Joseph J.Carr and John M.Brown, “Introduction to Biomedical Equipment Technology”, John Wiley and Sons, New York, 2011.
2. R.Anandanatarajan, “Biomedical Instrumentation and Measurements”, Second Edition, PHI Learning, 2016.

3. Mandeep singh, “Introduction to Biomedical Instrumentation”, Second Edition, Prentice Hall of India, New Delhi,2014
4. Shakti Chatterjee, Aubert Miller, “Biomedical Instrumentation Systems”, Cengage Learning, 2012
5. C.Raja Rao, Sujoy K.Guha, “ Principles of Medical Electronics and Biomedical Instrumentation”, Universities Press, 2010

Web References

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2. https://www.embs.org/about-biomedical-engineering/our-areas-of-research/diagnostic-therapetic systems
3. https://nptel.ac.in/courses/127/106/127106136/
4. medicinenet.com/script/main/art.asp?articlekey=6414
5. https://www.verywellhealth.com/cardiopulmonary-bypass-machine-used-for-surgery-3157220

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	-	2	2	2	-	1	-	-	-	-	2	-	1
2	3	2	-	2	2	2	-	1	-	-	-	-	2	-	1
3	3	-	-	2	3	3	-	1	-	-	-	-	2	-	1
4	3	-	2	2	3	2	-	1	-	-	-	-	2	-	1
5	3	2	2	3	3	2	-	1	-	-	-	-	2	-	1

Correlation Level: 1-Low, 2-Medium, 3- High

U20BMO402	TELEMEDICINE (Common to EEE, ECE, CSE, IT, ICE, CCE, AI&DS)	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives:

- To understand the classification of telemetry.
- To gain knowledge about biotelemetry principles
- To know about the applications of telemetry in various fields
- To provide the idea about the value of telemedicine
- To know the various applications in telemedicine.

Course Outcomes:

After completion of the course, the students will be able to

CO1 - Categorize the telemetry systems **(K2)**
CO2 - Understand the principles of biotelemetry in transmission of biological signals **(K3)**
CO3 - Apply the various Biotelemetry applications for diagnostics **(K3)**
CO4 - Acquire clear idea about the fundamentals of telemedicine **(K2)**
CO5 - Know about various applications of telemedicine **(K3)**

UNIT I INTRODUCTION TO TELEMETRY (9 Hrs)

Basic system, Classification, Non electrical telemetry systems, Mechanical and Pneumatic type, Voltage and Current telemetry systems, Local transmitters and Converters, Frequency telemetry system, Power Line carrier communication (PLCC).

UNIT II BIOTELEMETRY (9 Hrs)

Radio Telemetry principles, FM, AM, PCM, Transmission of biological data through radio telemetry.

UNIT III APPLICATION OF BIOTELEMETRY (9 Hrs)

Wireless Telemetry - Single Channel and Multi-channel Telemetry systems, Multi Patient Telemetry, Implantable Telemetry Systems, Ambulatory patient monitoring.

UNIT IV FUNDAMENTALS OF TELEMEDICINE (9 Hrs)

History and advancements in telemedicine, Benefits of telemedicine, Functional Block of a telemedicine system, Use of computers in distance mode of healthcare delivery, Familiarizing with technology of telemedicine, scanner, electro stethoscope, data reception equipment, Scope for telemedicine, Limitations of telemedicine.

UNIT V APPLICATIONS OF TELEMEDICINE (9 Hrs)

Telemedicine in Neuroscience, Telecardiology, Telepathology, Telepediatrics, Telepharmacy, Telepsychiatry and mental health, Veterinary.

Text Books

1. Marilyn J. Field , “A Guide to Assessing Telecommunications in Health Care”, Fourth Edition, Academy Press,2011.
2. Bashshur , R. L. , Sanders, J. H and Shannon, G, “Telemedicine: Theory and Practice”, Eight Edition, Springer,2014.
3. Olga (EDT), Ferre Roca, M. Sosa, “Handbook of Telemedicine”, Third Edition, IOS press 2009.

Reference Books

1. Bemmel, J.H. van, Musen, M.A. (Eds.), “Handbook of Medical Informatics”, Second Edition, Springer, 2010.

2. Simpson, W, “Video over IP. A practical guide to technology and applications’”, Ninth Edition, Focal Press, Elsevier, 2009.
3. Ferrer-Roca, O., Sosa-Iudicissa, , “Handbook of Telemedicine”, IOS Press, 2012
4. Norris, A.C, “Essentials of Telemedicine and Telecare”, Eight Edition, Wiley, 2017
5. Wotton, R., Craig, J., Patterson, V. (Eds.), “Introduction to Telemedicine”, Fifth Edition, Royal Society of Medicine Press Ltd., 2014.

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2. https://www.who.int/goe/publications/goe_telemedicine_2010.pdf
3. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5927731/

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	-	-	-	2	1	-	1	-	2	-	-	-	-	-
2	3	2	-	-	2	1	-	1	-	2	-	-	-	-	-
3	3	2	3	2	2	1	-	1	-	2	-	-	-	-	-
4	3	2	-	2	2	1	-	1	-	2	-	-	-	-	-
5	3	2	3	2	2	1	-	1	-	2	-	-	-	-	-

Correlation Level: 1-Low, 2-Medium, 3- High

	BASIC DBMS	L	T	P	C	Hrs
U20CCO401	(Common to EEE, ECE, MECH, CIVIL, ICE, Mechatronics, BME)	**3**	**0**	**0**	**3**	**45**

Course Objectives

- To understand about basics of Database Management System.
- To provide a general introduction to relational model and relational algebra.
- To study about normalization and SQL.
- To acquire knowledge about storage indexing and transaction management.
- To gain knowledge about the backup and recovery in database.

Course Outcomes

After completion of the course, the students will be able to

CO1 – Explain the concept of database management system.(**K2**)
CO2 – Create conceptual data model using entity relationship diagram.(**K2**)
CO3 – Analyze the various normalization.(**K4**)
CO4 – Describe the concept of storage indexing and transactions.(**K2**)
CO5 – Explain the database recovery and security.(**K2**)

UNIT I INTRODUCTION TO DATABASE MANAGEMENT (9 Hrs)

Introduction to Database Management systems – History - Characteristics – Users- three-level architecture- Entity-- relationship data model.

UNIT II THE RELATIONAL DATA MODEL AND RELATIONAL ALGEBRA (9 Hrs)

Data structures – Mapping E-R Model to Relational model – data manipulation – integrity – advantages – rules for fully relational systems – relational algebra – relational algebra queries.

UNIT III STRUCTURED QUERY LANGUAGE AND NORMALIZATION (9 Hrs)

SQL – Data definition – manipulation – views SQL in procedural programming – data integrity and constraints – triggers – data control – database security. Normalization – Undesirable properties – single-valued normalization – desirable properties of decompositions – multivalued dependencies

UNIT IV STORAGE INDEXING AND TRANSACTIONS MANAGEMENT (9 Hrs)

Different types of memories – secondary storage – buffer management – file structures – heap files – sorted files – index and types – indexed sequential file – B-tree – B+ tree. Transaction management – concepts – examples – schedules – serializability – concurrency control – deadlocks – lock and multiple granularity – nonlocking techniques.

UNIT V DATABASE BACKUP, RECOVERY AND SECURITY (9 Hrs)

Database system failure – backup – recovery and concept of log – log-based recovery techniques – types of recovery – log-based immediate update recovery technique. Database Security – violations – identifications and authentication – authorization / access control – security of statistical databases – audit policy – internet applications and encryption.

Text Books

1. Gupta.G.K, “Database Management Systems”, Tata McGraw Hill, 2011
2. Abraham Silberschatz, Henry F Korth, S Sudharshan, Database System Concepts 7th Edition, McGraw-Hill International Edition, 2019.
3. Ramez Elmasri and Shamkant Navathe, Durvasula V L N Somayajulu, Shyam K Gupta, “Fundamentals of Database Systems”, Pearson Education, United States of America, 2018.

Reference Books

1. Silberschatz, Korth.H and Sudarshan.S, “Database System Concepts”, 6th Edition, McGraw-HillInternational, 2011.
2. Hector Garcia-Molina, Jeffrey D.Ullman, Jennifer Widom, “Database System The Complete Book, 1st Edition, Pearson 2002.
3. Date CJ, Kannan A, Swamynathan S, An Introduction to Database System, 8th Edition, Pearson Education-2006.
4. Raghu Ramakrishna, Johannes Gehrke, Database Management Systems, 3rd Edition, McGraw Hill, 2014.
5. Ramez Elmasri, Durvasul VLN Somyazulu, Shamkant B Navathe, Shyam K Gupta, Fundamentals of Database Systems”, 7th Edition, Pearson Education, 2016.

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1. https://docs.oracle.com/cd/E11882_01/server.112/e41084/toc.htm MySQL Online Documentation
2. http://dev.mysql.com/doc/
3. http://www.rjspm.com/PDF/BCA-428%20Oracle.pdf
4. http://www.w3schools.com/
5. https://www.codecademy.com/learn/learn-

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	1	1	-	1	-	-	-	-	-	1	1	-	1	-
2	3	1	1	-	1	-	-	-	-	-	1	1	-	1	-
3	3	3	1	-	1	-	-	-	-	-	1	1	-	1	-
4	3	1	1	-	1	-	-	-	-	-	1	1	-	1	-
5	3	1	1	-	1	-	-	-	-	-	1	1	-	1	-

Correlation Level: 1-Low, 2-Medium, 3- High

		L	T	P	C	Hrs
U20CCO402	**INTRODUCTION TO COMMUNICATION SYSTEMS** (Common **to** EEE, CSE, IT, MECH, CIVIL, ICE, Mechatronics)	**3**	**0**	**0**	**3**	**45**

Course Objectives

- To provide basic knowledge of signals
- To study the various analog and digital modulation techniques
- To study the pulse modulation and multiplexing
- To infer Digital transmission techniques
- To provide knowledge about various multiple access technology and advanced communication techniques

Course Outcomes

After completion of the course, the students will be able to

CO1 - Comprehend the basic Characteristics of the signals.(**K2**)
CO2 - Comprehend needs of modulation and various analog modulation techniques (**K2**)
CO3 - Illustrate pulse modulation and multiplexing (**K3**)
CO4 - Explain Digital transmission techniques (**K2**)
CO5 - Describe multiple access techniques and advanced communication systems.(**K2**)

UNIT I SIGNAL ANALYSIS (9 Hrs)

Introduction to Signals- Representation and classification of Signals, Representation of signal in frequency domain, introduction to Spectrum of signal- Introduction to Fourier series and Fourier Transform

UNIT II ANALOG COMMUNICATION (9 Hrs)

Need for Modulation-– Block diagram of analog communication System- Amplitude Modulation – AM, DSBSC, SSBSC, modulators and demodulators – Angle modulation – PM and FM – modulators and demodulators – Superheterodyne receivers

UNIT III PULSE COMMUNICATION (9 Hrs)

Low pass sampling theorem – Quantization – PAM – PCM, DPCM, DM, and ADPCM And ADM - Time Division Multiplexing, Frequency Division Multiplexing

UNIT IV DIGITAL COMMUNICATION (9 Hrs)

Comparison of digital and analog communication system- Block diagram of digital communication system Phase shift keying – BPSK, DPSK, QPSK

UNIT V MULTIPLE ACCESS TECHNIQUES AND ADVANCED COMMUNICATION (9 Hrs)

Multiple Access techniques- FDMA, TDMA, CDMA- Frequency reuse, Handoff- Block diagram of advanced communication systems – satellite communication – Cellular Mobile Communication – Fibre Optical Communication System.

Text Books

1. H Taub, D L Schilling, G Saha, “Principles of Communication Systems”, 3rd edition, TMH 2007
2. S. Haykin, “Digital Communications”, John Wiley, 2005
3. B.P.Lathi,” Modern Digital and Analog Communication Systems”, 3rd edition, Oxford University Press, 2007

Reference Books

1. H P Hsu, Schaum Outline Series, “Analog and Digital Communications”, TMH 2006
2. B.Sklar,” Digital Communications Fundamentals and Applications”, 2nd edition Pearson Education 2007.
3. A.Bource Carson and Paul B.Crilly, “Communication Systems”, 5th Edition, Mc Graw Hill, 2010
4. Torrieri, Don, “Principles of Spread Spectrum Communication Systems”, Springer, 2015
5. Simon Haykin, “Communication Systems”, 4th Edition, John Wiley and Sons, 2001.

Web References

1. www.allaboutcircuits.com
2. https://nptel.ac.in/courses/108/102/108102096/
3. http://www.electronics-tutorials.ws
4. www.tutorialspoint.com
5. https://nptel.ac.in/courses/108/104/108104091/

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	1	1	-	1	-	-	-	-	-	1	1	-	1	-
2	3	1	1	-	1	-	-	-	-	-	1	1	-	1	-
3	3	3	1	-	1	-	-	-	-	-	1	1	-	1	-
4	3	1	1	-	1	-	-	-	-	-	1	1	-	1	-
5	3	1	1	-	1	-	-	-	-	-	1	1	-	1	-

Correlation Level: 1-Low, 2-Medium, 3- High

U20ADO401	KNOWLEDGE REPRESENTATIONS AND REASONING	L	T	P	C	Hrs
		3	0	0	3	45

(Common **to** EEE, ECE, IT,ICE, MECH, CIVIL, CCE,BME, Mechatronics)

Course Objectives

- To investigate the key concepts of knowledge representation (KR) techniques and different notations.
- To integrate the KR view as knowledge engineering approach to model organizational knowledge.
- To introduce the study of ontologies as a KR paradigm and applications of ontologies.
- To understand various KR techniques.
- To understand process, knowledge acquisition and sharing of ontology.

Course Outcomes

After completion of the course, the students will be able to

CO1 - Analyse and design knowledge based systems intended for computer implementation.**(K3)**

CO2 - Acquire theoretical knowledge about principles for logic-based representation and reasoning. **(K2)**

CO3 - Ability to understand knowledge-engineering process. **(K2)**

CO4 - Ability to implement production systems, frames, inheritance systems and approaches to handle uncertain or incomplete knowledge. **(K3)**

CO5 - Learn to think through the ethics surrounding privacy, data sharing and algorithmic decision-making.**(K2)**

UNIT I **(9 Hrs)**

The Key Concepts: Knowledge, Representation, Reasoning, Why knowledge representation and reasoning, Role of logic. Logic: Historical background, Representing knowledge in logic, Varieties of logic, Name, Type, Measures, Unity Amidst diversity

UNIT II **(9 Hrs)**

Ontology: Ontological categories, Philosophical background, Top-level categories, Describing physical entities, Defining abstractions, Sets, Collections, Types and Categories, Space and Time.

UNIT III **(9 Hrs)**

Knowledge Representations: Knowledge Engineering, Representing structure in frames, Rules and data, Object-oriented systems, Natural language Semantics, Levels of representation.

UNIT IV INDUSTRIALIZATION, OPPURTUNITIES AND APPLICATIONS **(9 Hrs)**

Processes: Times, Events and Situations, Classification of processes, Procedures, Processes and Histories, Concurrent processes, Computation, Constraint satisfaction, Change Contexts: Syntax of contexts, Semantics of contexts, First-order reasoning in contexts, Modal reasoning in contexts, Encapsulating objects in contexts.

UNIT V ETHICS AND RECENT TRENDS **(9 Hrs)**

Knowledge Soup: Vagueness, Uncertainty, Randomness and Ignorance, Limitations of logic, Fuzzy logic, Nonmonotonic Logic, Theories, Models and the world, Semiotics. Knowledge Acquisition and Sharing: Sharing Ontologies, Conceptual schema, Accommodating multiple paradigms, Relating different knowledge representations, Language patterns, Tools for knowledge acquisition.

Text Books

1. John F. Sowa, Thomson Learning "Knowledge Representation logical, Philosophical, and Computational Foundations", Course Technology Inc. publication, 1999.
2. Ronald J. Brachman, Hector J. Levesque,"Knowledge Representation and Reasoning", Morgan Kaufmann; 1st edition, 2004.
3. Eileen Cornell Way "Knowledge Representation and Metaphor" Springer; 1991st edition, 1991.

Reference Books

1. Trevor Bench-Capon, "Knowledge representation: an approach to artificial intelligence", Academic Press, 2014.
2. YuliaKahl, Michael Gelfond "Knowledge Representation, Reasoning, and the Design of Intelligent Agents The Answer-Set Programming Approach", Cambridge University Press; 1st edition, 2014.
3. Arthur B. Markman, "Knowledge representation" Psychology Press; 1st edition, 1998.
4. SanidaOmerović, GregaJakus, V. Milutinovic, SašoTomažič "Concepts, Ontologies, and Knowledge Representation" Springer; 2013.
5. Bernhard Nebel, Gerhard Lakemeyer "Foundations of Knowledge Representation and Reasoning" Springer, 1994.

Web References

1. https://www.javatpoint.com/knowledge-representation-in-ai
2. https://nptel.ac.in/courses/106/106/106106140/
3. https://www.youtube.com/watch?v=kXlr6ydiPAQ

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	1	2	2	1	3	-	-	-	-	-	-	-	-	-	1
2	2	3	2	3	2	-	-	-	-	-	-	-	-	-	-
3	1	3	1	2	2	-	-	-	-	-	-	-	-	-	-
4	1	2	1	2	1	-	-	-	-	-	-	-	-	-	1
5	2	1	3	1	3	-	-	2	-	-	-	-	-	-	-

Correlation Level: 1-Low, 2-Medium, 3- High

		L	T	P	C	Hrs
U20ADO402	**INTRODUCTION TO DATA SCIENCE**	**3**	**0**	**0**	**3**	**45**

(Common **to** EEE, ECE, IT,ICE, MECH, CIVIL, CCE,BME, Mechatronics)

Course Objectives

- To learn the basics of data science
- To enable the students to understand the statistics and probability.
- To understand the tools in developing and visualizing data.
- To gain good knowledge in the application areas of data science.
- To inculcate the perceiving, ethics surrounding privacy and acting of data science applications.

Course Outcomes

After completion of the course, the students will be able to

CO1 - Explore the fundamental concepts of data science. **(K2)**

CO2 - To understand the Mathematical Knowledge for Data Science.**(K2)**

CO3 - Visualize and present the inference using various tools. **(K3)**

CO4 - To expose the different opportunities in Industries. **(K3)**

CO5 - Learn to think through the ethics surrounding privacy, data sharing and decision-making.**(K2)**

UNIT I INTRODUCTION TO DATA SCIENCE (9Hrs)

Definition – Big Data and Data Science Hype – Why data science – Getting Past the Hype – The Current Landscape – Who is Data Scientist? - Data Science Process Overview – Defining goals – Retrieving data – Data preparation – Data exploration – Data modeling – Presentation..

UNIT II MATHEMATICAL PRELIMINARIES (9Hrs)

Probability: Probability vs. Statistics – Compound Events and Independence – Conditional Probability – Probability Distribution. Descriptive Statistics: Centrality Measures – Variability Measures - Interpreting Variance – Characterizing Distributions. Correlation Analysis: Correlation Coefficient – The Power and Significance – Detection Periodicities. Logarithms: Logarithms and Multiplying Probabilities – Logarithms and Ratios – Logarithms and Normalizing Skewed Distributions.

UNIT IIIDATA SCIENCE TOOLS (9Hrs)

Introduction to Data Science Tool – Data Cleaning Tools – Data Munging and Modelling Tools – Data Visualization Tools – Tools for Data Science.

UNIT IV INDUSTRIALIZATION, OPPURTUNITIES AND APPLICATIONS (9Hrs)

Data Economy and Industrialization – Introduction: Data Economy, Data Industry, Data Services – Data Science Application: Introduction, General Application Guidance - Different Domain – Advertising – Aerospace and Astronomy – Arts, Creative Design and Humanities – Bioinformatics – Consulting Services – Ecology and Environment – Ecommerce and Retail - Education – Engineering – Finance and Economy – Gaming.

UNIT V ETHICS AND RECENT TRENDS (9Hrs)

Data Science Ethics – Doing good data science – Owners of the data - Valuing different aspects of privacy - Getting informed consent - The Five Cs – Diversity – Inclusion – Future Trends.

Text Books

1. Davy Cielen, Arno D. B. Meysman, Mohamed Ali, “Introducing Data Science”, Manning Publications Co., 1st edition, 2016.
2. Chirag Shah, “A Hands on Introduction to Data Science“, Cambridge University Press, 2020.
3. SinanOzdemir, “Principles of Data Science”, Packt Publication, 2016.
4. D J Patil, Hilary Mason, Mike Loukides,“Ethics and Data Science”, O’ Reilly, 1st edition, 2018.

Reference Books

1. Hector Guerrero, “Excel Data Analysis: Modeling and Simulation”, Springer International Publishing, 2nd Edition, 2019.
2. Paul Curzon, Peter W. McOwan, “The Power of Computational Thinking”, World Scientific Publishing, 2017.
3. Steven S. Skiena, “Data Science Design Manual”, Spring International Publication, 2017.
4. RajendraAkerkar, PritiSrinivasSajja, “Intelligence Techniques for Data Science”, Spring International Publication, 2016.
5. Longbing Cao “Data Science Thinking: The Next Scientific, Technological and Economic Revolution”, Spring International Publication, 2018.

Web References

1. https://www.youtube.com/watch?v=-ETQ97mXXF0&ab_channel=edureka%21
2. https://www.javatpoint.com/data-science
3. https://www.coursera.org/browse/data-science /

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	1	2	3	2	2	-	-	-	-	-	-	-	-	-	-
2	2	2	2	1	1	-	-	-	-	-	-	-	-	-	-
3	2	1	3	2	3	-	-	-	-	-	-	-	-	2	-
4	1	2	2	1	1	-	-	-	-	-	-	-	-	-	1
5	2	1	1	2	1	-	-	1	-	-	-	-	-	-	-

Correlation Level: 1-Low, 2-Medium, 3- High

SRI MANAKULA VINAYAGAR
ENGINEERING COLLEGE
(An Autonomous Institution)

Puducherry

B.TECH. INSTRUMENTATION AND CONTROL ENGINEERING

ACADEMIC REGULATIONS 2019
(R-2019)

CURRICULUM

COLLEGE VISION AND MISSION

Vision

To be globally recognized for excellence in quality education, innovation, and research for the transformation of lives to serve the society

Mission

M1: Quality Education: To provide comprehensive academic system that amalgamates the cutting edge technologies with best practices

M2: **Research and Innovation**: To foster value- based research and innovation in collaboration with industries and Institutions globally for creating intellectuals with new avenues

M3: Employability and Entrepreneurship: To inculcate the employability and entrepreneurial skills through value and skill based training

M4 Ethical Values: To Instill deep sense of human values by blending societal righteousness with academic professionalism for the growth of society

DEPARTMENT VISION AND MISSION

Vision

To provide quality education, training and research in the area of Instrumentation and Control Engineering to meet the industrial and societal needs with ethical values

Mission

M1: Quality education: To impart technical knowledge, leadership and managerial skills to meet the current industrial and societal needs

M2: Research and Innovation: To foster innovation, research and development for the benefit of global community

M3: Employability and Entrepreneurship: To enhance the employability skills and inculcate entrepreneurial attitude.

M4: Ethical Values: To provide extension services to rural society and instill ethical values among the students

PROGRAMME OUTCOMES (POs)

PO1: Engineering knowledge:

Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2: Problem analysis:

Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3: Design/development of solutions:

Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4: Conduct investigations of complex problems:

Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data and synthesis of the information to provide valid conclusions.

PO5: **Modern tool usage:**

Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO6: The engineer and society:

Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7: Environment and sustainability:

Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of and need for sustainable development.

PO8: Ethics:

Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9: Individual and team work:

Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10: Communication:

Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11: Project management and finance:

Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12: Life-long learning:

Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

PEO 1: Core Competency:

Solve real-life engineering problems, design and development of innovative and cost-effective products exhibiting a solid foundation in Instrumentation and Control Engineering fundamentals to cater needs of society.

PEO 2: State of the art technology:

To impart state of the art technology to the students in the field of Instrumentation and Control Engineering to meet the industrial needs.

PEO 3: Multi-disciplinary skills:

To develop Multi-disciplinary skills and acquire leadership qualities along with professional and ethical values.

PEO 4: Innovation and entrepreneurship:

To promote innovation and entrepreneurship in designing and developing instrumentation systems to address social and technical challenges.

PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO1: Basic Knowledge in ICE:

Apply the knowledge of Instrumentation and Control Engineering to relate the fundamental concepts of Instrumentation (measurement, control, operation, monitoring and maintenance) to varied measurement systems and models.

PSO2: Advanced Tools for industrial automation:

Apply the knowledge of hardware and software tools for industrial automation systems

PSO3: Design and development of Instrumentation systems:

Ability to design and develop instrumentation systems to solve real time applications.

STRUCTURE FOR UNDERGRADUATE ENGINEERING PROGRAM

Sl.No	Course Category	No. of Credits
1	Humanities and Social Sciences (HS)	**05**
2	Basic Sciences(BS)	**22**
3	Engineering Sciences (ES)	**56**
4	Professional Core (PC)	**61**
5	Professional Electives (PE)	**18**
6	Open Electives (OE)	**09**
7	Internship / Project Work	**12**
8	Employability Enhancement Courses (EEC) **	**-**
9	Mandatory courses (MC) **	**-**
Total		**183**

SCHEME OF CREDIT DISTRIBUTION – SUMMARY

Sl. No	Course Category	Credits per Semester								Total Credits
		I	II	III	IV	V	VI	VII	VIII	
1	Humanities and Social Sciences (HS)	4	-	-	-	3	-	1	1	**5**
2	Basic Sciences (BS)	18	12	3	3	4	-	-	-	**22**
3	Engineering Sciences (ES)	8	18	4	4	-	-	-	-	**56**
4	Professional Core (PC)	-	-	14	8	12	15	9	3	**61**
5	Professional Electives (PE)	-	-	-	3	3	3	3	6	**18**
6	Open Electives (OE)	-	-	-	3	-	3	3	-	**9**
7	Project Work (PW)	-	-	-	-	-	-	2	8	**10**
8	Internship (PW)	-	-	-	-	-	-	2	-	**02**
9	Employability Enhancement Courses (EEC*)	-	-	-	-	-	-	-	-	-
10	Mandatory courses (MC*)	-	-	-	-	-	-	-	-	-
Total		**30**	**30**	**21**	**21**	**22**	**21**	**20**	**18**	**183**

**** EEC and MC are not included for CGPA calculation***

SEMESTER – I										
Sl. No.	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Theory										
1	T101	Mathematics – I	BS	3	1	0	4	25	75	100
2	T102	Physics	BS	4	0	0	4	25	75	100
3	T103	Chemistry	BS	4	0	0	4	25	75	100
4	T110	Basic Civil and Mechanical Engineering	ES	4	0	0	4	25	75	100
5	T111	Engineering Mechanics	ES	3	1	0	4	25	75	100
6	T112	Communicative English	HS	4	0	0	4	25	75	100
Practical										
6	P104	Physics Lab	BS	0	0	3	2	50	50	100
7	P105	Chemistry lab	BS	0	0	3	2	50	50	100
8	P106	Workshop Practice	BS	0	0	3	2	50	50	100
							30	300	600	900

SEMESTER – II										
Sl. No.	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Theory										
1	T107	Mathematics II	BS	3	1	0	4	25	75	100
2	T108	Material Science	BS	4	0	0	4	25	75	100
3	T109	Environmental Science	BS	4	0	0	4	25	75	100
4	T104	Basic Electrical and Electronics Engineering	ES	3	1	0	4	25	75	100
5	T105	Engineering Thermodynamics	ES	3	1	0	4	25	75	100
6	T106	Computer Programming	ES	3	1	0	4	25	75	100
Practical										
7	P101	Computer Programming Lab	ES	0	0	3	2	50	50	100
8	P102	Engineering Graphics	ES	0	0	3	2	50	50	100
9	P103	Basic Electrical and Electronics Lab	ES	0	0	3	2	50	50	100
Mandatory Course										
11	P107	NSS / NCC*	MC	0	0	0	-	-	-	-
							30	300	600	900

To be completed in I and II semesters, under Pass / Fail option only and not counted for CGPA calculation

SEMESTER – III										
Sl. No.	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Theory										
1	U19ICT31	Complex Analysis and Applications of Partial Differential Equations	BS	2	2	0	3	25	75	100
2	U19ICT32	Data Structures	ES	3	0	0	3	25	75	100
3	U19ICT33	Circuit Theory	PC	2	2	0	3	25	75	100
4	U19ICT34	Electrical and Electronic measurements	PC	3	0	0	3	25	75	100
5	U19ICT35	Electronics Engineering	PC	3	0	0	3	25	75	100
6	U19ICT36	Transducer Engineering	PC	3	0	0	3	25	75	100
Practical										
7	U19ICP31	Data Structures Lab	ES	0	0	2	1	50	50	100
8	U19ICP32	Electronics Engineering Lab	PC	0	0	2	1	50	50	100
9	U19ICP33	Transducer Engineering Lab	PC	0	0	2	1	50	50	100
Employability Enhancement Course										
10	U19ICC34	Certification Course-I**	EEC	0	0	4	-	100	-	100
11	U19ICS31	Skill Development Course 1: General Proficiency - I	EEC	0	0	2	-	100	-	100
12	U19ICS32	Skill Development Course 2 *	EEC	0	0	2	-	100	-	100
Mandatory Course										
13	U19ICM31	Physical Education	MC	0	0	2	-	100	-	100
							21	700	600	1300

SEMESTER – IV										
Sl. No	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Theory										
1	U19ICT41	Probability and Statistics	BS	2	2	0	3	25	75	100
2	U19ICT42	Programming in Java	ES	3	0	0	3	25	75	100
3	U19ICT43	Analog Integrated Circuits	PC	3	0	0	3	25	75	100
4	U19ICT44	Digital Logic Circuits	PC	2	2	0	3	25	75	100
5	U19ICE4X	Professional Elective –I #	PE	3	0	0	3	25	75	100
6	U19XXO4X	Open Elective-I $	OE	3	0	0	3	25	75	100
Practical										
7	U19ICP41	Programming in Java Lab	ES	0	0	2	1	50	50	100
8	U19ICP42	Electrical machines Lab	PC	0	0	2	1	50	50	100
9	U19ICP43	Analog and Digital circuits Lab	PC	0	0	2	1	50	50	100

Employability Enhancement Course										
10	U19ICC4X	Certification Course-II**	EEC	0	0	4	-	100	-	100
11	U19ICS41	Skill Development Course 3: General Proficiency - II	EEC	0	0	2	-	100	-	100
12	U19ICS42	Skill Development Course 4 *	EEC	0	0	2	-	100	-	100
Mandatory Course										
13	U19ICM41	Indian Constitution	MC	2	0	0	-	100	-	100
							21	700	600	1300

[#] Professional Electives are to be selected from the list given in Annexure I
[$] Open electives are to be selected from the list given in Annexure II
*** Certification courses are to be selected from the list given in Annexure III*
** Skill Development Courses (2 and 4) are to be selected from the list given in Annexure IV*

SEMESTER – V										
Sl. No.	**Course Code**	**Course Title**	**Category**	**Periods**			**Credits**	**Max. Marks**		
				L	**T**	**P**		**CAM**	**ESM**	**Total**
Theory										
1	U19ICT51	Numerical methods	BS	2	2	0	3	25	75	100
2	U19ICT52	Industrial Instrumentation-1	PC	3	0	0	3	25	75	100
3	U19ICT53	Industrial Unit Operations	PC	3	0	0	3	25	75	100
4	U19ICT54	Microprocessor and Embedded system design	PC	3	0	0	3	25	75	100
5	U19ICE5X	Professional Elective -II [#]	PE	3	0	0	3	25	75	100
6	U19XXO5X	Open Elective-II [$]	HS	3	0	0	3	25	75	100
Practical										
7	U19ICP51	Numerical methods Lab	BS	0	0	2	1	50	50	100
8	U19ICP52	Industrial Instrumentation lab	PC	0	0	2	1	50	50	100
9	U19ICP53	Instrumentation system design Lab	PC	0	0	2	1	50	50	100
10	U19ICP54	Microprocessor and Embedded system design lab	PC	0	0	2	1	50	50	100
Employability Enhancement Course										
11	U19ICC5X	Certification Course-III**	EEC	0	0	4	-	100	-	100
12	U19ICS51	Skill Development Course 5: Foreign Language / IELTS - I	EEC	0	0	2	-	100	-	100
13	U19ICS52	Skill Development Course 6: Presentation Skills using ICT	EEC	0	0	2	-	100	-	100
Mandatory Course										
14	U19ICM51	Essence of Indian Traditional Knowledge	MC	2	0	0	-	100	-	100
							22	750	650	1400

SEMESTER – VI										
Sl. No	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Theory										
1	U19ICT61	Industrial Instrumentation-II	PC	3	0	0	3	25	75	100
2	U19ICT62	Internet of Things (IoT) for automation	PC	3	0	0	3	25	75	100
3	U19ICT63	Process Control	PC	3	0	0	3	25	75	100
4	U19ICT64	Robotics and Automation	PC	3	0	0	3	25	75	100
5	U19ICE6X	Professional Elective – III #	PE	3	0	0	3	25	75	100
6	U19XXO6X	Open Elective-III $	OE	3	0	0	3	25	75	100
Practical										
7	U19ICP61	Internet of Things lab	PC	0	0	2	1	50	50	100
8	U19ICP62	Process Control lab	PC	0	0	2	1	50	50	100
9	U19ICP63	Simulation Lab	PC	0	0	2	1	50	50	100
Employability Enhancement Course										
10	U19ICC6X	Certification Course-IV**	EEC	0	0	4	-	100	0	100
11	U19ICS61	Skill Development Course 7: Foreign Language / IELTS - II	EEC	0	0	2	-	100	-	100
12	U19ICS62	Skill Development Course 8: Technical Seminar	EEC	2	0	0	-	100	-	100
13	U19ICS63	Skill Development Course 9: NPTEL / MOOC - I	EEC	0	0	0	-	100	-	100
Mandatory Course										
14	U19ICM64	Professional Ethics	MC	2	0	0	-	100	0	100
							21	800	600	1400

 # Professional Electives are to be selected from the list given in Annexure I
$ Open electives are to be selected from the list given in Annexure II
*** Certification courses are to be selected from the list given in Annexure III*

SEMESTER – VII										
Sl. No	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Theory										
1	U19ICT71	Biomedical Instrumentation	PC	3	0	0	3	25	75	100
2	U19ICT72	Process Automation	PC	3	0	0	3	25	75	100
3	U19ICE7X	Professional Elective – IV #	PE	3	0	0	3	25	75	100
4	U19XXO7X	Open Elective – IV $	OE	3	0	0	3	25	75	100
Practical										
5	U19ICP71	Business Basics for Entrepreneur	HS	0	0	2	1	100	-	100
6	U19ICP72	Process Automation lab	PC	0	0	2	1	50	50	100
7	U19ICP73	Virtual Instrumentation Lab	PC	0	0	2	1	50	50	100
8	U19ICP74	Comprehensive viva voce	PC	0	0	2	1	50	50	100
Project Work										

9	U19ICW71	Project Phase – I	PW	0	0	4	2	50	50	100
10	U19ICW72	Internship / In-plant Training	PW	0	0	0	2	100	-	100
							20	500	500	1000

SEMESTER – VIII										
Sl. No.	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Theory										
1	U19ICT81	Instrumentation in process industries	PC	3	0	0	3	25	75	100
2	U19ICE8X	Professional Elective – V#	PE	3	0	0	3	25	75	100
3	U19ICE8X	Professional Elective – VI#	PE	3	0	0	3	25	75	100
Practical										
4	U19ICP81	Entrepreneurship Management	HS	0	0	2	1	100	0	100
Project Work										
5	U19ICW81	Project phase – II	PW	0	0	16	8	40	60	100
Employability Enhancement Course										
6	U19ICS81	Skill Development Course 10: NPTEL / MOOC -II	EEC	0	0	0	-	100	-	100
							18	315	285	600
TOTAL CREDITS							**183**			

 # Professional Electives are to be selected from the list given in Annexure I
$ Open electives are to be selected from the list given in Annexure II

Annexure - I

PROFESSIONAL ELECTIVE COURSES

Professional Elective – I (Offered in Semester IV)		
Sl. No.	**Course Code**	**Course Title**
1	U19ICE41	Electric drives and control
2	U19ICE42	Electric and Hybrid Vehicles
3	U19ICE43	Communication Systems
4	U19ICE44	Signals and Systems
5	U19ICE45	Electrical Machines
Professional Elective – II (Offered in Semester V)		
Sl. No.	**Course Code**	**Course Title**
1	U19ICE51	Telemetry and Tele control
2	U19ICE52	Advanced control system
3	U19ICE53	Industrial electronics

4	U19ICE54	MEMS and NEMS
5	U19ICE55	Analytical Instrumentation
Professional Elective – III (Offered in Semester VI)		
Sl. No.	**Course Code**	**Course Title**
1	U19ICE61	Applied soft computing
2	U19ICE62	Power plant Instrumentation
3	U19ICE63	Building Automation
4	U19ICE64	Web Based Instrumentation
5	U19ICE65	Digital Control system
Professional Elective – IV (Offered in Semester VII)		
Sl. No.	**Course Code**	**Course Title**
1	U19ICE71	Computer control of processes
2	U19ICE72	Automotive Instrumentation system
3	U19ICE73	Fault Detection and Diagnosis
4	U19ICE74	Modern Electronic Instrumentation
5	U19ICE75	Fiber optics and Laser Instrumentation
Professional Elective – V (Offered in Semester VIII)		
Sl. No.	**Course Code**	**Course Title**
1	U19ICE80	Industrial safety and management
2	U19ICE81	System Identification and Adaptive Control
3	U19ICE82	Advanced Instrumentation system
4	U19ICE83	Industrial Data Networks
5	U19ICE84	Field Instrumentation and cabling
Professional Elective – VI (Offered in Semester VIII)		
Sl. No.	**Course Code**	**Course Title**
1	U19ICE85	Design of Process Control System Components
2	U19ICE86	Renewable Energy Resources
3	U19ICE87	Industry 4.0
4	U19ICE88	Cyber Security in Industrial Automation
5	U19ICE89	Piping and Instrumentation Diagram

Annexure - II
OPEN ELECTIVE COURSES

Sl. No	Course Code	Course Title	Offering Department	Permitted Departments
Open Elective – I (Offered in Semester IV)				
1	U19EEO41	Solar Photovoltaic Fundamentals and Applications	EEE	ECE, ICE, MECH, CIVIL, Mechatronics
2	U19EEO42	Electrical Safety	EEE	ECE, ICE, MECH, CIVIL, Mechatronics, BME, IT, CSE
3	U19ECO41	Engineering Computation with MATLAB	ECE	ICE, EEE, MECH, CIVIL, BME, Mechatronics
4	U19ECO42	Consumer Electronics	ECE	EEE, ICE, CSE, MECH, IT, CIVIL, BME, Mechatronics
5	U19CSO41	Web Development	CSE	EEE, ECE, ICE, MECH, CIVIL, BME, Mechatronics
6	U19CSO42	Analysis of Algorithms	CSE	EEE, ECE, ICE, MECH, CIVIL, BME, Mechatronics
7	U19CSO43	Programming in JAVA	CSE	ECE, MECH, Mechatronics
8	U19ITO41	Database System: Design & Development	IT	EEE, ECE, ICE, BME
9	U19ITO42	R programming	IT	EEE, ECE, ICE, BME, MECH, Mechatronics
10	U19ICO41	Sensors and Transducers	ICE	ECE, CSE, IT, MECH, CIVIL
11	U19ICO42	Control System Engineering	ICE	CSE, IT, MECH
12	U19MEO41	Rapid Prototyping	MECH	EEE, ECE, ICE, CIVIL, BME
13	U19MEO42	Material Handling System	MECH	EEE, ICE, CIVIL, Mechatronics
14	U19MEO43	Power Plants for Electrical Engineering	MECH	EEE
15	U19CEO41	Energy and Environment	CIVIL	EEE, ECE, MECH, BME, IT, Mechatronics
16	U19CEO42	Building Science and Engineering	CIVIL	EEE, MECH, BME
17	U19BMO41	Medical Electronics	BME	EEE, ECE, CSE, IT, ICE, MECH, Mechatronics
18	U19BMO42	Telemedicine	BME	EEE, ECE, CSE, IT, ICE
19	U19CCO41	Basic DBMS	CCE	EEE, ECE, MECH, CIVIL, ICE, Mechatronics, BME
20	U19CCO42	Introduction to Communication Systems	CCE	EEE, CSE, IT, MECH, CIVIL, ICE, Mechatronics
Open Elective – II / Open Elective – III				
1	U19HSO51 / U19HSO61	Product Development and Design	MBA	**Common to B. Tech** (Offered in Semester V for **EEE, ECE, ICE, CIVIL, BME**) (Offered in Semester VI for **CSE, IT,**
2	U19HSO52 / U19HSO62	Intellectual Property and Rights	MBA	
3	U19HSO53 / U19HSO63	Marketing Management and Research	MBA	

4	U19HSO54 / U19HSO64	Project Management for Engineers	MBA	**MECH, Mechatronics**)
5	U19HSO55 / U19HSO65	Finance for Engineers	MBA	
Open Elective – II / Open Elective – III (Offered in Semester V for **CSE, IT, MECH, Mechatronics**) (Offered in Semester VI for **EEE, ECE, ICE, CIVIL, BME**)				
1	U19EEO53 / U19EEO63	Conventional and Non-Conventional Energy Sources	EEE	ECE, ICE, MECH, CIVIL, BME, Mechatronics
2	U19EEO54 / U19EEO64	Industrial Drives and Control	EEE	ECE, ICE, MECH, Mechatronics
3	U19ECO53 / U19ECO63	Electronic Product Design and Packaging	ECE	EEE, CSE, IT, ICE MECH, BME, Mechatronics
4	U19ECO54 / U19ECO64	Automotive Electronics	ECE	EEE, ECE, ICE, MECH
5	U19CSO54 / U19CSO64	Platform Technology	CSE	EEE, ECE, ICE, MECH, CIVIL, BME
6	U19CSO55 / U19CSO65	Graphics Designing	CSE	EEE, ECE, ICE, MECH, CIVIL, BME
7	U19ITO53 / U19ITO63	Essentials of Data Science	IT	EEE, ECE, ICE, MECH, CIVIL, BME
8	U19ITO54 / U19ITO64	Mobile App Development	IT	EEE, ECE, ICE, MECH, CIVIL, BME, Mechatronics
9	U19ITO55 / U19ITO65	Data Structures	IT	MECH
10	U19ICO53 / U19ICO63	Fuzzy logic and neural networks	ICE	CSE, IT, CIVIL, BME
11	U19ICO54 / U19ICO64	Measurement and Instrumentation	ICE	ECE, Mechatronics
12	U19MEO54 / U19MEO64	Heating, ventilation and air conditioning system (HVAC)	MECH	EEE, ECE, ICE, CIVIL
13	U19MEO55 / U19MEO65	Creativity Innovation and New Product Development	MECH	EEE, ECE, ICE, CIVIL, BME, Mechatronics
14	U19CEO53 / U19CEO63	Disaster Management	CIVIL	EEE, ECE, CSE, IT, ICE, MECH, BME
15	U19CEO54 / U19CEO64	Air Pollution and Solid Waste Management	CIVIL	EEE, ECE, CSE, IT, ICE, MECH, BME
16	U19BMO53 / U19BMO63	Biometric Systems	BME	EEE, ECE, CSE, IT, ICE, MECH, Mechatronics
17	U19BMO54 / U19BMO64	Medical Robotics	BME	EEE, ECE, CSE, IT, ICE, MECH, CIVIL , Mechatronics
18	U19CCO53 / U19CCO63	Network Essentials	CCE	EEE, MECH, CIVIL, ICE, Mechatronics, BME
19	U19CCO54 / U19CCO64	Web Programming	CCE	EEE, ECE, MECH, CIVIL, ICE, Mechatronics, BME
20	U19ADO51 / U19ADO61	Principle of Artificial Intelligence and Machine Learning	AI&DS	EEE, ECE, CSE, IT, ICE, MECH, CIVIL
21	U19ADO52 / U19ADO62	Data science Application of Vision	AI&DS	EEE, ECE, CSE, IT, ICE, MECH, CIVIL, BME, Mechatronics
Open Elective – IV (Offered in Semester VII)				
1	U19EEO75	Hybrid and Electrical Vehicle	EEE	ECE, Mechatronics , MECH

2	U19EEO76	Electrical Energy Conservation and auditing	EEE	ECE, ICE, MECH, CIVIL, BME, Mechatronics
3	U19ECO75	IoT and its Applications	ECE	EEE, ICE, CSE, MECH, IT, CIVIL
4	U19ECO76	Cellular and Mobile Communications	ECE	EEE, ICE, CSE, MECH, IT, CIVIL, BME, Mechatronics
5	U19CSO76	Artificial Intelligence	CSE	EEE, ICE, CIVIL, MECH
6	U19CSO77	Cloud Technology and its Applications	CSE	EEE, ICE, MECH, CIVIL, BME, Mechatronics
7	U19ITO76	Automation Techniques & Tools- DevOps	IT	EEE, ECE, ICE, CSE, MECH, CIVIL, BME, Mechatronics
8	U19ITO77	Augmented and Virtual Reality	IT	EEE, ICE, MECH, CIVIL, BME
9	U19ICO75	Process Automation	ICE	EEE, ECE, CSE, MECH, IT, CIVIL, BME, Mechatronics.
10	U19ICO76	Virtual Instrumentation	ICE	EEE, ECE, MECH, Mechatronics
11	U19MEO76	Principles of Hydraulic and Pneumatic System	MECH	EEE, ECE, ICE, CIVIL
12	U19MEO77	Supply Chain Management	MECH	EEE, ECE, CIVIL, Mechatronics
13	U19CEO75	Energy Efficient Buildings	CIVIL	EEE, ECE, MECH
14	U19CEO76	Global Warming and Climate Change	CIVIL	EEE, ECE, CSE, IT, ICE, MECH, BME
15	U19MCO71	Building Automation	Mechatronics	MECH, CIVIL
16	U19MCO72	Automation in Manufacturing Systems	Mechatronics	MECH, CIVIL
17	U19BMO75	Internet of Things for Healthcare	BME	EEE, ECE, ICE
18	U19BMO76	Telehealth Technology	BME	EEE, ECE, ICE
19	U19CCO75	Data Science using python	CCE	EEE, ECE, MECH, CIVIL, ICE, Mechatronics, BME,
20	U19CCO76	Mobile Applications Development using Android	CCE	EEE, ECE, MECH, CIVIL, ICE, Mechatronics, BME,
21	U19ADO73	Data Science Application of NLP	AI&DS	EEE, ECE, CSE, IT, ICE, MECH, CIVIL, BME, Mechatronics
22	U19ADO74	Artificial Intelligence Applications	AI&DS	EEE, ECE, CSE, IT, ICE, MECH, CIVIL, BME

Annexure – III

EMPLOYABILITY ENHANCEMENT COURSES – (A). CERTIFICATION COURSES

Course Code	Course Title
U19ICCX1	Advanced Java Programming
U19ICCX2	Cloud Computing
U19ICCX3	Embedded system using Arduino
U19ICCX4	Fundamentals of IoT
U19ICCX5	Fuzzy Logic and Neural Networks
U19ICCX6	Industrial Automation
U19ICCX7	PLC
U19ICCX8	Pneumatics Automation
U19ICCX9	Python Programming

Annexure - IV

EMPLOYABILITY ENHANCEMENT COURSES – (B). SKILL DEVELOPMENT COURSES

Sl. No	Course Code	Course Title
1	U19ICS31	Skill Development Course 1 : General Proficiency - I
2	U19ICS32	Skill Development Course2 *
		1) Troubleshooting of Electronic Equipments
		2) Office Automation
		3) Mobile Phone Servicing
3	U19ICS41	Skill Development Course 3 : General Proficiency - II
4	U19ICS42	Skill Development Course4 *
		1) Calibration of Measuring Instruments
		2) Introduction to Robotics
		3) Labview Implementation
5	U19ICS51	Skill Development Course5 : Foreign Language/ IELTS -I
6	U19ICS52	Skill Development Course6 : Presentation Skills using ICT
7	U19ICS61	Skill Development Course7 : Foreign Language/ IELTS - II
8	U19ICS62	Skill Development Course8 : Technical Seminar
9	U19ICS63	Skill Development Course9 : NPTEL/MOOC - I
10	U19ICS81	Skill Development Course10 : NPTEL/MOOC-II

**** Any one course to be selected from the list***

T102	PHYSICS	L	T	P	C	Hrs
		3	0	0	3	45

(Common to all branches)

Course Objectives

- To understand the concepts of physics and its significant contributions in the advancement of technology and invention of new products that dramatically transformed modern-day society.
- To expose the students to different areas of physics which have direct relevance and applications to different Engineering disciplines
- To understand the concepts and applications of Ultrasonic, optics and some optical devices, Lasers and Fiber optics, Nuclear energy sources and wave mechanics

Course Outcomes

After successful completion of the course, students will be able to

CO1- Understand the basic concepts of sound Engineering and ideas to get good audibility inside a hall. Also gain knowledge about the production, propagation, properties and application of ultrasonic waves. **(K2)**

CO2 - Interpret the different characteristic behavior of light waves with air, glass, lens, grating, prism etc., Gain adequate knowledge about the interference, diffraction and polarization phenomenon of light waves and their applications. **(K2)**

CO3- Understand the principle mechanism of laser light; distinguish between ordinary light and laser light. Basic idea about the various laser sources. Also gain knowledge about the optical fibers and their importance in communication. **(K3)**

CO4 - Understand the basic concept of quantum mechanics, dual nature of matter, and importance of energy of electrons associated with the properties of the materials. Also able to calculate energy of electron in an energy level by solving Schrodinger's equation. **(K1)**

CO5- Gain knowledge about the structure of nucleus its constituents, nature. Understanding the nuclear energy fission and fusion concepts. Basic ideas of nuclear reactors to produce energy. **(K3**)

UNIT I ACOUSTICS & NDT (9 Hrs)

Ultrasonics - Ultrasonic Waves Productions (Piezoelectric & Magnetostriction method) – Detections(Acoustic Grating) NDT applications – Ultrasonic Pulse Echo Method - Liquid Penetrant Method Acoustics - Factors affecting Acoustic of Buildings (Reverberation, Loudness, Focusing, Echo, Echelon Effect and Resonance) and their Remedies - Sabine's formula for Reverberation Time – Doppler effect and its applications to Radars.(elementary ideas)

UNIT II OPTICS (9 Hrs)

Interference - Air Wedge – Michelson's Interferometer - Wavelength Determination – Interference Filter – Antireflection Coatings. Diffraction - Diffraction Grating – Dispersive power of grating - Resolving Power of Grating & Prism Polarisation Basic concepts of Double Refraction - Huygens Theory of Double Refraction- Quarter and Half Wave Plates – Specific Rotary Power – Laurent Half Shade Polarimeter.

UNIT III LASERS & FIBER OPTICS (9 Hrs)

Lasers - Principles of Laser – Spontaneous and Stimulated Emissions - Einstein's Coefficients – Population Inversion and Laser Action – types of Optical resonators (qualitative ideas) – Types of Lasers- NdYAG, CO2 laser, GaAs Laser-applications of lasers.

Fiber Optics - Principle and Propagation of light in optical fiber – Numerical aperture and acceptance angle – Types of optical fibers (material, refractive index, mode)-applications to sensors and Fibre Optic communication.

UNIT IV WAVE MECHANIC **(9 Hrs)**

Matter Waves – de Broglie Wavelength – Uncertainty Principle – Schrödinger Wave Equation – Time Dependent – Time Independent – Application to Particle in a One Dimensional potential Box – Quantum Mechanical Tunneling – Tunnel Diode.

UNIT V NUCLEAR ENERGY SOURCE **(9 Hrs)**

General Properties of Nucleus (Size, Mass, Density, Charge) – Mass Defect – Binding Energy - Disintegration in fission –Nuclear Reactor: Materials Used in Nuclear Reactors.– PWR – BWR – FBTR. Nuclear fusion reactions for fusion reactors-D-D and D-T reactions, Basic principles of Nuclear Fusion reactors.

Text Books

1. V Rajendran, Engineering Physics, 2 nd Edition, TMH, New Delhi 2011 (For Units I to IV only).
2. Arthur Beiser, Concepts of Modern Physics, 6 th Edition, TMH, New Delhi reprinted 2008. (For Unit V only)

Reference Books

1. Ajoy Ghatak, Optics, 5 th Edition TMH, New Delhi,2012.
2. K. Thyagarajan and Ajoy Ghatak, Lasers Fundamentals and Applications, 2 nd Edition, Springer2010.
3. R. Murugesan, Modern Physics, S. Chand & Co, New Delhi2006.
4. K.R.Nambiar, Lasers, New Age International, New Delhi,2008.
5. Science of Engineering Materials, 2 nd Edition, C.M. Srivastava and C. Srinivasan, New Age Int. (P) Ltd, New Delhi, 1997
6. Avadhanulu M N , Engineering Physics, Vol-I, S. Chand& Co,2009.

Web References

1. https://swayam.gov.in/nd1_noc20_ph15/preview
2. https://swayam.gov.in/nd1_noc20_ph22/preview

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	3	2	3	-	-	-	-	-	-	-	1	2	1
2	3	3	2	2	3	-	-	-	-	-	-	-	1	2	1
3	3	3	2	3	3	-	-	-	-	-	-	-	1	2	1
4	3	3	3	3	2	-	-	-	-	-	-	-	1	2	-
5	3	3	3	1	3	-	-	-	-	-	-	-	1	2	1

Correlation Level: 1-Low, 2-Medium, 3- High

T103	CHEMISTRY	L	T	P	C	Hrs
		3	0	0	3	45

(Common to all branches)

Course Objectives

- To Know the fundamental principles of Engineering Chemistry required solving engineering problems.
- Practical implementation of fundamental theory concepts.
- To Introduce new techniques and latest information that motivates the students to bring out his or her views and work effectively.
- To enable the students understand the role of engineering materials such as polymers, energy production, electrical field basic concepts of material behaviour and study the environmental applications in the field of engineering and technology
- To acquire knowledge of engineering materials and about fuels and batteries

Course Outcomes

After successful completion of the course, students will be able to

CO1- Understand the basic concept of hardness of water, the chemicals responsible for it, measurement of hardness, its disadvantages and its removal **(K2)**

CO2 - Understand the synthesis of various organic and inorganic polymer. **(K2)**

CO3 - Understand the application of the concept of oxidation and reduction reaction to various cells **(K2)**

CO4 - Understand the application of electrochemistry in corrosion of metals and also about different types of corrosion control methods **(K2)**

CO5 - Understand the concept of phase equilibrium and its application to different types of heterogeneous equilibrium system like eutectic alloys **(K2)**

UNIT–I WATER (9 Hrs)

Hardness of water - units and calcium carbonate equivalent. Determination of hardness of water-EDTA method. Disadvantages of hard water – boiler scale and sludge, caustic embrittlement, priming & foaming and boiler corrosion. Water softening methods – internal & external conditioning – Lime-Soda process, Zeolite process and Ion-exchange process. Desalination – reverse osmosis & electrodialysis

UNIT-II POLYMERS (9 Hrs)

Classification, types of polymerization reactions – mechanism of radical, ionic and Ziegler-Natta polymerizations. Polymer properties – chemical resistance, crystallinity and effect of temperature, Mn and Mw. Thermoplastics and thermosets. Preparation, properties and uses of PVC, TEFLON, Nylons, Bakelite, Polyurithane, Rubbers – vulcanization, synthetic rubber, BuNa-S, BuNa-N, silicone and butyl rubber. Conducting polymers – classification and applications. Polymer composites – FRP – laminar composites. Moulding constituents of plastic, moulding techniques – compression, injection, transfer and extrusion moulding.

UNIT – III ELECTRO CHEMICAL CELLS (9 Hrs)

Galvanic cells, single electrode potential, standard electrode potential, electromotive series. EMF of a cell and its measurement. Nernst equation. Electrolyte concentration cell. Reference electrodes – hydrogen, calomel, Ag/AgCl & glass electrodes. Batteries – primary and secondary cells, Leclanche cell, Lead acid storage cell, Ni-Cd battery & alkaline battery. Fuel cells – H2-O2 fuel cell.

UNIT – IV CORROSION AND ITS CONTROL (9 Hrs)

Chemical & electrochemical corrosion – Galvanic, pitting, stress and concentration cell corrosion. Factors influencing corrosion – corrosion control methods – cathodic protection and corrosion inhibitors. Protective coating – types of protective coatings – metallic coating – tinning and galvanizing, cladding, electroplating and anodizing.

UNIT – V PHASE RULE **(9 Hrs)**

Definition and derivation of phase rule. Application to one component system – water and sulfur systems. Thermal analysis, condensed phase rule .Two component systems – Pb-Ag, Cu-Ni, and Mg-Zn systems

Text Books

1. P.C. Jain and Monika Jain, Engineering Chemistry, Dhanpat Rai and Sons, New Delhi 15th Ed,2010.
2. B.Sivasankar (2008) , "Engineering Chemistry ", Tata McGraw Hill , India
3. Shaley Oberoi & Monica Malik (2009), "Engineering Chemistry made easy", Cengage Learning, Delhi.
4. Engineering Chemistry by Rama Devi, Venkata Ramana Reddy and Rath, Cengage learning, New Delhi. (2016)
5. Engineering Chemistry by Shikha Agarwal, Cambridge University Press, Delhi (2015)

Reference Books

1. S. S. Dara, A Textbook of Engineering Chemistry, 11 th Ed, Scand & Co., Ltd. New Delhi,2008
2. B. K. Sharma, Engineering Chemistry, 3 rd edition Krishna Prakashan Media (P) Ltd., Meerut,2001
3. P. Kannan and A. Ravi Krishnan "Engineering Chemistry" Hi-Tech Sri Krishna Publications, Chennai, 9th Ed,2009
4. N. Krishnamurthy, P. Vallinayagam and D. Madhavan, Engineering Chemistry, 2 nd Ed.PHI Learning PVT., LTD, New Delhi,2008.

Web References

1. https://water.usgs.gov/edu/hardness.html
2. https://www.polymer-project.org/
3. www.materials.unsw.edu.au/tutorials/online-tutorials/corrosion
4. www.electrochem.org/redcat-blog/4-useful-electrochemistry-websites-2/
5. https://serc.carleton.edu/research_education/equilibria/phaserule.html

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	1	-	-	-	1	1	-	-	-	-	1	1	-	-
2	2	1	-	-	-	1	1	-	-	-	-	1	1	-	-
3	2	1	-	-	-	1	1	-	-	-	-	1	1	-	-
4	2	1	-	-	-	1	1	-	-	-	-	1	1	-	-
5	2	1	-	-	-	1	1	-	-	-	-	1	1	-	-

Correlation Level: 1-Low, 2-Medium, 3- High

		L	T	P	C	Hrs
T110	BASIC CIVIL AND MECHANICAL ENGINEERING	3	0	0	3	45

(Common to all branches)

Course Objectives

- To be able to differentiate the type of buildings according to national building code.
- To understand building components and their functions.
- Discuss the different types of roads, bridges and dams.
- To describe different types of combustion systems such as Internal and External Combustion systems
- To discuss various Energy Resources available for power generation.
- To explain the working of various different manufacturing process.

Course Outcomes

After completion of the course, the students will be able to

CO1 - Understand the basic concepts of different types of buildings and building materials. **(K3)**

CO2 - Learn various types of building components and their functions. **(K3)**

CO3 - Describe the importance of the basic infrastructure. **(K3)**

CO4 - Understand the classification of engines, low pressure Steam generators, its mounting and accessories**. (K2)**

CO5 - Apply the knowledge of thermal systems and equipment's in power plants and analyze the way of harnessing the renewable energies and its utilization.**(K3)**

CO6 - Understand the basic principles of machining, manufacturing and metal joining processes such as Lathe machine, Drilling, Grinding, Welding, green sand moulding foundry process. **(K2)**

PART A - CIVIL ENGINEERING

UNIT – I BUILDINGS, BUILDING MATERIALS (9 Hrs)

Buildings-Definition-Classification according to NBC-plinth area, Floor area, carpet area, floor space index-construction materials-stone, brick, cement, cement-mortar, concrete, steel- their properties and uses.

UNIT- II BUILDINGS ANDTHEIR COMPONENTS (9 Hrs)

Buildings: Various Components and their functions. Soils and their classification. Foundation: function and types. Masonry- function and types. Floors: definition and types of floors. Roofs: definition f and types

UNIT – III BASIC INFRASTRUCTURE (9 Hrs)

Surveying: classification, general principles, types, Uses, instruments used. Roads-types: components, types and their advantage and disadvantages. Bridges: components and types of bridges. Dams: Purpose, types of dams. Water supply-sources and quality requirements, need and principles of rainwater harvesting.

PART B – MECHANICAL ENGINEERING

UNIT – IV INTERNAL AND EXTERNAL COMBUSTION SYSTEMS (9 Hrs)

IC engines – Classification – Working principles - Diesel and petrol engines: two stroke and four stroke engines – Merits and demerits. Steam generators (Boilers) – Classification – Constructional features (of only low pressure boilers) – Boiler mountings and accessories – Merits and demerits - Applications.

UNIT – V POWER GENERATION SYSTEM (9 Hrs)

Conventional and Non-Conventional: Hydraulic – Thermal – Nuclear power plants – Schemes and layouts (Description Only) Solar – wind –Geothermal - Wave – Tidal and Ocean Thermal Energy Conversion systems – Basic power plant schemes and layouts (Description only)

UNIT – VI MANUFACTURING PROCESSES (9 Hrs)

Machines – Lathe – Drilling – Bending – Grinding – Shearing (Description only) Machining Processes – Turning – Planning – Facing – Blanking – Drilling – Punching – Shearing – Bending – Drawing – Filing – Sawing – Grinding. Moulding and Metal Joining - Pattern making – Green and dry sand moulding – Arc and Gas welding – Brazing – Soldering (process description only).

Text Books

1. Natarajan, K V, Basic Civil Engineering, 11th edition, Dhanalakshmi publications Chennai, 2011.
2. Venugopal , K and Prabhu Raja, Basic Mechanical Engineering, Anuradha Publisher, 2012.
3. K.Pravin Kumar, Basic Mechanical Engineering, Pearson Publications, 2009.
4. Shanmugam G, Palanichamy MS, Basic Civil and Mechanical Engineering,1st Edition, McGraw Hill Education, 2018.
5. R.Vaishnavi,M.Prabhakaran,V.Vijayan, Basic Civil and Mechanical Engineering, S. Chand Publisher, 2013.

Reference Books

1. Purushothama Raj.P., Basic civil engineering, 3rd Edn., Dhanam Publications, Chennai,2001
2. Rajput, R K, Engineering Materials, S Chand &Co. Ltd., New Delhi,2012.
3. Punmia, B.C., et. al., Surveying , Vol-I, Laxmi Publishers, New Delhi,2012.
4. Punmia, B.C., et.al Building Construction, Laxmi Publishers, New Delhi,2012.
5. El.Wakil, M.M., Power Plant Technology, Mc Graw Hill BookCo.,1985.
6. Hajra Choudhry, et. al., Workshop Technology Vol I and II, Media Promoters Publishers Pvt. Ltd., Bombay,2004.
7. Lindberg, R.A.Process and Materials of Manufacture, PHI,1999.
8. H.N.Gupta, R.C.Gupta and Arun Mittal, Manufacturing Processes, New Age Publications,2001
9. Nagpal, Power Plant Engineering, Khanna Publishers, Delhi,1998.

Web References

1. https://nptel.ac.in/courses/112107291/
2. https://nptel.ac.in/courses/112/103/112103262/
3. https://ocw.mit.edu/courses/mechanical-engineering/2-61-internal-combustion-engines-spring-2017/ lecture-notes/
4. https://nptel.ac.in/courses/105102088/
5. https://nptel.ac.in/courses/105104101/

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	1	3	1	1	2	1	-	1	2	1	3	-	-	-
2	3	1	3	1	1	2	1	-	1	2	1	3	-	-	-
3	3	1	3	1	1	2	1	-	1	2	1	3	-	-	-
4	3	2	1	-	-	1	2	-	-	-	-	3	1	-	-
5	3	2	2	2	2	2	2	-	-	-	-	3	1	-	-
6	3	2	2	2	2	2	2	-	-	-	-	3	1	-	1

Correlation Level: 1-Low, 2-Medium, 3- High

T111	ENGINEERING MECHANICS	L	T	P	C	Hrs
		3	0	0	3	45

(Common to all branches)

Course Objectives

- To understand the vector and scalar representation of forces and moments, static equilibrium of particles and rigid bodies in two dimensions.
- To comprehend the effect of friction on equilibrium
- To analysis of trusses and friction
- To understand the laws of motion, the kinematics of motion and the interrelationship and to learn to write the dynamic equilibrium equation
- To emphasis the concepts through solved examples

Course Outcomes

After completion of the course, the students will be able to

CO1- Understand the concepts of Equilibrium of a body, Moment of a force and to convert multiple forces into a single resultant force **(K2)**

CO2 - Apply the principles of internal forces, support reactions on Trusses/beams and friction between two surfaces.**(K3**)

CO3 - Interpret the knowledge of Centroid and center of gravity for different sections to calculate the moment of inertia for sections. **(K3**)

CO4 - Analyze and compare the principle of conservative forces, conservation of energy and D'Alembert's principle **(K4**)

CO5 - Analyze and compare the kinematics and kinetics of rigid bodies. **(K4)**

UNIT I FUNDAMENTAL OF MECHANIC (9 Hrs)

Basic Concepts Force System and Equilibrium, Definition of Force, Moment and Couple, Principle of Transmissibility, Varignon's theorem, Resultant of force system – Concurrent and non concurrent coplanar forces, Condition of static equilibrium for coplanar force system, stability of equilibrium, , applications in solving the problems on static equilibrium of bodies.

UNIT II PRACTICAL APPLICATION OF FORCE SYSTEM (9 Hrs)

Structural member: definition, Degree of freedom, concept of free body diagrams, types of supports and reactions, types of loads, Analysis of Trusses-method of joints, method of sections. Friction: Introduction, Static dry friction, simple contact friction problems, ladders, wedges.

UNIT III PROPERTIES OF SURFACES (9 Hrs)

Properties of sections – area, centroids of lines, areas and volumes, moment of inertia first moment of inertia, second moment of inertia and product moment of inertia, polar moment of inertia, radius of gyration, mass moment of inertia.

UNIT IV KINEMATICS AND KINETICS OF PARTICLES (9 Hrs)

Equations of motion - Rectilinear motion, curve linear motion, Relative motion, D'Alembert's principle, work- Energy equation – Conservative forces and principle of conservation of energy, Impulse – momentum, Impact – Direct central impact and oblique central impact

UNIT V KINEMATICS AND KINETICS OF RIGID BODIES (9 Hrs)

Plane motion, Absolute motion, Relative motion, translating axes and rotating axes, work and energy, impulse and momentum

Text Books

1. Rajesekaran, S and Sankara Subramanian., G., Engineering Mechanics, Vikas Publishing House Private Ltd., 2002.
2. Dr.I.S.Gujral, “Engineering Mechanics” second edition, Lakshmi Publication (P), Ltd., 2011.
3. Dr. Sadhu Singh, A Textbook Of Engineering Mechanics, S.Chand& company Pvt. Ltd., 2013.

Reference Books

1. Palanichamy, M.S. Nagan, S., Engineering Mechanics – Statics & Dynamics, Tata McGraw-Hill, 2011.
2. Beer, F.P and Johnson Jr. E.R, Vector Mechanics for Engineers, Vol. 1 Statics and Vol.2 Dynamics, McGraw - Hill International Edition, 1997.
3. Bhavikatti,S.S and K.G. Rajashekarappa, Engineering Mechanics, New Age International (p) Ltd, New Delhi, 2010.
4. Arthur P. Boresi and Richard J. Schmidt, “Engineering Mechanics: Statics and Dynamics”, Thomson Asia Private Limited, Singapore, 2010.
5. D.P.Sharma “Engineering Mechanics”, Dorling Kindersley India Pvt. Ltd, New Delhi, 2010.

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1. http://nptel.iitm.ac.in/video.php?subjectId=112103108
2. http://www.nptel.iitm.ac.in/courses/Webcourse-contents/IIT-KANPUR / Engineering mechanics / Table of Contents.html
3. https://nptel.ac.in/courses/112/106/112106286/
4. https://www.coursera.org/learn/engineering-mechanics-statics
5. https://nptel.ac.in/courses/122/104/122104014/

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	2	3	-	-	-	-	-	-	-	1	1	-	-
2	3	2	2	3	-	-	-	-	-	-	-	1	1	-	-
3	3	2	2	3	-	-	-	-	-	-	-	1	1	-	-
4	3	2	2	3	-	-	-	-	-	-	-	1	1	-	-
5	3	2	2	3	-	-	-	-	-	-	-	1	1	-	-

Correlation Level: 1-Low, 2-Medium, 3- High

T112	COMMUNICATIVE ENGLISH	L	T	P	C	Hrs
		3	0	0	3	45

(Common to all branches)

Course Objectives

- To improve the LSRW skills of I B.Tech students
- To instil confidence and enable the students to communicate with ease
- To equip the students with the necessary skills and develop their language prowess
- To sequence the thought of writing with cohesion and coherence
- To extend knowledge on varied aspects of business correspondence

Course Outcomes

After completion of the course, the students will be able to

CO1 - Procure holistic development of LSRW skills **(K2)**
CO2 - Gain efficacies to compete confidently in the interviews **(K3)**
CO3 - Effectively enhances the oral communication skills **(K3)**
CO4 - Select compile and synthesize information for written mode of communication **(K2)**
CO5 - Familiarize and Excels in different business correspondence in work place **(K3)**

UNIT I BASIC COMMUNICATION THEORY (9 Hrs)

History of Computers – Block diagram of a Computer – Components of a Computer system – Classification of computers - Hardware – Software – Categories of Software – Operating System – Applications of Computers – Network structure – Internet and its services – Intranet – Study of word processor – Preparation of worksheets.

UNIT II COMPREHENSION AND ANALYSIS (9 Hrs)

Comprehension of technical and non-technical material – Skimming, scanning, inferring-Note making and extension of vocabulary, predicting and responding to context-Intensive Reading and Reviewing.

UNITIII WRITING (9 Hrs)

Effective sentences, cohesive writing, clarity and conciseness in writing – Introduction to Technical Writing – Better paragraphs, Definitions, Practice in Summary Writing – Four modes of writing – Use of dictionaries, indices, library references – making bibliographical entries with regard to sources from books, journals, internet etc.

UNIT IV BUSINESS WRITING/ CORRESPONDENCE (9 Hrs)

Report writing – Memoranda – Notice – Instruction – Letters – Resumes – Job applications.

UNIT V ORAL COMMUNICATION (9 Hrs)

Basics of phonetics – Presentation skills – Group Discussions – Dialogue writing – Short Extempore – Debates-Role Plays-Conversation Practice.

Text Books

1. Robert J.Dixson. ,Complete Course in English, Prentice-Hall of India Pvt. Ltd., NewDelhi,2006.

Reference Books

1. Ashraf M.Rizvi., Effective Technical Communication. Tata-McGraw,2005.
2. Boove, Courtland R et al., Business Communication Today. Delhi. PearsonEducation,2002.
3. Meenakshi Raman and Sangeeta Sharma., Technical Communication Principles And Practice,OUP, 2007.
4. Robert J.Dixson., Everyday Dialogues in English, Prentice-Hall of India Pvt. Ltd., NewDelhi,2007.
5. Sethi,J and Kamalesh Sadanand., A Practical Course in English Pronunciation, Prentice-Hall of India Pvt. Ltd, NewDelhi,2007

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1. https://books.google.co.in/books/about/Effective_Tech_Communication.html
2. http://www.prenhall.com/bov
3. https://global.oup.com/academic/product/technical-communication
4. https://www.amazon.in/Everyday-Dialogues-English-Dixson-R-J/dp
5. https://www.sapnaonline.com/books/practical-course-english-pronunciation-w-sethi-j-812032594x-9788120325944

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	1	-	-	-	-	-	-	-	-	3	-	1	-	-	-
2	1	-	-	-	-	-	-	-	-	3	-	1	-	1	-
3	1	-	-	-	-	-	-	-	-	3	-	1	-	1	-
4	1	-	-	-	-	-	-	-	-	3	-	1	-	1	-
5	1	-	-	-	-	-	-	-	-	3	-	1	-	-	-

Correlation Level: 1-Low, 2-Medium, 3- High

P104	PHYSICS LABORATORY	L	T	P	C	Hrs
		0	0	3	1	45

(Common to all branches)

Course Objectives

- To provide a practical understanding of some of the concepts learnt in the theory course on Physics

Course Outcomes

After completion of the course, the students will be able to

CO1 - Ability to operate optical equipments like Spectrometer, Polarimeter to find the optical properties like dispersive power, Resolving power and specific rotatory power. **(K2)**

CO2 - Capable of handling screw gauge, venire caliper and travelling microscope to calculate the required parameters. **(K4)**

CO3 - Acquired basic knowledge about Thermal conduction and magnetic field due to a current carrying coil. **(K3)**

CO4 - Ability to prepare formal laboratory reports describing the results of experiments and to interpret the data from the experiments.**(K5**)

List of Experiments

1. Thermal conductivity – Lee's DISC 2. Thermal conductivity – Radial flow
2. Spectrometer – Prism or Hollow prism
3. Spectrometer – Transmission grating
4. Spectrometer - Ordinary & Extraordinary rays
5. Newton's rings
6. Air – wedge
7. Half shade polarimeter – Determination of specific rotator power
8. Jolly's experiment – determination of α
9. Magnetism: i – h curve 11. Field along the axis of coil carrying current
10. Vibration magnetometer – calculation of magnetic moment & pole strength
11. Laser experiment: wavelength determination using transmission grating, reflection grating (vernier calipers) & particle size determination
12. Determination of optical absorption coefficient of materials using laser
13. Determination of numerical aperture of an optical fiber
14. Electrical conductivity of semiconductor – two probe / four probe method
15. Hall effect in semiconductor.

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	1	1	3	3	2	2	3	3	2	3	-	2	1
2	3	3	1	1	3	3	1	2	3	3	2	3	-	2	-
3	3	3	2	1	3	3	2	2	3	3	2	3	-	1	1
4	3	3	2	1	-	3	2	3	3	3	2	3	-	2	1

Correlation Level: 1-Low, 2-Medium, 3- High

P105 **CHEMISTRY LABORATORY**

L	T	P	C	Hrs
0	0	3	1	45

(Common to all branches)

Course Objectives

- To gain a practical knowledge of Engineering Chemistry in relevance to Industrial applications
- To enable the learners to get hands-on experience on the principles discussed in theory sessions and to understand the applications of these concepts in engineering.
- To understand and explain scientifically the various chemistry related problems in the industry
- To develop experimental skills for building technical competence.

Course Outcomes

After completion of the course, the students will be able to

CO1 - To understand about titrimetric analysis which can be used to estimate the amount of metal in a mineral **(K2)**

CO2 - To understand about titrimetric analysis which can be used to estimate the amount of chemical present in a sample **(K3)**

CO3 - To understand about titrimetric analysis which can be used to estimate the quality of any sample.**(K2)**

CO4 - To perform conductometric titration and its uses to analyze any sample **(K3)**

CO5 - To perform experiments by using colorimeter From which concentration of a sample can be determined from absorbance value **(K3)**

List of Experiments

1. Determination of dissolved oxygen in water.
2. Determination of total hardness of water by EDTA method.
3. Determination of carbonate and bicarbonate in water.
4. Estimation of chloride content in water.
5. Estimation of magnesium by EDTA.
6. Estimation of acetic acid in vinegar.
7. Estimation of ferrous by permanganometry.
8. Estimation of ferrous and ferric iron in a solution mixture by dichrometry.
9. Estimation of available chlorine in bleaching powder.
10. Estimation of copper in copper sulphate solution.

Demonstration Experiments (Any two of the following)

1. Determination of COD of water sample.
2. Determination of lead by conductometry.

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	-	-	-	2	2	-	-	1	3	1	-	-	1	-	-
2	-	-	-	2	2	-	-	1	3	1	-	-	1	-	-
3	-	-	-	2	2	-	-	1	3	1	-	-	1	-	-
4	-	-	-	2	2	-	-	1	3	1	-	-	1	-	-

Correlation Level: 1-Low, 2-Medium, 3- High

P106	WORKSHOP PRACTICE	L	T	P	C	Hrs
		0	0	3	1	30

(Common to all branches)

Course Objectives

- To convey the basics of mechanical tools used in engineering
- To establish hands on experience on the working tools
- To develop basic joints and fittings using the hand tools
- To establish the importance of joints and fitting in engineering applications
- To explain the role of basic workshop in engineering and underlying physical mechanism used in mechanical machines.

Course Outcomes

After completion of the course, the students will be able to

CO1 - Understand the functioning and usage of basic hand tools of fitting, welding and carpentry.**(K2)**

CO2 - Apply the knowledge of fitting tools and machineries to perform the exercise on fitting joints like symmetric asymmetric and angular fitting.**(K3)**

CO3 - Apply the knowledge of gas and Arc welding principles to perform to join the metal with joints like Lap and V- Butt joints.**(K3)**

CO4 - Apply the knowledge of metal joining process using sheet metals and to perform to make tray and frustum.**(K3)**

CO5 - Apply the knowledge of carpentry tools and equipment's to perform the joints like mortise and half lap joint.**(K3)**

List of Experiments

Fitting

1. Study of tools and Machineries
2. Symmetric fitting
3. Acute angle fitting

Welding

1. Study of arc and gas welding equipment and tools
2. Simple lap welding(Arc)
3. Single V butt welding(Arc)

Sheet metal work

1. Study of tools and machineries
2. Frustum
3. Waste collection tray.

Carpentry

1. Study of tools and machineries
2. Half lap joint
3. Corner mortise joint.

Reference Books

1. HS Bawa, Workshop Practices, Tata McGraw Hill Publishing Co Ltd, 2015
2. S.K. Hajra Choudhury, A. K. Hajra Choudhury, "Elements of Workshop Technology", Vol I:Manufacturing Processes, 15th Edition Reprinted, Media Promoters & Publishers Pvt Ltd.,2013
3. D.Sathish, Engineering Workshop Practices Laboratory Manual, Notion press publisher, 2019
4. R.K. Rajput, Workshop Practice, Published by Laxmi Publications Pvt. Ltd. 2011
5. RS Khurmi and JK Gupta, Basics of Workshop Practice, S Chand Publisher, 2011

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1. http://www.nptelvideos.in/2012/12/manufacturing-processes-ii.html
2. http://ecoursesonline.iasri.res.in/mod/page/view.php?id=3804
3. https://www.tpctraining.com/collections/machine-shop-practices-training
4. https://www.vlab.co.in/broad-area-mechanical-engineering
5. https://nptel.ac.in/courses/112/107/112107219/

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	-	-	-	2	2	-	-	1	3	1	-	-	1	-	-
2	-	-	-	2	2	-	-	1	3	1	-	-	1	-	-
3	-	-	-	2	2	-	-	1	3	1	-	-	1	-	-
4	-	-	-	2	2	-	-	1	3	1	-	-	1	-	-

Correlation Level: 1-Low, 2-Medium, 3-High

T107	MATHEMATICS – II	L	T	P	C	Hrs
		3	1	0	4	60

(Common to all branches)

Course Objectives

- To familiarize the concept of matrices.
- To introduce the concepts of curl, divergence and integration of vectors in vector calculus
- To equip themselves familiar with Laplace transform
- To solve the differential equations using Inverse Laplace transform techniques.
- To gain good knowledge in application of Fourier transform.

Course Outcomes

After completion of the course, the students will be able to

CO 1 – Understand the concept of Eigen values and Eigen vectors, Diagonalization of a matrix. **(K2)**
CO 2 – Understand the use of vector calculus. **(K2)**
CO 3 – Apply Laplace transform of simple function. **(K3)**
CO 4 – Apply inverse Laplace transform of simple functions**. (K3)**
CO 5 – Compute Fourier transforms of various functions. **(K3)**

UNITI MATRICES (12 Hrs)

Eigen values and Eigen vectors of a real matrix, Characteristic equation, Properties of Eigen values and Eigenvectors. Cayley-Hamilton Theorem, Diagonalization of matrices. Reduction of a quadratic form to canonical form by orthogonal transformation. Nature of quadratic forms.

UNIT II VECTOR CALCULUS (12 Hrs)

Gradient, divergence and curl, their properties and relations. Gauss divergence theorem and Stoke's theorem (without proof). Simple application problems

UNIT III LAPLACE TRANSFORM (12 Hrs)

Definition, Transforms of elementary functions, properties. Transform of derivatives and integrals. Multiplication by t and division by t. Transform of unit step function, transform of periodic functions. Initial and final value theorems.

UNIT IV APPLICATIONS OF LAPLACE TRANSFORM (12 Hrs)

Methods for determining inverse Laplace Transforms, convolution theorem, Application to differential equations and integral equations. Evaluation of integrals by Laplace transforms

UNIT V FOURIER TRANSFORM (12 Hrs)

Fourier Integral theorem (statement only), Fourier transform and its inverse, properties. Fourier sine and cosine transforms, their properties, convolution and Parseval's identity.

Text Books

1. Venkataraman M.K., Engineering Mathematics, National Publishing Company, Chennai,2012
2. Kandasamy P. et al, Engineering Mathematics, Vol.2 & 3, S. Chand & Co., New Delhi.

Reference Books

1. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi,2008.
2. Grewal B.S., Higher Engineering Mathematics, Khanna Publishers, New Delhi, 41st,Edition,2011.
3. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint,2010.
4. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons, New Delhi, 8 thEdition.
5. Bali N. and Goyal M., Advanced Engineering Mathematics, Lakshmi Publications Pvt. Ltd., New Delhi, 7th Edition,2010.

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2. http://www.snggdcg.ac.in/pdf/study-material/mathematics/SMch18.pdf
3. https://www.youtube.com/watch?v=MLSfh33ZCwE
4. https://www.khanacademy.org/math/differential-equations/laplace-transform/convolution-integral/v/the-convolution-and-the-laplace-transform
5. http://www-users.math.umn.edu/~mille003/fouriertransform.pdf

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	1	-	-	-	1	1	-	-	-	-	1	2	-	1
2	2	1	-	-	-	1	1	-	-	-	-	1	1	-	1
3	3	2	1	1	-	1	-	-	-	-	-	1	2	-	2
4	3	2	1	1	-	1	-	-	-	-	-	1	2	-	2
5	3	2	1	1	-	1	-	-	-	-	-	1	2	-	2

Correlation Level: 1-Low, 2-Medium, 3-High

T108	MATERIAL SCIENCE	L	T	P	C	Hrs
		3	0	0	3	45

(Common to all branches)

Course Objectives

- To understand the importance of Material Science as a subject that revolutionized modern day technologies
- To understand the significance of material science in the development of new materials and devices for all branches of Engineering.
- To impart knowledge to the Engineering students about some of the important areas of Materials Science so as to enable them perceive the significant contributions of the subject in Engineering and Technology

Course Outcomes

After completion of the course, the students will be able to

CO1 - Identify crystal lattices and their structures, crystalline planes and directions in a crystal lattice in terms of Miller Indices. To interpret X-ray diffraction studies and different types of lattice defects and their impact. **(K2)**

CO2 - To identify the nature of polarization in a dielectric material and to explain the various dielectric material and their characterization. **(K2)**

CO3 - Understand the source of a materials magnetic behaviour and be able to distinguish types of magnetism. Having Basic idea about the read/ write mechanism of various magnetic storage devices. **(K3)**

CO4-Differentiate semiconductors; calculate the intrinsic carrier concentration in semiconductors.Understand the phenomenon of superconductivity: Student is able to define basic properties of superconducting materials and identify potential areas of their applications. **(K1)**

CO5 -Able to differentiate between nanomaterials and conventional materials. Have a broad understanding of the techniques used to synthesize nanomaterials, evaluate the properties of nanomaterials, identify the role of nanomaterials in current nanotechnology revolution, be prepared for more advanced courses in Materials Science and Engineering**. (K3)**

UNIT I CRYSTAL STRUCTURE AND LATTICE DEFECTS (9 Hrs)

Crystal structure - Bravais Lattices , Crystal Systems - Coordination Number, Atomic Radius, Packing Factor for FCC & HCP structures – Miller Indices- Powder X Ray Diffraction Method Lattice defects – Qualitative ideas of point, line, surface and volume defects.

UNIT II DIELECTRIC PROPERTIES (9 Hrs)

Dielectric Polarization and Mechanism –Temperature dependence of polarization, Internal or local Field - Clausius-Mossotti relation. Basic ideas of Dielectric loss - frequency dependence of dielectric constant – Measurement of Dielectric constant and loss using Scherring bridge – Elementary ideas of Piezoelectrics, Ferroelectrics and Pyroelectric materials and Applications

UNIT III MAGNETIC PROPERTIES (9 Hrs)

Origin of atomic magnetic moment – Bohr magneton-Elementary Ideas of classification of magnetic materials (Dia, Para, Ferro, antiferro & Ferri). – Quantum theory of Para & Ferro Magnetism – Domain Theory of Hysteresis – Heisenberg Theory of Exchange Interaction (without derivation) – Qualitative ideas of Anti ferromagnetic Ordering – Structure and Properties of Ferrites – Properties of Soft & Hard Magnetic Materials – Applications. Magnetic data storage – Magnetic tapes, Hard disks, Magneto optical recording.

UNIT IV SEMI CONDUCTORS AND SUPER CONDUCTORS (9 Hrs)

Semiconductors -Derivation of Carrier concentration in intrinsic Semiconductors –Basic ideas of Electrical conductivity in intrinsic and extrinsic semiconductors (without derivations) -temperature dependence of carrier concentration and electrical conductivity in semiconductors (qualitative ideas), Hall effect in Semiconductors -- Application of Hall Effect, Basic Ideas of Compound Semiconductors (II-VI & III-V) Superconductivity - Basic concepts – transition temperature – Meissener effect – Type I and II superconductors – High Temperature Superconductors – 123 superconductor – Applications of superconductors.

UNIT V ADVANCED MATERIALS (9 Hrs)

Liquid Crystals – Types – Application as Display Devices Metallic Glasses – preparation by melt spinning. Twin roller system, properties and applications

Shape Memory alloys (SMA), Shape memory effect, Properties and applications of SMA Nanomaterials- Nano materials (one, Two & three Dimensional) –Methods of synthesis (PVD, CVD, Laser Ablation, Solgel, Ball-milling Techniques), Properties and applications of nano materials. carbon nano tubes– synthesis, Properties and applications.

Text Books

1. V Rajendran, Engineering Physics, 2 nd Edition, TMH, New Delhi2011.
2. Arthur Beiser, Concepts of Modern Physics, 6 th Edition, TMH, New Delhi reprinted 2008. (For Unit V only)

Reference Books

1. Ali Omar M, Elementary Solid State Physics, Addison Wesley Publishing Co.,2009.
2. William D Callister Jr., Material Science and Engineering, 6th Edition, John Wiley and sons,2009.
3. Charles Kittel, Introduction to Solid State Physics, 7th Edition, John Wiley &sons, Singapore,2007.
4. V Raghavan , Materials Science and Engineering- A First Course, 5th Edition, Prentice Hall of India, 2008.
5. B.S. Murty, P. Shankar, Baldev Raj, B.B. Rath, and James Murday, Text book of Nanoscience and Nanotechnology, Universities Press, Hyderabad 2012
6. M.N. Avadhanulu, Enginerring Physics- Volume-II, S. Chand &Co, New Delhi,2009
7. Pillai S.O, Solid State Physics, 6th Edition – New Age International,2005.

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2. https://swayam.gov.in/nd1_noc20_ph22/preview

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	3	1	2	3	1	1	1	2	3	3	3	2	1
2	3	3	3	1	2	3	1	1	1	2	1	3	3	1	1
3	3	3	3	1	3	3	2	1	1	2	1	3	3	2	1
4	3	3	3	1	3	3	2	1	1	2	2	3	3	1	-
5	3	1	3	1	3	3	2	1	1	2	3	3	3	2	1

Correlation Level: 1-Low, 2-Medium, 3-High

T109	ENVIRONMENTAL SCIENCE (Common to all branches)	L	T	P	C	Hours
		3	0	0	3	45

Course Objectives:

- To know about the environment
- To understand about environmental pollution
- To apply the knowledge in understanding various environmental issues and problems.

Course Outcomes

After completion of the course, the students will be able to

CO1 - Understand the various environmental segments, its significance to life, also about various natural resources, effects of over utilization and its protection which can lead to sustainable development.

CO2 - Understand the study of ecology of various systems of nature and also about the diverse species present and its protection.

CO3 - Understand various sources of air pollution, the scientific basis behind it and its effect on nature.

CO4 - Understand the various ways of water pollution, its sources and effects, different water pollution monitoring technique, treatment of waste water and also the effects of solid waste and its management.

CO5 - Understand the concept of spectroscopy and its application to monitor pollution

UNIT-I ENVIRONMENT AND ENERGY RESOURCES (9 Hrs)

Environmental segments – atmosphere, hydrosphere, lithosphere and biosphere. Atmospheric layers. Pollution definition and classification. Pollutants classification. Forest resources – use and over exploitation, deforestation, forest management. Water resources – use and conflicts over water, dams – benefits and problems. Mineral resources – mineral wealth of India, environmental effects of extracting and using mineral resources. Food resources – world food problems, environmental impact of modern Agriculture – fertilizer and pesticides. Energy resources – growing needs, renewable and non-renewable energy resources and use of alternate energy sources. From unsustainable to sustainable development.

UNIT II ECOSYSTEM AND BIODIVERSITY (9 Hrs)

Concept of an ecosystem - structure and function of an ecosystem.Producers, consumers, and decomposers.Energy flow in the ecosystem. Food chains, food webs and ecological pyramids. Introduction, types, characteristic features, structure and function of forest, grassland, desert and aquatic (fresh water, esturine and marine) ecosystems. Biodiversity – definition, genetic species and ecosystem diversity. Value of biodiversity - consumptive use, productive use, social, ethical, aesthetic and option values. Hot spots of biodiversity. Threats to biodiversity, habitat loss, poaching of wildlife, human wildlife conflicts. Endangered and endemic species. Conservation of biodiversity – in-situ and exsitu conservation of biodiversity.

UNITIII AIR POLLUTION (9 Hrs)

Definition and classification. Chemical and photochemical reaction in different layers of atmosphere. Causes, sources, effects and control measures of air pollutants - oxides of Nitrogen, oxides of Carbon, oxides of Sulfur, hydrocarbons, chloro-fluoro carbons and particulates. Mechanism and effects of air pollution phenomenon – Global Warming, Ozone Depletion, Acid Rain, Sulfurous Smog and Photochemical Smog..

UNITIV WATER AND LAND POLLUTION (9 Hrs)

Water pollution – causes and effects of organic water pollutants – pesticides, insecticides, detergents and surfactants. Causes and effects of inorganic water pollutants – heavy metal pollution due to Hg,

Pb, Cr & Cu. Water pollution control and monitoring – DO, COD, BOD & TOC. Land Pollution – Solid waste management – causes, effect andcontrol measures of urban and industrial wastes. Thermal and radioactive pollution.

UNIT V POLLUTION CONTROL AND MONITORING (9 Hrs)

Basic concepts and instrumentation of IR, UV-VIS, atomic absorption spectrometry, Gas Chromatography and Conductometry. Analysis of air pollutants – NOx, COx, SOx, H2S, Hydrocarbons and particulates.

Text Books

1. PK. De, "Environmental chemistry" 7th Ed; New age international (P) Ltd, New Delhi, 2010.
2. K. RaghavanNambiar, "Text Book of Environmental Studies" 2nd Ed, Scitech Publications (India) Pvt Ltd, India, 2010.
3. G. S. Sodhi, Fundamental concepts of environmental chemistry, I Ed, Alpha Science International Ltd, India, 2000.

Reference Books

1. B.K. Sharma, "Environmental chemistry" 11th Ed, KRISHNA Prakashan Media (P) Ltd, Meerut, 2007.
2. S.S.Dara, and D.D. Mishra "A text book of environmental chemistry and pollution control, 5th Ed, S.Chandand Company Ltd, New Delhi, 2012.
3. Richard T. Wright, Environmental Science: Toward a Sustainable Future, 10thedition, Prentice Hall, 2008

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3. http://www.world.org/weo/pollution
4. www.water-pollution.org.uk/
5. https://www.tceq.texas.gov/airquality/monops/sites

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	1	1	1	-	1	3	-	-	-	-	2	2	-	1
2	2	1	1	1	-	1	3	-	-	-	-	2	2	-	1
3	3	1	1	1	-	1	3	-	-	-	-	2	2	-	1
4	3	1	1	1	-	1	3	-	-	-	-	2	2	-	1
5	3	1	1	1	-	1	3	-	-	-	-	2	2	-	1

Correlation Level: 1-Low, 2-Medium, 3-High

T104	BASIC ELECTRICAL AND ELECTRONICS ENGINEERING	L	T	P	C	Hrs
		3	0	0	3	45

(Common to all branches)

Course Objectives

- To understand and gain basic knowledge about magnetic and electrical circuits
- To gain basic knowledge about single phase and three phase power measurement
- To understand the operating principles of stationary and rotating machines
- To understand the characteristics and applications of semiconductor devices
- To provide the basic knowledge in Digital electronics
- To understand the purpose of communication and acquire knowledge on different communication systems

Course Outcomes

After completion of the course, the students will be able to

CO1 - Analyze the basic concepts, various laws and theorems used in DC circuits. **(K3)**

CO2 - Analyze and solve the AC circuits and develop resonance circuits for transmitter and receiver. **(K4)**

CO3 - Gain the knowledge of power production in power system and application of transformers and motors in real time. **(K2)**

CO4 - Understand the operations of semiconductor diode, BJT, FET and its applications. **(K2)**

CO5 - Summarize the digital electronics concepts for sequential and combinational circuits. **(K2)**

CO6 - Explain and Relate different Communication Systems. **(K2)**

PART A - ELECTRICAL

UNIT I DC CIRCUITS (9 Hrs)

Definition of Voltage, Current, Power & Energy, circuit parameters, Ohm's law, Kirchoff's law & its applications – Simple Problems - Division of current in Series & parallel circuits - star/delta conversion - Node and mesh methods of analysis of DC circuits.

UNIT II AC CIRCUITS (9 Hrs)

Concepts of AC circuits – rms value, average value, form and peak factors – Simple RLC series circuits – Concept of real and reactive power – Power factor - Introduction to three phase system - Power measurement by two wattmeter method

UNIT III ELECTRICAL MACHINES AND POWER PLANTS (9 Hrs)

Law of Electromagnetic induction, Fleming's Right & Left hand rule - Principle of DC rotating machine, Single phase transformer and single phase induction motor (Qualitative approach only) - Simple layout of thermal and hydro generation (block diagram approach only).Fundamentals of fuses and circuit breakers.

PART B – ELECTRONICS

UNIT IV ELECTRONIC CIRCUITS (9 Hrs)

V-I Characteristics of diode - Half-wave rectifier and Full-wave rectifier – with and without capacitor filter - Transistor - Construction & working - Input and output characteristics of CB and CE configuration - Transistor as an Amplifier - Principle and working of Hartley oscillator and RC phase shift oscillator - Construction and working of JFET &MOSFET.

UNIT V DIGITAL ELECTRONICS (9 Hrs)

Boolean algebra – Reduction of Boolean expressions - De-Morgan's theorem - Logic gates Implementation of Boolean expressions - Flip flops - RS, JK, T and D. Combinational logic - Half adder, Full adder and Subtractors. Sequentiallogic- Ripple counters and shift registers.

UNIT VI COMMUNICATION AND COMPUTER SYSTEMS (9 Hrs)

Model of communication system - Analog and digital - Wired and wireless channel. Block diagram of various communication systems - Microwave, satellite, optical fiber and cellular mobile system. Network model - PAN, LAN, MAN and WAN - Circuit and packet switching - Overview of ISDN.

Text Books

1. Kothari D P and Nagrath I J , Basic Electrical Engineering , Tata McGraw Hill,2009. (For Units I toIII).
2. Rajendra Prasad , " Fundamentals of Electronic Engineering", Cengage learning, New Delhi, First Edition, 2011 (For UnitI V)
3. Morris Mano, "Digital design", PHI Learning, Fourth Edition, 2008 (For UnitV)
4. Wayne Tomasi, "Electronic Communication Systems- Fundamentals Theory Advanced", Sixth Edition, Pearson Education, 2004. (For Unit VI)

Reference Books

1. R.Muthusubramaniam, S.Salivahanan and K.A. Mureleedharan, Basic Electrical Electronics and Computer Engineering, Tata McGraw Hill, 2004.
2. J.B.Gupta, A Course in Electrical Power, Katson Publishing House, New Delhi, 1993.
3. David. A. Bell, "Electronic Devices and Circuits", PHI Learning Private Ltd, India, Fourth Edition, 2008
4. Donald P Leach, Albert Paul Malvino and Goutam Saha, "Digital Principles and Applications," 6th edition,Tata McGraw Hill Publishing Company Ltd.,New Delhi,2008.
5. S.K. Sahdev, Fundamentals of Electrical Engineering and Electronics, Dhanpat Rai & Co, 2013.
6. Jacob Millman and Christos C. Halkias, "Electronic Devices and Circuits" Tata McGraw Hill
7. R.L. Boylestad and L. Nashelsky, "Electronic Devices and Circuit Theory", PHI Learning Private Limited, Ninth Edition, 2008
8. M.S.Sukija and T.K.Nagasarkar, "Basic electrical and Electronics Engineering", Oxford University Press, 2012.

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4. http://electrical-engineering-portal.com/
5. http://www.electronics-tutorials.ws
6. https://www.geeksforgeeks.org/digital-electronics-logic-design-tutorials/
7. https://nptel.ac.in/courses/117/102/117102059/

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	2	2	3	-	-	-	-	-	-	-	2	2	2
2	3	3	2	2	3	-	-	-	-	-	-	-	2	2	2
3	3	3	2	2	3	-	-	-	-	-	-	-	2	1	2
4	3	1	2	2	-	-	-	-	-	-	-	-	2	2	2
5	3	2	2	2	-	-	-	-	-	-	-	-	2	2	2
6	3	-	2	-	-	-	-	-	-	-	-	-	2	2	2

Correlation Level: 1 - Low, 2 - Medium, 3 - High

T105	ENGINEERING THERMODYNAMICS	L	T	P	C	Hrs
		3	0	0	3	45

(Common to all branches)

Course Objectives

- To understand the basics of the thermodynamic principles
- To establish the relationship of these principles to thermal system behaviors
- To develop methodologies for predicting the system behavior
- To establish the importance of laws of thermodynamics applied to energy systems
- To explain the role of refrigeration and heat pump as energy systems and develop an intuitive understanding of underlying physical mechanism and a mastery of solving practical problems in real world

Course Outcomes

After completion of the course, the students will be able to

CO1- Understand the fundamental thermodynamic concepts and its basic laws**. (K2)**

CO2- Apply first law of thermodynamics concepts to calculate the system work for closed and open systems**. (K3**)

CO3- Apply Second Law of Thermodynamics and entropy concepts to evaluate the performance of heat engine, heat pump and refrigerator**. (K3)**

CO4 - Apply the principles of gas power cycles to calculate its thermal performance. **(K3)**

CO5 - Understand the basic working principle of refrigeration systems**. (K2)**

UNIT I BASIC CONCEPTS AND DEFINITIONS (9 Hrs)

Energy conversion and efficiencies - System, property and state - Thermal equilibrium - Temperature - Zeroth law of Thermodynamics – Pure substance - P, V and T diagrams – Thermodynamic diagrams.

UNIT II FIRST LAW OF THERMODYNAMICS (9 Hrs)

The concept of work and adiabatic process - First law of thermodynamics - Conservation of Energy principle for closed and open systems - Calculation of work for different processes of expansion of gases.

UNIT III SECOND LAW OF THERMODYNAMICS (9 Hrs)

Equilibrium and the second law - Heat engines - Kelvin-Planck statement of second law of thermodynamics - Reversible and irreversible processes - Carnot principle - Clausius inequality- Entropy

UNIT IV GAS POWER CYCLES (9 Hrs)

Air standard cycles: The air standard Carnot cycle - Air standard Otto cycle, diesel cycle, dual cycle and Brayton cycles and their efficiencies.

UNIT V REFRIGERATION CYCLES AND SYSTEMS (9 Hrs)

Reverse Carnot cycle - COP - Vapor compression refrigeration cycle and systems (only theory) - Gas refrigeration cycle - Absorption refrigeration system – Liquefaction – Solidification (only theory).

Text Books

1. Nag, P. K., “Engineering Thermodynamics”, 4 th edition, Tata Mc Graw Hill Publishing Co. Ltd., New Delhi, 2008.

Reference Books

1. Arora, C.P., “Thermodynamics” , Tata Mc Graw Hill Publishing Co. Ltd., NewDelhi,2010
2. Burghardt, M.D., “Engineering Thermodynamics with Applications”, 4th edition, Harper & Row, N.Y.,2009.
3. Huang, F.F., “Engineering Thermodynamics” 2nd edition , Macmillan Publishing Co. Ltd.,N.Y.,2011.

4. Cengel, Y.A. and Boles, M.A., "Thermodynamics - An Engineering Approach", 5th edition, McGraw Hill,2008.
5. Wark, K., “Thermodynamics”, 4th edition ,Mc Graw Hill,N.Y.,2009.

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2. https://nptel.ac.in/courses/112108148/
3. https://nptel.ac.in/courses/112/103/112103275/
4. https://www.linkedin.com/company/heat-transfer-and-process-design-htpd
5. https://www.udemy.com/course/an-introduction-to-heat-transfer/

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	2	2	2	-	-	-	-	-	-	-	1	-	-
2	3	2	2	2	2	-	-	-	-	-	-	-	-	-	-
3	3	2	3	3	2	-	-	-	-	-	-	-	-	-	-
4	3	2	3	3	-	-	-	-	-	-	-	-	1	-	-
5	3	2	3	3	-	-	-	-	-	-	-	-	-	-	1
6	3	2	2	2	2	-	-	-	-	-	-	-	1	-	-

Correlation Level: 1 - Low, 2 - Medium, 3 - High

T106	COMPUTER PROGRAMMING	L	T	P	C	Hrs
		3	0	0	3	60

(Common to all branches)

Course Objectives

- To introduce the basics of computers and information technology.
- To educate problem solving techniques.
- To impart programming skills in C language.
- To practice structured programming to solve real life problems.
- To study the basic concepts of File operations.

Course Outcomes

After completion of the course, the students will be able to

CO1 - Identify and understand the working components of a computer system. **(K1)**
CO2 -Understand, analyze and implement like algorithm, pseudo codes and programming structures. **(K2)**
CO3 -Analyze and make use of logical structure of a C program. **(K3)**
CO4 -Make use of pointers, memory allocation and data handling to implement C programs. **(K3)**
CO5 -Understand the working of files and directives. **(K3)**

UNIT I (9 Hrs)

History of Computers – Block diagram of a Computer – Components of a Computer system – Classification of computers - Hardware – Software – Categories of Software – Operating System – Applications of Computers – Network structure – Internet and its services – Intranet – Study of word processor – Preparation of worksheets.

UNIT II (9 Hrs)

Problem solving techniques – Program – Program development cycle – Algorithm design Flowchart - Pseudo code. Introduction to C – History of C – Importance of C - C tokens – data types – Operators and expressions – I/O functions.

UNIT III (9 Hrs)

Decision making statements – branching and looping – arrays – multidimensional arrays– Functions – Recursion – Passing array to functions. Storage classes – Strings – String library functions.

UNIT IV (9 Hrs)

Structures – Arrays and Structures – nested structures – passing structures to functions– user defined data types – Union. Pointers – pointers and arrays – pointers and functions - pointers and strings - pointers and Structures.

UNIT V (9 Hrs)

Files – operations on a file – Random access to files – command line arguments. Introduction to pre processor – Macro substitution directives – File inclusion directives – conditional compilation directives – Miscellaneous directives.

Text Books

1. Balagurusamy. E, “Programming in ANSI C”, Tata McGraw Hill, Sixth edition,2012.
2. Ashok N. Kamthane, “Computer programming”, Pearson Education, 2007.
3. Kenneth A. Reek, “Pointers on C”, Pearson Education, 2007.

Reference Books

1. Vikas Verma, “A Workbook on C “, Cengage Learning, Second Edition,2012.
2. Ashok N Kamthane, “Computer Programming”, Pearson education, Second Impression,2008.

3. Kernighan,B.W and Ritchie,D.M, “The C Programming language”, Second Edition, Pearson Education, 2006.
4. R.G. Dromey, “How to Solve it by Computer”, Pearson Education, Fourth Reprint, 2007.
5. Stephen G. Kochan, “Programming in C”, Third Edition, Pearson Education, 2007.

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2. http://www.btechsmartclass.com/c_programming/C-Program-Development-Life-Cycle.html
3. https://www.learn-c.org/en/Multidimensional_Arrays
4. https://www.tutorialspoint.com/cprogramming/c_structures.htm
5. https://www.w3schools.in/c-tutorial/command-line-arguments/

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	1	-	-	3	-	-	-	-	-	-	-	-	2	2
2	2	1	-	-	3	-	-	-	-	-	-	-	-	2	2
3	3	2	1	1	3	-	-	-	-	-	-	-	-	2	2
4	3	2	1	1	3	-	-	-	-	-	-	-	-	2	2
5	3	2	1	1	3	-	-	-	-	-	-	-	-	2	2

Correlation Level: 1 - Low, 2 - Medium, 3 - High

P101	COMPUTER PROGRAMMING LAB	L	T	P	C	Hrs
		0	0	3	2	30

(Common to all branches)

Course Objectives

- To study and understand the use of OS commands
- To gain a hands on experience of compilation and execution of 'C 'programs
- To understand the working of control statements
- To design functional methods.
- To make use pointers in various programs

Course Outcomes

After completion of the course, the students will be able to

CO1 - Apply and practice logical ability to solve the problems. Understand C programming development environment, compiling, debugging, linking and executing a program using the development environment. **(K2)**

CO2 - Analyzing the complexity of problems, Modularize the problems into small modules and then convert them into programs. **(K2)**

CO3 - Understand and apply the in-built functions and customized functions for solving the problems. **(K3)**

CO4 -Understand and apply the pointers, memory allocation techniques and use of files for dealing with variety of problems.**(K3)**

CO5 - Document and present the algorithm's, flowcharts and programs in form of user-manuals.**(K3)**

List of Experiments

1. Study of OS Commands
2. Write a C program to find the Area of the triangle.
3. Write a C program to find the total and average percentage obtained by a student for 6subjects.
4. Write a C program to read a three digit number and produce output like 1hundreds 7 tens 2 units for an input of 172
5. Write a C program to check whether a given character is vowel or not using Switch – Case statement.
6. Write a C program to print the numbers from 1 to 10 along with their squares.
7. Write a C program to find the sum of 'n' numbers using for, do – while statements.
8. Write a C program to find the factorial of a given number using Functions.
9. Write a C program to swap two numbers using call by value and call by reference.
10. Write a C program to find the smallest and largest element in anarray.
11. Write a C program to perform matrix multiplication.
12. Write a C program to demonstrate the usage of Local and Global variables.
13. Write a C program to perform various string handling functions: strlen, strcpy, strcat,strcmp.
14. Write a C program to remove all characters in a string except alphabets.
15. Write a C program to find the sum of an integer array using pointers.
16. Write a C program to find the Maximum element in an integer array using pointers.
17. Write a C program to create student details using Structures.
18. Write a C program to display the contents of the file on the monitor screen.
19. Create a File by getting the input from the keyboard and retrieve the contents of the file using file operation commands.
20. Write a C program to pass the parameter using command line arguments.

Text Books

1. Balagurusamy. E, “Programming in ANSI C”, Tata McGraw Hill, Sixth edition,2012.
2. Ashok N. Kamthane, “Computer programming”, Pearson Education, 2007.
3. Kenneth A. Reek, “Pointers on C”, Pearson Education, 2007.

Reference Books

1. VikasVerma, “A Workbook on C “, Cengage Learning, SecondEdition,2012
2. Ashok N Kamthane, “Computer Programming”, Pearson education, Second Impression,2008.
3. Kernighan,B.W and Ritchie,D.M, “The C Programming language”, Second Edition, Pearson Education, 2006.
4. R.G. Dromey, “How to Solve it by Computer”, Pearson Education, Fourth Reprint, 2007
5. Stephen G. Kochan, “Programming in C”, Third Edition, Pearson Education, 2007

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2. https://www.studytonight.com/c/programs/array/largest-and-smallest-element-in-array
3. https://www.programiz.com/c-programming/examples/information-structure-array
4. https://www.geeksforgeeks.org/c-program-print-contents-file/
5. https://www.studytonight.com/c/command-line-argument.php

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	1	-	-	3	-	-	-	-	-	-	-	-	2	2
2	2	1	-	-	3	-	-	-	-	-	-	-	-	2	2
3	3	2	1	1	3	-	-	-	-	-	-	-	-	2	2
4	3	2	1	1	3	-	-	-	-	-	-	-	-	2	2
5	3	2	1	1	3	-	-	-	-	-	-	-	-	2	2

Correlation Level: 1 - Low, 2 - Medium, 3 - High

P102	ENGINEERING GRAPHICS	L	T	P	C	Hrs
		0	0	3	1	60

(Common to all branches)

Course Objectives

- To convey the basics of engineering drawing
- To explain the importance of an engineering drawing
- To teach different methods of making the drawing
- To establish the importance of projects and developments mode in drawing that are used in real systems
- To develop the role of computer aided design Auto Cad and significance of using these drawings

Course Outcomes

After completion of the course, the students will be able to

CO1 - Understand the basic concepts of engineering drawings. **(K2)**

CO2- Apply various concepts like dimensioning, conventions and BIS codes, the theory and methods of projection. **(K3)**

CO3 - Improve their imagination and visualization skills to design new products. **(K4)**

CO4 - Create engineering drawing of physical object representing engineering systems. **(K4)**

CO5 - Analysis the different views and computer aided drafting tools. **(K3)**

UNIT 0

Introduction to Standards for Engineering Drawing practice, Lettering, Line work and Dimensioning

UNIT I

Conic sections, Involutes, Spirals, Helix. Projection of Points, Lines and Planes

UNIT II

Projection of Solids and Sections of Solids.

UNIT III

Development of surfaces - Intersection of surfaces (cylinder-cylinder, cylinder-cone)

UNIT IV

Isometric projections and Orthographic projections.

UNIT V

Computer Aided Drafting: Introduction to Computer Aided Drafting hardware - Overview of application software - 2D drafting commands (Auto CAD) for simple shapes - Dimensioning.

Text Books

1. K.R. Gopalakrishna and Sudhir Gopalakrishna, Engineering Graphics, Inzinc Publishers,2007.

Reference Books

1. N.D. Bhatt, Engineering Drawing, 49th edition, Chorotar Publishing House,2006.
2. K. Venugopal, Engineering Drawing and Grahics + Auto CAD, 4 th edition, New Age International Publication Ltd.,2004.
3. David I cook and Robert N Mc Dougal, Engineering Graphics and Design With computer applications, Holt – Sounders Int. Edn.1985.
4. James D Bethune and et. al., Modern Drafting, Prentice Hall Int.,1989.
5. K.V. Natarajan, A Text Book of Engineering Drawing, Dhanalakshmi Publishers,2006.
6. BIS, Engineering Drawing practice for Schools & College,1992.

Web References

1. http://nptel.ac.in/courses/112103019
2. https://en.wikipedia.org/wiki/Engineering drawing
3. https://nptel.ac.in/courses/105/104/105104148/
4. https://onlinecourses.nptel.ac.in/noc20_me79/preview
5. https://www.btechguru.com/courses--nptel--engineering-drawing----video-lecture.html

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	1	-	-	3	-	-	-	-	-	-	3	-	-	1
2	3	1	-	-	3	-	-	-	-	-	-	3	-	-	1
3	3	1	-	-	3	-	-	-	-	-	-	3	-	-	1
4	3	1	-	-	3	-	-	-	-	-	-	3	-	-	1
5	3	1	-	-	3	-	-	-	-	-	-	3	-	-	1

Correlation Level: 1-Low, 2-Medium, 3- High

		L	T	P	C	Hrs
P103	**BASIC ELECTRICAL AND ELECTRONICS LAB** (Common to all branches)	0	0	3	2	45

Course Objectives

- To get an exposure on the basic electrical tools, applications and precautions
- To gain training on different types of wiring used in domestic and industrial applications.
- To detect and find faults in electrical lamp and ceiling fan
- To get an exposure on the measurements of voltage and phase using CRO, basic operation and applications devices such as PN junction diode and transistor
- To gain a practical knowledge on the functions and application of basic logic gates and flip flops

Course Outcomes

After completion of the course, the students will be able to

CO1 - Follow the safety procedures when working with electricity and various tools. **(K4)**

CO2 - Do line diagram and wiring practices for domestic application. **(K5)**

CO3 - Use the protection circuits for electrical networks**. (K3)**

CO4 - Design and verify the kirchoff's law. **(K4)**

CO5 - Analyze the characteristics of PN diode and use it for rectifier applications. **(K4)**

CO6 - Gain knowledge on digital electronics to solve problems related to boolean algebra. **(K4)**

ELECTRICAL LAB

List of Experiments

1. Electrical Safety, Precautions, study of tools and accessories.
2. Practices of different joints.
3. Wiring and testing of series and parallel lamp circuits.
4. Staircase wiring.
5. Doctor's room wiring.
6. Bed room wiring.
7. Go down wiring.
8. Wiring and testing a ceiling fan and fluorescent lamp circuit.
9. Study of different types of fuses, circuits breakers and A.C and D.C meters.

ELECTRONICS LAB

List of Experiments

1. Study of CRO
   (a) Measurement of AC and DC voltages
   (b) Frequency and phase measurements (using Lissajou's figures)
2. Verification of Kirchoff's Voltage and Current Laws
   Determine the voltage and current in given circuits using Kirchoff"s laws theoretically and verify the laws experimentally.
3. Characteristics and applications of PN junction diode.
   Forward and Reverse characteristics of PN junction diode.
   Application of Diode as Half wave Rectifier – Measurement of ripple factor with and without capacitor filter
4. Frequency Response of RC Coupled Amplifiers
   Determination of frequency response of given RC coupled amplifier - Calculation of bandwidth.
5. Study of Logic Gates
   (a) Verification of Demorgan's theorems
   (b) Verification of truth tables of OR, AND, NOT, NAND, NOR, EX-OR, EX-NOR gates and Flipflops - JK, RS, T and D
   (c) Implementation of digital functions using logic gates and Universal gates.

Reference Books

1. Kothari D P and Nagrath I J, Basic Electrical Engineering, Tata McGraw Hill, 2009.
2. R.Muthusubramaniam, S.Salivahanan and K.A. Mureleedharan, Basic Electrical Electronics and Computer Engineering, Tata McGraw Hill, 2004
3. Sudhakar and S. P. Shyam Mohan, "Circuits and Networks Analysis and Synthesis", Tata McGraw Hill Publishing Company Ltd., New Delhi, 4th Edition, 2010.
4. Rajendra Prasad, "Fundamentals of Electronic Engineering", Cengage learning, New Delhi, First Edition, 2011.
5. Donald P Leach, Albert Paul Malvino and Goutam Saha, "Digital Principles and Applications," 6th edition, Tata McGraw Hill Publishing Company Ltd.,New Delhi,2008
6. Morris Mano, "Digital design", PHI Learning, Fourth Edition, 2008
7. Edward Hughes, John Hiley, Keith Brown, Ian McKenzie Smith, "Electrical and Electronics Technology", Pearson Education Limited, New Delhi, 10th Edition, 2010.

Web References

1. https://www.electrical4u.com/
2. https://www.allaboutcircuits.com/
3. https://www.circuitlab.com/
4. http://www.electronics-tutorials.ws
5. https://www.geeksforgeeks.org/digital-electronics-logic-design-tutorials/
6. https://nptel.ac.in/courses/117/102/117102059/

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	3	3	3	-	-	-	3	-	-	-	3	3	3
2	3	3	3	3	3	-	-	-	3	-	-	-	2	2	2
3	3	3	2	3	3	-	-	-	3	-	-	-	2	2	2
4	3	3	2	3	2	-	-	-	3	-	-	-	3	3	3
5	3	3	2	3	2	-	-	-	3	-	-	-	3	3	3
6	3	3	2	3	2	-	-	-	3	-	-	-	3	3	2

Correlation Level: 1 - Low, 2 - Medium, 3 - High

		L	T	P	C
P107	**NCC / NSS**	**0**	**0**	**3**	**1**

- NCC/NSS training is compulsory for all the Undergraduate students
- The above activities will include Practical/field activities/Extension lectures. The above activities shall be carried out outside class hours.
- In the above activities, the student participation shall be for a minimum period of 45 hours.
- The above activities will be monitored by the respective faculty incharge and the First Year Coordinator.
- Pass /Fail will be determined on the basis of participation, attendance, performance and behavior. If a candidate Fails, he/she has to repeat the course in the subsequent years
- Pass in this course is mandatory for the award of degree.

U19ICT31	COMPLEX ANALYSIS AND APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS	L	T	P	C	Hrs
		2	2	0	3	60

(Common to EEE,ICE,MECH & Mechatronics)

Course Objectives

- To understand the analytic functions of complex variables.
- To apply the analytic function techniques to transform irregular geometry into regular geometry.
- Expose the concept of complex integration.
- To understand the nature of wave equations.
- To know the solutions of one dimensional and two dimensional heat flow equations.

Course Outcomes

After completion of the course, the students will be able to

CO1- Understand the concepts of function of a complex variable.**(K2)**
CO2 - Transform complex functions from one plane to another plane.**(K3)**
CO3 - Apply the concept of complex integration over contour.**(K3)**
CO4 - Understand the concept of initial and boundary value problems**. (K2)**
CO5 - Solve the one and two dimensional heat equation using Fourier series.**(K3)**

UNIT I FUNCTION OF A COMPLEX VARIABLE (12 Hrs)

Continuity, derivative and analytic functions – Necessary conditions Cauchy-Riemann equations and sufficient conditions – Harmonic and orthogonal properties of analytic function – Construction of analytic function.

UNIT II CONFORMAL MAPPINGS (12 Hrs)

Conformal mapping – Simple and standard transformations like w = z+c, c z, z^2, e^z, sin z, cos h z and z+1/z -Bilinear transformation and cross ratio property - Taylor's and Laurent's theorem- Series expansion of complex valued functions- classification of singularities.

UNIT III COMPLEX INTEGRATION (12 Hrs)

Cauchy's integral theorem and its application – Cauchy's integral formula and problems – Residues and evaluation of residues – Cauchy's residue theorem – Contour integration: Cauchy's and Jordan's Lemma - Application of residue theorem to evaluate real integrals – unit circle and semicircular contour.

UNIT IV APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS (12 Hrs)

Solution of partial differential equation by the method of separation of variables – Boundary value problems – Fourier series solutions of one dimensional wave equation – Transverse vibration of an elastic string.

UNIT V ONE AND TWO DIMENSIONAL HEAT EQUATIONS (12 Hrs)

Fourier series solutions of one dimensional heat flow equation – Fourier series solutions of two dimensional heat flow equation under steady state conditions.

Text Books

1. B.S.Grewal, "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 4th Edition, 2020.
2. N.P Bali. and Dr. Manish Goyal, "Engineering Mathematics", Lakshmi Publications Pvt. Ltd., New Delhi, 9th Edition, 2015.
3. P. Sivaramakrishna Das and C. Vijayakumari, "Engineering Mathematics", PearsonsPublications, New Delhi,4th Edition, 2017.

Reference Books

1. C.Gupta ,B.Shree Ram Singh, M. Kumar, "Engineering Mathematics for semester I & II", Tata McGraw Hill, New Delhi, 1st Edition, 2015.

2. H.K. Dass& Dr. Rama Verma, “Introduction to Engineering Mathematics – Volume II”, S. Chand & Co, New Delhi, 9th Edition, 2019.
3. Erwin Kreyszig, “Advanced Engineering Mathematics”, John Wiley & Sons, New Delhi, 10th Edition, 2019.
4. Ravish R. Singh and Mukul Bhatt, “Engineering Mathematics”, Tata McGraw Hill, New Delhi, 1st Edition, 2016.
5. B.V Ramana, “Higher Engineering Mathematics”, Tata McGraw Hill, New Delhi, 3rd Edition, 2018..

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1. https://nptel.ac.in/courses/122107036/
2. https://nptel.ac.in/courses/111107119/
3. https://youtu.be/W3HXK1Xe4nc
4. https://youtu.be/Mwpz1zjPlzI
5. https://youtu.be/CnrAivf9I6o

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes(PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	1	-	-	-	-	-	-	-	-	-	1	-	-	1
2	3	2	1	1	-	-	-	-	-	-	-	1	-	-	1
3	3	2	1	1	-	-	-	-	-	-	-	1	-	-	1
4	2	1	-	-	-	1	-	-	-	-	-	1	-	-	1
5	3	2	1	1	-	1	-	-	-	-	-	1	-	-	1

Correlation Level: 1-Low, 2-Medium, 3- High

		L	T	P	C	Hrs
U19ICT32	**DATA STRUCTURES**	3	0	0	3	45

(Common to CSE, ECE, EEE, IT, ICE, MECH, CIVIL, BME, Mechatronics)

Course Objectives

- To impart the basic concepts of data structures and its terminologies.
- To understand concepts about stack and queue operations.
- To understand basic concepts about linked list and its various operations.
- To understand concepts about Tree and its applications.
- To understand basic concepts about Sorting, Hashing and Graph.

Course Outcomes

After completion of the course, the students will be able to

CO1 - Compute time and space complexity for given problems **(K3)**
CO2 - Demonstrate stack, queue and its operation. **(K3)**
CO3 - Illustrate the various operations of linked list. **(K3)**
CO4 - Use the concepts of tree for various applications. **(K3)**
CO5 - Outline the various sorting, hashing and graph techniques. **(K3)**

UNIT I BASIC TERMINOLOGIES OF DATA STRUCTURES (9 Hrs)

Introduction: Basic Terminologies– Elementary Data Organizations. Data Structure Operations: Insertion – Deletion –Traversal. Analysis of an Algorithm. Asymptotic Notations. Time-Space trade off. Array and its operations. Searching: Linear Search and Binary Search Techniques –Complexity analysis.

UNIT II STACK AND QUEUE OPERATIONS (9 Hrs)

Stacks and Queues: ADT Stack and its operations. Applications of Stacks: Expression Conversion and evaluation. ADT Queue and its operations. Types of Queue: Simple Queue – Circular Queue – Priority Queue – Deque.

UNIT III LINKED LIST OPERATIONS (9 Hrs)

Linked Lists: Singly linked list: Representation in memory. Algorithms of several operations: Traversing – Searching – Insertion – Deletion. Linked representation of Stack and Queue. Doubly linked list: operations. Circular Linked Lists: operations.

UNIT IV TREES (9 Hrs)

Trees: Basic Tree Terminologies. Different types of Trees: Binary Tree – Threaded Binary Tree – Binary Search Tree – Binary Tree Traversals – AVL Tree. Introduction to B-Tree and B+ Tree.

UNIT V SORTING, HASHING AND GRAPHS (9 Hrs)

Sorting: Bubble Sort – Selection Sort – Insertion Sort – Heap Sort – Shell Sort and Radix Sort. Performance and Comparison among the sorting methods. Hashing: Hash Table – Hash Function and its characteristics. Graph: Basic Terminologies and Representations – Graph traversal algorithms.

Text Books

1. Ellis Horowitz, SartajSahni, ”Fundamentals of Data Structures”, Illustrated Edition, Computer Science Press,2018.
2. Thomas H. Core man, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein, “Introduction to Algorithms”, PHI, Third Edition,2010.
3. AlfredV.Aho,Jeffrey D.Ullman,JohnE.Hopcroft,“Data Structures and Algorithms”,4th Edition,2009.

Reference Books

1. Balagurusamy, “Data Structures”, Tata McGraw-Hill Education, 2019.
2. D.Samanta, “Classic Data Structures, Prentice-Hall of India, Second Edition, 2012.

3. Robert Kruse, C.L. Tondo and Bruce Leung, “Data Structures and Program Design in c”, Prentice-Hall of India, Second Edition, 2007.
4. Mark Allen Weiss, “Data Structures and Algorithm Analysis in C”, Pearson Education, Second Edition, 2006.
5. Mark Allen Weiss,”Algorithms, Data Structures and Problem Solving with C++”, Addison-Wesley Publishing Company, Illustrated Edition, 1995.

Web References

1. https://www.geeksforgeeks.org/data-structures/
2. https://www.javatpoint.com/data-structure-tutorial/
3. https://www.studytonight.com/data-structures/
4. https://www.tutorialspoint.com/data_structures_algorithms/
5. https://www.w3schools.in/data-structures-tutorial/intro/

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	1	-	-	-	-	-	-	-	-	-	1	2
CO2	3	2	1	1	-	-	-	-	-	-	-	-	-	1	2
CO3	3	2	1	1	-	-	-	-	-	-	-	-	-	1	2
CO4	3	2	1	1	-	-	-	-	-	-	-	-	-	1	2
CO5	3	2	1	1	-	-	-	-	-	-	-	-	-	1	2

Correlation Level: 1-Low, 2-Medium, 3- High

		L	T	P	C	Hrs
U19ICT33	CIRCUIT THEORY	2	2	0	3	60

Course Objectives

- To impart knowledge on the fundamental principles of Electrical circuits
- To analyze circuits using various network theorems
- To acquire knowledge about steady state circuits
- To introduce the concepts of transients
- To impart knowledge on resonance and coupled circuits.

Course Outcomes

After completion of the course, the students will be able to

CO1 - Analyze D.C and A.C. Circuits.**(K4)**

CO2 - Apply the Network Theorems **(K3)**

CO3 - Analyze the steady state analysis of circuits **(K3)**

CO4 - Analyze the transient Circuits with respect to its Switching Conditions **(K4)**

CO5 - Design Circuits based on Resonance Conditions and analyze coupled circuits **(K3)**

UNIT I DC AND AC CIRCUITS (12 Hrs)

Electrical Quantities, Ohm's Law, Resistors -Series and parallel Combinations - voltage and current division, Kirchhoff's Laws. Mesh and node Analysis - A.C. circuits- Average and RMS value - Power, Power Factor and Energy.

UNIT II NETWORK REDUCTION AND THEOREMS (BOTH DCAND AC) (12 Hrs)

Network reduction- source transformation – star delta conversion. Superposition Theorem, Thevenin's Theorem, Norton's Theorem, Maximum power transfer Theorem, Reciprocity Theorem.

UNIT III STEADY STATE ANALYSIS (12 Hrs)

Sinusoidal Excitation applied to Purely Resistive - Inductive and Capacitive Circuits- RL, RC and RLC Series Circuits.

UNIT IV TRANSIENT RESPONSE ANALYSIS (12 Hrs)

Time Domain Analysis - Transient response of RL, RC & RLC Networks with DC Input - Solution using Laplace transforms.

UNIT V RESONANCE AND COUPLED CIRCUITS (12 Hrs)

Series and Parallel resonance - Quality factor and Bandwidth. Coupled circuits – Faraday's laws of electromagnetic induction - Self and mutual inductance – Dot convention - Coefficient of coupling – Tuned circuits – Single tuned circuits.

Text Books

1. Sudhakar and Shyam Mohan Palli," Circuits and Networks; Analysis and Synthesis", 3rd Edition, Tata McGraw Hill,2008
2. William H. Hayt, Jr. Jack E. Kemmerly and Steven M. Durbin, "Engineering Circuit Analysis", McGraw Hill Science Engineering, Seventh Edition,2019.
3. M.E. Van Valkenburg "Network Analysis", Third Edition, Prentice-Hall,2019.

Reference Books

1. Joseph Ed minister and Mahmood Nahvi, "Electric Circuits", Schaum's Outline Series, FourthEdition, Tata McGraw Hill Publishing Company, New Delhi,2017.
2. P. Ramesh Babu, "Circuit theory" Second Edition, Scitech Publications Pvt. Ltd,2014.

3. N.C. Jagan& C. Lakshminarayana, 'Network Theory' B.S Publications,2006.
4. Kuriakose, "Circuit Theory", PHI Learning,2005.
5. Allan.H.Robbins, Wilhelm C. Miller, "Circuit Analysis Theory and Practice", Cengage Learning India, 2013.

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1. http://bookboon.com/en/textbooks/electrical-electronics-engineering
2. http://www.freebookcentre.net/electronics-ebooks-download/Circuit-Theory-Lecture. Handouts.html.
3. https://nptel.ac.in/courses/108/102/108102042/

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes(PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	3	3	-	-	-	1	-	-	-	-	3	1	2
2	3	3	3	3	-	-	-	1	-	-	-	-	3	1	2
3	3	3	3	3	-	-	-	1	-	-	-	-	3	1	2
4	3	3	3	3	-	-	-	1	-	-	-	-	3	1	2
5	3	3	3	3	-	-	-	1	-	-	-	-	3	1	2

Correlation Level: 1-Low, 2-Medium, 3- High

U19ICT34	ELECTRICAL AND ELECTRONIC MEASUREMENTS	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To give an overview of current, voltage, power and energy measuring instruments
- To give an overview of measurement of power and energy meters
- To expose the students to the design of bridges for the measurement of resistance, capacitance and inductance
- To give an idea about electronic and digital meters
- To study display devices, waveform generators and analyzers.

Course Outcomes

After completion of the course, the students will be able to

CO1 - Understand the principle and working of electrical measuring instruments.**(K2)**

CO2 - Develop knowledge to measure parameters like voltage, current, power, energy.**(K3)**

CO3 - To measure the electrical parameters of various circuits **(K3)**

CO4 - Evaluate the performance of instruments under various operating conditions **(K3)**

CO5 - Select instruments suitable for specific applications **(K3)**

UNIT I ELECTRICAL MEASUREMENTS (9 Hrs)

Basics of Measurements, General features and Classification of electro mechanical instruments. Principles of Moving coil, moving iron, dynamometer type, rectifier type, thermal instruments. Errors and compensation, Extension of instrument range: shunt and multipliers, calibration of voltmeter and ammeters, CT and PT.

UNIT II MEASUREMENT OF POWER AND ENERGY (9 Hrs)

Electro-dynamic wattmeter, Low Power Factor (LPF) wattmeter, errors, Single and three phase power measurement, Hall effect wattmeter, thermal type wattmeter. Energy measurement - Single phase and polyphase induction type energy meter - theory and adjustments - Testing of energy meters - Calibration of wattmeter and energy meter.

UNIT III MEASUREMENT OF RESISTANCE, INDUCTANCE AND CAPACITANCE (9 Hrs)

Measurement of Resistance: Wheatstone's bridge, Sensitivity, Limitations. Kelvin's double bridge. Earth resistance measurement by fall of potential method and by using Megger. **Measurement of Inductance and Capacitance:** Sources and detectors, Maxwell's inductance bridge, Maxwell's inductance and capacitance bridge, Hay's bridge, Anderson's bridge, Schering bridge.

UNIT IV ELECTRONIC AND DIGITAL MEASUREMENTS (9 Hrs)

Introduction. essentials of electronic instruments, Advantages of electronic instruments. True rms reading voltmeter. Electronic multimeters. Digital voltmeters (DVM) - Ramp type DVM, Integrating type DVM, Continuous – balance DVM and Successive - approximation DVM. Q meter. Principle of working of electronic energy meter (block diagram treatment), Extra features offered by present day meters and their significance in billing

UNIT V DISPLAY DEVICES, WAVEFORM GENERATORS AND ANALYZERS (9 Hrs)

DSO, DPO, MSO, Analog Recorders – Strip Chart and X-Y recorders, Digital Recorders Function generators, Signal generators, Waveform analyzers, Spectrum analyzers, Distortion analyzers.

Text Books

1. Golding, E.W. and Widdis, F.C., "Electrical Measurements and Measuring Instruments", A.H.Wheeler and Co, 5th Edn,2011.
2. David A. Bell, "Electronic Instrumentation and Measurements", Oxford University Press, 3rd Edition, 2013.
3. ShawnyA K, "A course in Electrical and Electronic Measurements and Instrumentation", DhanpatRai and Sons. 19th revisededition,2014.

Reference Books

1. Kalsi.H.S, "Electronic Instrumentation", Tata McGraw Hill Education Private Limited,3rdEdition,2012
2. Patranabis, Principles of Electronic Instrumentation -PHI,2008
3. Joseph. J. Carr, Elements of Electronic Instrumentation & Measurements, III edition, Pearson Education,2003.
4. Electronics Instruments and Instrumentation Technology – Anand,PHI
5. Doebelin, E.O., Measurement systems, McGraw Hill, Fourthedition

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2. http://www.brainkart.com/subject/Measurements-and-Instrumentation_204/
3. https://onlinecourses.nptel.ac.in/noc19_ee44/preview
4. https://www.careerride.com/mcq/electrical-and-electronic-measurements-instrumentation-electrical-engineering-mcq-questions-and-answers-272.aspx

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes(PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	-	-	-	-	1	-	-	-	-	-	1	3	1	2
2	3	-	-	-	-	1	-	-	-	-	-	1	3	1	2
3	3	-	-	-	-	1	-	-	-	-	-	1	3	1	2
4	3	-	-	-	-	1	-	-	-	-	-	1	3	1	2
5	3	-	-	-	-	1	-	-	-	-	-	1	3	1	2

Correlation Level: 1-Low, 2-Medium, 3- High

U19ICT35 **ELECTRONICS ENGINEERING**

L	T	P	C	Hrs
3	0	0	3	45

Course Objectives

- To study the basic semiconductor diodes and its applications.
- To understand the operation and characteristics of transistors
- To understand small signal and large signal amplifiers
- To know about feedback amplifiers and oscillators
- To study about special semiconductor devices.

Course Outcomes

After completion of the course, the students will be able to

CO1 - Understand the basic semiconductor diodes and its applications **(K2)**

CO2 - Gain knowledge about the working and characteristics of transistors. **(K2)**

CO3 - Understand small signal and large signal amplifiers **(K2)**

CO4 - Analyze the operation of feedback amplifiers and oscillators **(K4)**

CO5 -.Analyze the special semiconductor devices **(K4)**

UNIT I PN JUNCTION DEVICES (9 Hrs)

PN junction diode – structure, operation, V-I characteristics, Applications. Rectifiers - Half wave, Full wave, Bridge Rectifiers. Clippers – Positive, negative, Biased. Clampers - Positive, negative. Voltage Multipliers – Doublers, Triplers, Quadruplers. Zener diode – working, Characteristics, Zener Breakdown, Zener as regulator.

UNITII TRANSISTORS (9 Hrs)

Bipolar Junction Transistors - Construction, Working, Characteristics, Biasing. Operating point..Bias Stability. Methods – Fixed Bias, Collector feedback bias, Voltage Divider bias. Bias Compensation.- Diode compensation, Thermistor compensation, Sensistor compensation.. Field Effect Transistors. - JFET - n channel, p channel - Construction, Working, Parameters, Characteristics, Biasing of JFET – Fixed bias, Self bias, Voltage divider bias. MOSFET – Enhancement and Depletion MOSFET - Construction, working, Drain and Transfer characteristics.

UNIT III SMALL SIGNAL AND LARGE SIGNAL AMPLIFIERS (9 Hrs)

BJT small signal model – Analysis of CE, CB and CC amplifiers - FET small signal model – Analysis of CS and Source follower. Power Amplifiers – Classification – Class A Amplifiers – Class B Amplifier – Class AB Amplifier - Distortion - Class C and Class D amplifiers. Differential Amplifiers.

UNIT IV FEEDBACK AMPLIFIERS AND OSCILLATORS (9 Hrs)

Advantages of negative feedback – voltage / current, series, shunt feedback. Positive feedback – Condition for oscillations - Hartley, Colpitts, Wien bridge, and Crystal oscillators.

UNIT V SPECIAL SEMICONDUCTOR DEVICES (9 Hrs)

SCR- DIAC - TRIAC - UJT - Varactor diode - PIN diode - Tunnel diode - Gunn diode. Display devices - LED, LCD, LASER diode.- Construction, working and characteristics.

Text Books

1. Jacob Millman, Chritos C Halkias,“ Electronic Devices and Circuits”, 4th edition. McGraw Hill Education India Private Ltd., 2015.
2. David A. Bell ,”Electronic Devices and Circuits”, Prentice Hall of India,2004.
3. Nagrath I. J., Electronic Devices and Circuits, PHI Learning,2007

Reference Books

1. Thomas L. Floyd, “Electronic devices” Prentice Hall”, 10th Edition,2018.
2. Robert L. Boylestad, “Electronic Devices and Circuit Theory”, 11th Edition,2015

3. Donald A Neaman," Semiconductor Physics and Devices" , 4th edition, McGraw Hill Education India Private Ltd.,2011
4. Sedra and Smith," Microelectronic Circuits, , Oxford University Press, 5th Edition,2012
5. Salivahanan, "Electron Devices and Circuits", 4th edition, McGraw Hill Education India Private Ltd.,2016

Web References

1. www.allaboutcircuits.com
2. www.circuitstoday.com
3. http://www.electronics-tutorials.ws
4. https://nptel.ac.in/courses/108/108/108108112/

COs/POs/PSOs Mapping

CO's	Program Outcomes (POs)												Program Specific Outcomes(PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	1	1	-	-	1	-	-	2	-	1	1	3	1	1
2	3	1	1	-	-	1	-	-	2	-	1	1	3	1	1
3	3	1	1	-	-	1	-	-	2	-	1	1	3	1	1
4	3	1	1	-	-	1	-	-	2	-	1	1	3	1	1
5	3	1	1	-	-	1	-	-	2	-	1	1	3	1	1

Correlation Level: 1-Low, 2-Medium, 3- High

U19ICT36	TRANSDUCER ENGINEERING	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- Get exposed to basic concepts of measurement
- To acquire knowledge on different types of resistive transducers and their application
- To gain knowledge on capacitive and inductive transducers.
- To get introduced to miscellaneous transducers.
- To acquaint various sensors.

Course Outcomes

After completion of the course, the students will be able to

CO1 - Understand the basic concepts of measurement.**(K2)**

CO2 - Understand the concepts of Resistive transducers. **(K2)**

CO3 - Get familiar with various types of inductive and capacitive transducers.**(K2)**

CO4 - Understand the concept of various types of smart transducers**(K2)**

CO5 - Be familiar with the concept of Smart Sensor **(K3)**

UNITI INTRODUCTION (9 Hrs)

Generalized scheme of a measurement system – Errors in measurements–types of errors - probability of errors – probable error, limiting errors. Reliability of measurement systems – failure rate – reliability improvement, Availability, redundancy. Difference between Sensors and Transducers, Classification, Active and Passive transducers, Different types of noises in measurements and its Suppression methods.

UNIT II RESISTIVE TRANSDUCERS (9 Hrs)

Resistive transducers: Potentiometers, loading effect – strain gauges – gauge factor – types of strain gauges – rosettes – semiconductor strain gauges, Resistance thermometers, materials, construction, characteristics – Thermistors and photo resistors (LDR) – hot wire anemometer – constant current and constant temperature operation – humidity sensors.

UNIT III INDUCTIVE AND CAPACITIVE TRANSDUCERS (9 Hrs)

Self and mutual inductive transducers, eddy current transducers, proximity sensors, tacho-generators and stroboscope. Capacitive transducers – variable area type – variable air gap type – variable permittivity type – signal conditioning circuit– Capacitor microphone – frequency response.

UNIT IV MISCELLANEOUS TRANSDUCERS (9 Hrs)

Piezoelectric transducers, photoelectric transducers, Hall effect transducers, Magnetostrictive transducers. Optical sensors, IC sensor for temperature – signal conditioning circuits, Introduction to Fiber optic sensors – Temperature, pressure, flow and level measurement using fiber optic sensors.

UNIT V SMART SENSORS (9 Hrs)

Introduction to Smart Sensors and Semiconductor sensors, MEMS, MOEMS, Nano-sensors, SQUID Sensors,- Environmental Monitoring sensors (Water Quality & Air Pollution)- Sensor for Motion and Position Measurement, GPS, INS, Doppler, SONAR, Thermal Sensors .

Text Books

1. S. Vijayachitra, Transducers engineering, 2nd edition, Prentice Hall of India, 2016.E.A.
2. D. Patranabis, Instrumentation and control, PHI,2011
3. Murthy D.V.S., “Transducer and Instrumentation”, PHI, 2nd Edition,2012.

Reference Books

1. Jacob Fraden "Handbook of modern sensors physics, designs and applications", 5th edition, Springer,2015.
2. Pavel Ripka "Modern sensors handbook", ISTE Ltd, 1st edition,2007.
3. Sensors and transducers by Patranabis,. 2ndEdition,2003.
4. John G. Webster, Sensors and Signal Conditioning, Wiley Inter Science, 2ndEdition,2008
5. Renganathan S., “Transducer Engineering” -Allied Publishers Limited,2003

Web References

1. https://lecturenotes.in/subject/30/sensors-and-transducers-st
2. https://lecturenotes.in/notes/2143-notes-for-sensors-and-transducers-st-by-anita-mohanty
3. https://www.electronicshub.org/sensors-and-transducers-introduction/
4. https://lecturenotes.in/notes/2143-notes-for-sensors-and-transducers-st-by-anita-mohanty

COs/POs/PSOs Mapping

CO’S	Program Outcomes (POs)												ProgramSpecific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	-	2	-	-	1	2	-	-	-	2	-	3	2	2
2	2	-	3	-	-	1	2	-	-	-	2	-	3	2	2
3	2	-	2	-	-	1	2	-	-	-	2	-	3	2	2
4	2	-	3	-	-	1	2	-	-	-	-	-	3	2	2
5	2	-	2	-	2	2	3	-	-	-	2	-	3	2	2

Correlation Level: 1-Low, 2-Medium, 3- High

		L	T	P	C	Hrs
U19ICP31	**DATA STRUCTURES LAB**	0	0	2	1	30

(Common to CSE, ECE, EEE, IT, ICE, MECH, CIVIL, BME, Mechatronics,)

Course Objectives

- To learn the basic concepts of Data Structures.
- To learn about the concepts of Searching Techniques.
- To learn about the concepts of Sorting Techniques.
- To study about the linear Data Structures.
- To study about non-linear Data Structures.

Course Outcomes

After completion of the course, the students will be able to

CO1 - Analyze the algorithm's / program's efficiency in terms of time and space complexity.**(K3)**
CO2 - Solve the given problem by identifying the appropriate Data Structure.**(K3)**
CO3 - Solve the problems of searching and sorting techniques. **(K3)**
CO4 - Solve problems in linear Data Structures.**(K4)**
CO5 - Solve problems in non-linear Data Structures. **(K4)**

List of Exercises

1. Write a C program to implement recursive and non-recursive i) Linear search ii) Binary Search.
2. Write a C program to implement i) Bubble sort ii) Selection sort iii) Insertion sort iv) Shell sort v) Heap sort.
3. Write a C program to implement the following using an array. a) Stack ADT b) Queue ADT
4. Write a C program to implement list ADT to perform following operations a) Insert an element into a list. b) Delete an element from list c) Search for a key element in list d) count number of nodes in list.
5. Write a C program to implement the following using a singly linked list. a) Stack ADT b) Queue ADT.
6. Write a C program to implement the de queue (double ended queue) ADT using a doubly linked list and an array.
7. Write a C program to perform the following operations:
   a) Insert an element into a binary search tree.
   b) Delete an element from a binary search tree.
   c) Search for a key element in a binary search tree.
8. Write a C program that use recursive functions to traverse the given binary tree in a) Preorder b) In order and c) Post order.
9. Write a C program to perform the AVL tree operations.
10. Write a C program to implement Graph Traversal Techniques.

Reference Books

1. Yashavant Kanetkar, "Data Structures through C", BPB Publications, 3rd edition, 2019.
2. Gav.pai, "Data Structures and Algorithms", McGraw-Hill India, 1st edition, 2013.
3. Manjunath Aradhya M and Srinivas Subramiam, "C Programming and Data Structures", Cengage India 1st edition, 2017.
4. Reema Thareja, "Data structures using C", 2nd edition, Oxford University, 2014.
5. Tenebaum Aaron M, " Data Structures using C', Pearson Publisher, 1st edition, 2019.

Web References

1. https://www.tutorialspoint.com/data_structures_algorithms/
2. https://www.w3schools.in/data-structures-tutorial/intro/
3. https://nptel.ac.in/courses/106103069/
4. https://swayam.gov.in/nd1_noc20_cs70/preview
5. https://nptel.ac.in/courses/106103069/

COs/POs/PSOs Mapping

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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	1	1	3	-	-	-	-	-	-	-	-	1	2
2	3	2	1	1	3	-	-	-	-	-	-	-	-	1	2
3	3	2	1	1	3	-	-	-	-	-	-	-	-	1	2
4	3	2	1	1	3	-	-	-	-	-	-	-	-	1	2
5	3	2	1	1	3	-	-	-	-	-	-	-	-	1	2

Correlation Level: 1-Low, 2-Medium, 3- High

		L	T	P	C	Hrs
U19ICP32	ELECTRONICS ENGINEERING LAB	0	0	2	1	30

Course Objectives

- To design the rectifier circuits
- To design the characteristics of Diode and transistor
- To construct the amplifier circuits
- To design the oscillator circuits
- To design the circuits using PSPICE

Course Outcomes

After completion of the course, the students will be able to

CO1 - Design different rectifier circuits.**(K3**)
CO2 - Analyze the characteristics of Diode and transistor **(K4)**
CO3 - Interpret the amplifier circuits **(K3)**
CO4 - Design the oscillator circuits.**(K4)**
CO5 - Evaluate the analog circuits using PSPICE**(K4)**

List of Experiments

Hardware Experiments

1. Characteristics of PN Junction Diode
2. Characteristics of Zener Diode
3. Characteristics of transistor a) CB b)CE
4. Half wave Rectifier with and without Filter.
5. Full Wave Rectifier with and without Filter
6. Clippers and Clampers
7. Design and Testing of Hartley oscillators
8. Design and Testing Colpitts Oscillators
9. Design and Testing of Power Amplifier
10. Design and Testing of RC coupled amplifiers
11. Characteristics of FET

Software Experiments (PSPICE SIMULATION)

1. Design and Testing of PN junction characteristic.
2. Design and testing transistor characteristic
3. Design and testing of Rectifier circuits
4. Design and Testing of Multivibrator
5. Design and Testing of RC Phase shift oscillator

Reference Books

1. J. Millman and C.C. Halkias, Integrated Electronics, McGraw-Hill,2007.
2. Salivahanan, S. Electronic devices and circuits. Tata McGraw-Hill Education,2011.
3. Robert L. Boylestad and Louis Nashelsky, Electronic Devices and Circuits Theory, Pearson/ Prentice Hall, 9th Edition, 2013.
4. Sedra and Smith," Microelectronic Circuits, , Oxford University Press, 5th Edition, 2012
5. Jacob Millman,Chritos C Halkias," Electronic Devices and Circuits", 4th edition. McGraw Hill Education India Private Ltd.,2015

Web References

1. www.allaboutcircuits.com
2. www.circuitstoday.com
3. http://www.electronics-tutorials.ws
4. https://nptel.ac.in/courses/108/108/108108112/

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3	3	2	3	2	-	-	-	-	2	-	2	2	3	2	3
4	3	2	3	2	-	-	-	-	2	-	2	2	3	2	3
5	3	2	3	2	-	-	-	-	2	-	2	2	3	2	3

Correlation Level: 1-Low, 2-Medium, 3- High

		L	T	P	C	Hrs
U19ICP33	TRANSDUCER ENGINEERING LAB	0	0	2	1	30

Course Objectives

- To experimentally verify the principle and characteristics of various transducers
- Obtain the knowledge about various types of Sensors & Transducers and their working principle
- Understand the various types of transducers like Resistive, Capacitive and Inductive
- Learn some of the miscellaneous transducers
- To select and design suitable instruments to meet the requirements of industrial applications.

Course Outcomes

After completion of the course, the students will be able to

CO1 - Know the standards to measure and to compute the statistical error analysis **(K4)**

CO2- An ability to analyze and understand various sensors based on its classification and working principle. **(K4)**

CO3 - Demonstrate the performance characteristics of various transducers **(K3)**

CO4 - Acquire knowledge of analyzing different stages of signal conditioning units **(K4)**

CO5 - Design a measurement system for an application.**(K4)**

List of Experiments

1. Characteristics of Strain gauge
2. Characteristics of potentiometer.
3. Measurement of force/load using a load cell.
4. Angular displacement Measurement using capacitive transducers.
5. Speed measurement using photoelectric tachometer.
6. Pressure measurement using piezoelectric transducers.
7. Static and Dynamic Characteristics of Hall Effect Sensor
8. Characteristics of LVDT.
9. Static and Dynamic characteristics of thermocouple, Thermistor and RTD
10. Characteristics of I /P Converters.
12. Characteristics of Optical Transducers.
13. Measurement of position using synchro transmitter and Receiver
14. Characteristics of Filled in system thermometer

Reference Books

1. Handbook of Laboratory Measurements and Instrumentation IFSA Publishing (2011)
2. Sawhney. A.K, “A Course in Electrical and Electronics Measurements and Instrumentation”, 18th Edition, Dhanpat Rai& Company Private Limited,2017.
3. Renganathan. S,“Transducer Engineering”, 4th edition Allied Publishers, Chennai,2003.
4. Sensors and transducers by Patranabis,. 2nd Edition,2003.
5. John G.Webster, Sensors and Signal Conditioning, Wiley Inter Science, 2nd Edition,2008

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1. https://lecturenotes.in/subject/30/sensors-and-transducers-st
2. https://lecturenotes.in/notes/2143-notes-for-sensors-and-transducers-st-by-anita-mohanty
3. https://www.cardano.pv.it/progetti/clil/materiali/Elettrotecnica.pdf

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2	3	-	1	-	-	2	2	-	2	-	2	1	3	3	3
3	3	-	1	-	-	2	2	-	2	-	2	1	3	3	3
4	3	-	1	-	-	2	2	-	2	-	2	1	3	3	3
5	3	-	1	-	-	2	2	-	2	-	2	1	3	3	3

Correlation Level: 1-Low, 2-Medium, 3- High

		L	T	P	C	Hrs
U19ICC3X	CERTIFICATION COURSE-I	0	0	4	-	50

Students shall choose an International certification course offered by the reputed organizations like Google, Microsoft, IBM, Texas Instruments, Bentley, Autodesk, Eplan and CISCO, etc. The duration of the course is 40-50 hours specified in the curriculum, which will be offered through Centre of Excellence. Pass /Fail will be determined on the basis of participation, attendance, performance and completion of the course. If a candidate Fails, he/she has to repeat the course in the subsequent years. Pass in this course is mandatory for the award of degree.

U19ICS31	SKILL DEVELOPMENT COURSE 1 GENERAL PROFICIENCY–I	L	T	P	C	Hrs
		0	0	2	-	30

Course Objectives

- To enrich strong vocabulary and decoding skills through comprehension analysis
- To advance communication and leadership skills pragmatically
- To pronounce English sounds in isolation and in connected speech
- To expand effective written communication skills to meet organizational goals
- To extend knowledge on verbal aptitude and prepare for interviews

Course Outcomes

After completion of the course, the students will be able to

CO1 - Interpret meaning and apply reading strategies in technical and non-technical context (K2)
CO2 - Develop interpersonal communication skills professionally (K3)
CO3 - Infer the distinct speech sounds and overcome native language influence (K2)
CO4 - Demonstrate various forms of formal writing (K2)
CO5 - Apply the techniques of verbal aptitude in competitive exams (K3)

UNIT I - COMPREHENSION ANALYSIS (6 Hrs)

Listening: Listening Comprehension (IELTS based) – **Speaking**: Break the iceberg - **Reading:** Reading technical passage (IELTS based) - **Writing:** Writing Task: 1 (IELTS: Graph/ Process /Chart Description) **Vocabulary:** Synonyms (IELTS)

UNIT II - PERSONALITY DEVELOPMENT (6 Hrs)

Listening: Interview Videos- **Speaking:** Extempore& Presentation (Soft Skills) - **Reading:** British & American Vocabulary, Read and review (Books, Magazines) - **Writing**: SWOT Analysis **Vocabulary:** Idioms (IELTS)

UNIT III -INFERENTIAL LEARNING (6 Hrs)

Listening: Listening Speech sounds to overcome Mother Tongue Influence, Anecdotes– **Speaking**: Interpersonal Interaction & Situational attribution–**Reading**: Distinguish between facts & opinions - **Writing:** Writing Conversation to different context **Vocabulary:** Phrasal Verbs (IELTS)

UNIT IV - INTERPRETATION AND FUNCTIONAL WRITING (6 Hrs)

Listening: Group Discussion videos - **Speaking:** Group Discussion Practice - **Reading:** Interpretation of data - Graph, table, chart, diagram (IELTS based) -**Writing**: Writing Task: 2 (IELTS) **Vocabulary:** Collocations (IELTS)

UNIT V- APTITUDE (6 Hrs)

Language Enhancement: Articles**,** Preposition, Tenses
Verbal Ability Enhancement: Blood Relation, Completing Statements- Cloze test, Spotting Errors –Sentence Improvement, One Word Substitution, Word Analogy, Word Groups(**GATE**)

Reference Books

1. Jeff Butterfield, “Soft Skills for Everyone”, Cengage Learning, New Delhi, 2012.
2. Mn,Taylor, and Grant Taylor. “English Conversation Practice”. Tata McGraw-Hill Education, 1975.
3. Bailey, Stephen. “Academic writing: A practical guide for students”. Psychology Press, 2003.
4. Aggarwal, R. S. “A Modern Approach to Verbal & Non Verbal Reasoning”. S. Chand, 2010.
5. Wren, Percival Christopher, and Wren Martin. “High School English Grammar and Composition”. S Chand, 2005.

Web References

1. https://www.ielts-exam.net/grammar/
2. https://ieltsfocus.com/2017/08/02/collocations-ielts/
3. https://www.fresherslive.com/online-test/blood-relations-questions-and-answers
4. https://www.toppr.com/guides/english-language/reading-comprehension/cloze-test/
5. https://www.examsbook.com/word-analogy-test-questions-with-answers

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	1	-	-	-	-	-	-	-	-	3	-	1	1	-	-
2	1	-	-	-	-	-	-	1	-	3	-	1	1	-	-
3	1	-	-	-	-	-	-	-	-	3	-	1	-	-	-
4	1	-	-	-	-	-	-	-	-	3	-	1	1	-	-
5	1	-	-	-	-	-	-	-	-	3	-	1	-	-	-

Correlation Level: 1-Low, 2-Medium, 3- High

U19ICS32

SKILL DEVELOPMENT COURSE 2

(Choose anyone of the below three courses)

L	T	P	C	Hrs
0	0	2	-	30

1. TROUBLESHOOTING OF ELECTRONIC EQUIPMENTS

Course Content:

1. Reliability Aspects of Electronic Equipment.
2. Fundamental Troubleshooting Procedures.
3. Electronic Test Equipment.
4. Tools and Aids for Servicing and Maintenance.
5. PCB Testing and Soldering Techniques.
6. Power Supply and Subsystems Troubleshooting.
7. Mechanical and Electro-mechanical Components.
8. Passive Components and Their Testing.
9. Testing of Semiconductor Devices.
10. Troubleshooting Digital Circuits.
11. Troubleshooting Microprocessor-Based Systems.

(OR)

2. OFFICE AUTOMATION

Course Content:

1. Basics of Computer
2. Operating Systems Ms-Windows & Linux
3. Office Applications – I Ms Office: Ms-Word Open Office: Writer
4. Office Applications - ii Ms Office: Ms-Excel Open Office: Calc& Math
5. Office Applications - iii Ms Office: Ms-Access Open Office: Base
6. Office Applications - iv Ms Office: Ms-Power Point Open Office: Impress
7. Internet & Advanced Communication

(OR)

3. MOBILE PHONE SERVICING

Course Content:

1. How to remove and fix mobile speaker and ringer
2. How to repair and tracing battery connector supply
3. Mobile not charging and charging/discharging problem solution
4. Soldering and disordering of mobile components
5. Mobile phone fingerprint related problem solution
6. Mobile phone assembling & dissembling
7. What is GSM and CDMA generation
8. How to remove and fix headphone jack
9. How to remove damage and fix on/off switch
10. Mobile charging circuit repair
11. Mobile network circuit repair
12. Mobile repair with miracle box
13. Mobile repair with z3x box

		L	T	P	C	Hrs
U19ICM31	PHYSICAL EDUCATION	0	0	2	-	30

Physical Education is compulsory for all the Undergraduate students and Pass in this course is mandatory for the award of degree. Physical Education activities will include games and sports/extension lectures. The student participation shall be for minimum period of 30 hours. Physical Education activities will be monitored by the Director of Physical Education. Pass/Fail will be determined on the basis of participation, attendance, performance and conduct. If a candidate fails, he/she has to repeat the course in the subsequent years.

U19ICT41	PROBABILITY AND STATISTICS	L	T	P	C	Hrs
		2	2	0	3	60

(Common to EEE & ICE)

Course Objectives

- To acquire skills in handling situation including more than one random variable
- To familiarize the student about the continuous random variables and their Applications.
- To study the basic concepts of Statistics.
- To learn the concept of testing hypotheses using statistical analysis.
- To learn the concept of Small sampling.

Course Outcomes

After completion of the course, the students will be able to

CO1 - Apply the concept of probability in random variables. **(K3)**
CO2 - Apply the basic rules of continuous random variables. **(K3)**
CO3 - Understand the basic concepts of Statistics. **(K2)**
CO4 - Derive the inference for various problems using testing of hypothesis in large samples **(K5)**
CO5 - Solve the problems related to testing of hypothesis in small samples **(K5)**

UNIT I DISCRETE RANDOM VARIABLES (12 Hrs)

Random Variables and their event spaces – The probability mass function – Distribution functions – Binomial –Geometric – Negative Binomial and Poisson.

UNIT II CONTINUOUS RANDOM VARIABLES (12 Hrs)

Some important distributions – Exponential distribution –Gamma –Weibull – Gaussian distributions. Application of distribution – Reliability – Failure density and Hazard function.

UNITIII STATISTICS (12 Hrs)

Measures of central tendency – Arithmetic Mean, Median and Mode – Measures of dispersion and Standard deviation –Skewness and Measures of Skewness – Pearson's coefficient of Skewness – Moments – Correlation – Rank correlation and regression.

UNIT IV LARGE SAMPLES (12 Hrs)

Curve fitting by the method of least squares – Fitting of straight lines – Second degree parabolas and more general curves – Test of significance: Large samples test for single proportions, differences of proportions, single mean, difference of means and standard deviations.

UNIT V SMALL SAMPLES (12 Hrs)

Test for single mean – Difference of means and correlations of coefficients – Test for ratio of variances– Chi-square test for goodness of fit and independence of attributes.

Text Books

1. B.S.Grewal, "Higher Engineering Mathematics", Khanna Publishers - **Paperback –** 3rd Edition,2017.
2. T. Veerarajan, "Probability, Statistics and Random Processes", Tata McGraw-Hill Education, 2008.
3. Dr. A. Singaravelu, "Probability and Statistics", Meenakshi Agency, Paperback – 1,2019.

Reference Books

1. Ravish R. Singh, MukulBhatt, "Engineering Mathematics", McGraw-Hill, 1st Edition, 2017.
2. William Mendenhall, Robert J. Beaver, Barbara M. Beaver: "Introduction to Probability & Statistics", Cengage Learning; 15th Edition 2019.

3. Richard .A. Johnson, Irwin Miller and John E. Freund," Probability and Statistics for Engineers", Pearson Education, Asia, 9th Edition, 2018.
4. Vijay K. Rohatgi and A.K. Md. Ehsanes Saleh, "An Introduction to Probability and Statistics", Wiley ,2008.
5. E. Rukmangadachari, "Probability and Statistics", Pearson Education India ,2012.

Web References

1. http:// www.stat110.net
2. http://www.nptel.ac.in/courses/111105035 (R.V)
3. http:// www.probabilitycourse.com.
4. www.edx.org/Probability
5. http://www2.aueb.gr/users/demos/pro-stat.pdf

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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	1	1	-	-	-	-	-	-	-	1	-	-	1
2	3	2	1	1	-	-	-	-	-	-	-	1	-	-	1
3	2	1	-	-	-	1	-	-	-	-	-	1	-	-	1
4	3	2	1	1	-	1	-	-	-	-	-	1	-	-	1
5	3	2	1	1	-	1	-	-	-	-	-	1	-	-	1

Correlation Level: 1-Low, 2-Medium, 3- High

U19ICT42	PROGRAMMING IN JAVA	L	T	P	C	Hrs
		3	0	0	3	45

(Common to CSE, ECE, EEE, IT, ICE, MECH, CIVIL, BME, Mechatronics,)

Course Objectives

- To gain and explore the knowledge of java programming
- To know the principles of inheritances, packages, interfaces
- To get familiarized to generic programming, multithreading concepts.
- To gain and explore the advanced concepts in Java.
- To explore database connectivity

Course Outcomes

After completion of the course, the students will be able to

CO1 - Write a maintainable java program for a given algorithm and implement the same.**(K2)**
CO2 - Demonstrate the use of inheritance, interface and package in relevant applications. **(K3)**
CO3 - Create java applications using exception handling, thread and generic programming. **(K3)**
CO4 - Build java distributed applications using Collections and IO streams.**(K3)**
CO5 - Exemplify simple graphical user interfaces using GUI components and database programs.**(K3)**

UNIT I INTRODUCTION TO JAVA PROGRAMMING (9 Hrs)

The History and Evolution of Java – Byte code – Java buzzwords – Data types – Variables – Arrays – operators – Control statements – Type conversion and casting. Concepts of classes and objects: Basic Concepts of OOPs – constructors – static keyword –Final with data –Access control –This key word – Garbage collection – Nested classes and inner classes – String class

UNIT II INHERITANCE, PACKAGES AND INTERFACES (9 Hrs)

Inheritance: Basic concepts – Forms of inheritance – Super key word – method overriding – Abstract classes – Dynamic method dispatch – The Object class. Packages: Defining – Creating and Accessing – importing packages. Interfaces: Defining –Implementing –Applying –Variables and extending interfaces

UNIT III EXCEPTION HANDLING, MULTI THREADING (9 Hrs)

Concepts of Exception handling –Types of exceptions –Creating own exception – Concepts of Multithreading – creating multiple threads – Synchronization –Inter thread communication. Enumeration: Autoboxing– Generics.

UNIT IV COLLECTIONS, I/OSTREAM (9 Hrs)

Collections: List –Vector – Stack – Queue – Dequeue –Set – SortedSet. Input / Output Basics – Streams – Byte streams and Character streams – Reading and Writing Console – Reading and Writing Files.

UNITV EVENT DRIVEN PROGRAMMING AND JDBC (9 Hrs)

Events – Delegation event model – Event handling – Adapter classes. AWT: Concepts of components – Font class – Color class and Graphics. Introduction to Swing: Layout management - Swing Components. Java Database Connectivity. Develop real time applications.

Text Books

1. Herbert Schildt, “Java: The Complete Reference”, TMH Publishing Company Ltd,11th Edition,2018.
2. Sagayaraj, Denis, Karthik, Gajalakshmi, “JAVA Programming for core and advanced learners”, Universities Press Private Limited, 2018.

3. Herbert Schildt, “The Complete Reference JAVA 2”, TMH, Seventh Edition, 2006.

Reference Books

1. H.M.Dietel and P.J.Dietel, “Java How to Program”, 11th Edition, Pearson Education/PHI, 2017.
2. Nageshvarrao, “Core Java and Integrated Approach”, 1st Edition, Dreamtech, 2016.
3. Cay S. Horstmann, Gary cornell, “Core Java Volume –I Fundamentals”, Prentice Hall,9th Edition, 2013.
4. P.J. Dietel and H.M Dietel, “Java for Programmers”, Pearson Education, 9th Edition, 2011.
5. Cay.S.Horstmann and Gary Cornell, “Core Java 2”, Pearson Education, 8th Edition,2008.

Web References

1. http://www.ibm.com/developerworks/java/
2. http://docs.oracle.com/javase/tutorial/rmi/.
3. IBM’s tutorials on Swings, AWT controls and JDBC.
4. https://www.edureka.co/blog
5. https://www.geeksforgeeks.org

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												ProgramSpecific Outcomes(PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	1	-	-	2	-	-	-	-	-	-	-	-	2	-
2	3	2	1	1	3	-	-	-	-	-	-	-	-	2	-
3	3	2	1	1	3	-	-	-	-	-	-	-	-	2	-
4	3	2	1	1	3	-	-	-	-	-	-	-	-	2	-
5	3	2	1	1	3	-	-	-	-	-	-	-	-	2	-

Correlation Level: 1-Low, 2-Medium, 3- High

U19ICT43	ANALOG INTEGRATED CIRCUITS	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To study the IC fabrication procedure.
- To study characteristics; realize circuits; design for signal analysis using Op-amp ICs.
- To study the applications of Op-amp.
- To study internal functional blocks and the applications of special ICs like Timers, PLL.
- To study the different applications IC's.

Course Outcomes

After completion of the course, the students will be able to

CO1- To understand the IC fabrication process **(K2)**

CO2- Analyze the characteristics of op-amp and its significance **(K4)**

CO3- Gain knowledge on various applications of op-amp.**(K3)**

CO4- Design and analyze the 555 timer and its application. **(K3)**

CO5- Analyze different application IC's **(K2)**

UNIT I IC FABRICATION (9 Hrs)

IC classification, fundamental of monolithic IC technology, epitaxial growth, masking and etching, diffusion of impurities. Realization of monolithic ICs and packaging. Fabrication of diodes, capacitance, resistance and FETs

UNIT II INTRODUCTION TO OP-AMP (9 Hrs)

Ideal OP-AMP characteristics, DC characteristics, AC characteristics, differential amplifier; frequency response of OP-AMP; Basic applications of op-amp – Inverting and Non-inverting Amplifiers-V/I & I/V converters, summer, differentiator and integrator

UNIT III APPLICATIONS OF OP-AMP (9 Hrs)

Instrumentation amplifier, Log and Antilog Amplifiers, first and second order active filters, comparators, multivibrators, waveform generators, clippers, clampers, peak detector, S/H circuit, D/A converter (R- 2R ladder and weighted resistor types), A/D converters using op amps.

UNIT IV SPECIAL ICs (9 Hrs)

Functional block, characteristics and application circuits with 555 Timer IC-566 voltage controlled oscillator IC; 565-phase lock loop IC, Analog multiplier ICs.

UNIT V APPLICATION ICs (9 Hrs)

IC voltage regulators –LM78XX,79XX Fixed voltage regulators - LM317, 723 Variable voltage regulators, switching regulator- SMPS- LM 380 power amplifier- ICL 8038 function generator IC.

Text Books

1. David A.Bell, 'Op-amp & Linear ICs', Oxford,2013.
2. D.Roy Choudhary, SheilB.Jani, 'Linear Integrated Circuits', II edition, New Age,2012.
3. Ramakant. Gayakwad, 'Op-amps and Linear Integrated Circuits', IV Edition, Pearson Education,2003 PHI.2015

Reference Books

1. Fiore, "Op-amps & Linear Integrated Circuits Concepts & Applications", Cengage,2010.
2. Floyd, Buchla, "Fundamentals of Analog Circuits, Pearson,2013.
3. Sergio Franco, "Design with operational amplifier and analog integrated circuits", McGraw Hill,2017
4. Robert F.Coughlin, Fredrick F. Driscoll, 'Op-amp and Linear ICs', PHI Learning, 6th edition,2012.
5. S.Salivahanan & V.S.Kanchana Bhaskaran ,"Linear Integrated Circuits,TMH,2nd Edition,4th Reprint,2016.

Web References

1. https://studentsfocus.com/ec8453-lic-notes-linear-integrated-circuits-notes-ece-4th-sem/
2. https://studentsfocus.com/ec6404-lic-notes-linear-integrated-circuits-lecture-notes-ece-4th-sem-annauniversity/
3. https://lecturenotes.in/subject/668/linear-integrated-circuits-lic

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes(PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	-	-	-	-	-	-	-	-	-	-	-	3	1	3
2	3	-	2	1	-	-	-	-	1	-	-	-	3	1	3
3	3	2	3	1	-	-	-	-	1	-	-	-	3	1	3
4	3	-	3	1	-	-	-	-	1	-	-	-	3	1	3
5	3	2	3	-	-	-	-	-	1	-	-	-	3	1	3

Correlation Level: 1-Low, 2-Medium, 3- High

U19ICT44 DIGITAL LOGIC CIRCUITS

L	T	P	C	Hrs
2	2	0	3	60

Course Objectives

- To gain knowledge on number systems and Boolean algebra
- To get the basic idea about combinational circuits.
- To design and develop combinational circuits.
- To study the operations of sequential circuits
- To acquire knowledge on memory devices

Course Outcomes

After completion of the course, the students will be able to

CO1 - Attain knowledge on basic binary systems **(K3)**

CO2 - Analyze the combinational circuits **(K4)**

CO3 - Gain knowledge on combinational logic design. **(K4)**

CO4 - Explore about the sequential circuits and its applications **(K3)**

CO5 - Acquire information about the memory devices **(K2)**

UNIT I NUMBER SYSTEMS (12 Hrs)

Review of number Systems Binary arithmetic –Binary codes - BCD, Gray code, Excess 3 code, Error detection and correction codes - Parity, Hamming code, Boolean algebra - Basic postulates and theorems, De-Morgan's Theorem - – Logic functions-Universal gate functions - Reduction of switching equations using Boolean algebra, Realization of switching function

UNIT II SIMPLIFICATION OF BOOLEAN FUNCTIONS (12 Hrs)

Design procedure of Combinational Logic – Design of two level gate networks -Sum of Products (SOP) - Product of Sums(POS) - Canonical SOP - Canonical POS - Karnaugh Map - Simplifications of Boolean functions using Karnaugh Map and implementation using Logic function – Advantages and limitations of K-Map - Tabulation method - Simplifications of Boolean functions using Tabulation method

UNIT III COMBINATIONAL CIRCUITS (12 Hrs)

Half Adder, Full Adder - Half Subtractor, Full Subtractor- Parallel binary Adder, Parallel binary Subtractor - Carry look ahead Adder- BCD Adder- Decoders- Encoders - Priority Encoder- Multiplexers- MUX as universal combinational modules- Demultiplexers- Code convertors- Magnitude Comparator

UNIT IV SEQUENTIAL CIRCUITS (12 Hrs)

Introduction to Sequential circuits – Flip flops – SR, JK, D and T flip flops, Master Slave flip flop, Characteristic and excitation table – Realization of one flip flop with other flip flops – Registers – Shift registers – Counters – Synchronous and Asynchronous counters – Modulus counters – Ring Counter – Johnson Counter – State diagram, State table, State minimization – Hazards.

UNIT V MEMORY DEVICES (12 Hrs)

Classification of memories –ROM organization - PROM – EPROM – EEPROM – EAPROM, RAM organization – Write operation – Read operation – Memory cycle - Timing wave forms – Memory decoding– memory expansion – Static RAM Cell- Bipolar RAM cell – MOSFET RAM cell – Dynamic RAM cell– Programmable Logic Devices – Programmable Logic Array (PLA) - Programmable Array Logic (PAL) – Complex Programmable Logic Device (CPLD)- Field Programmable Gate Arrays (FPGA) - Implementation of combinational logic circuits using ROM, PLA,PAL.

Text Books

1. M. Morris Mano and Michael D. Cilette, Digital Designǁ, Prentice Hall, FifthEdition,2011
2. Thomas L Floyd, " Digital Fundamentals", Prentice Hall, 11thEdition,2014.
3. R.P.Jain, Modern Digital Electronics, 4th EditionTMH,2010.

Reference Books

1. Donald P.Leach and Albert Paul Malvino, Digital Principles and Applications, 6th Edition,TMH,2003.
2. William H. Gothmann, Digital Electronics PrenticeHall,2001
3. John M. Yarbrough, Digital logic: Applications and Design Thomas Vikas Publishing House,2002.
4. Anand Kumar Fundamentals of Digital Circuits Prentice Hall of India, Pvt Ltd, New Delhi, Second Edition,2014.
5. Charles H. Roth Larry L. Kinney, Raghunandan G. H.Fundamentals of Logic Design Cengage Learning India Pvt. Ltd.; 1 edition, 1 September2019

Web References

1. https://nptel.ac.in/courses/117106086/
2. https://learn.ni.com/teach/resources/1104/digital-electronics.
3. https://nptel.ac.in/courses/117/106/117106086/

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	3	3	-	-	-	-	-	1	-	1	3	1	3
2	3	3	3	3	-	-	-	-	-	1	-	1	3	1	3
3	3	3	3	3	-	-	-	-	-	1	-	1	3	1	3
4	3	3	3	3	-	-	-	-	-	1	-	1	3	1	3
5	2	3	3	3	-	-	-	-	-	1	-	1	3	1	3

Correlation Level: 1-Low, 2-Medium, 3- High

U19ICP41	PROGRAMMING IN JAVA LAB	L	T	P	C	Hrs
		0	0	2	1	30

(Common to CSE, ECE, EEE,IT, ICE, MECH,CIVIL,BME, Mechatronics)

Course Objectives

- To acquire programming skill in core java.
- To learn how to design java program and applications.
- To acquire object oriented skills in java.
- To develop the skill of designing applications.
- To explore database connectivity.

Course Outcomes

After completion of the course, the students will be able to

CO1 - Apply and practice logical formulations to solve simple problems leading to specific applications.**(K3)**

CO2 - Demonstrate the use of inheritance, interface and package in relevant applications. **(K3)**

CO3 -Create java applications using exception handling multithread. **(K3)**

CO4 - Build java distributed applications using Collections and IO streams. **(K3)**

CO5 - Develop simple database programs. **(K3)**

List of Exercises

1. Develop simple programs using java technologies and testing tools.
2. Develop a java program that implements class and object.
3. Write a java program to demonstrate inheritance.
4. Develop a simple real life application program to illustrate the use of Multi Threads.
5. Implement simple applications using Collections.
6. Develop a simple application and use JDBC to connect to a back-end database.
7. Create a student application with Add, Edit, Delete, Show functions using JDBC.
8. Create a Bill Application to store sales details using JDBC.
9. Create java applications using Exception Handling for error handling.
10. Develop a java program that implements the Packages.

Reference Books

1. E. Balaguruswamy, “Programming with Java”, TMH Publ, 2nd Edition, 2005.
2. JAVA How to programming by DIETEL & DIETEL.
3. Herbert Schildt, “The Complete Reference JAVA 2”, TMH, Seventh Edition, 2006.
4. Cay.S.Horstmann and Gary Cornell, “Core Java 2”, Vol. 2, Advanced Features, Pearson Education, Seventh Edition, 2010.
5. Sagayaraj, Denis, Karthik, Gajalakshmi, “JAVA Programming for core and advanced learners”, Universities Press Private Limited, 2018.

Web References

1. http://www.ibm.com/developerworks/java/
2. http://docs.oracle.com/javase/tutorial/rmi/.
3. IBM’s tutorials on Swings, AWT controls and JDBC.
4. https://www.edureka.co/blog
5. https://www.geeksforgeeks.org

CO-POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	1	-	-	2	-	-	-	-	-	-	-	-	2	-
2	3	2	1	1	3	-	-	-	-	-	-	-	-	2	-
3	3	2	1	1	3	-	-	-	-	-	-	-	-	2	-
4	3	2	1	1	3	-	-	-	-	-	-	-	-	2	-
5	3	2	1	1	3	-	-	-	-	-	-	-	-	2	-

Correlation Level: 1-Low, 2-Medium, 3- High

U19ICP42	ELECTRICAL MACHINES LAB	L	T	P	C	Hrs
		0	0	2	1	30

Course Objectives

- To introduce practical knowledge on domestic wiring and analysis of electrical circuits.
- To provide the methods to test and evaluate the performance of electrical machines.
- To evaluate the open circuit and short circuit test on single phase transformer.
- To impart knowledge on speed control of DC shunts motor.
- To observe the performance of load test on single phase induction motor, three phases quirrel cage induction motor and single-phase alternator.

Course Outcomes

After completion of the course, the students will be able to

CO1 - Acquire knowledge on wiring electrical circuits such as domestic, Go-Down wiring and Doctor's Wiring. **(K3)**

CO2 - Apply proper measurement techniques for the calculation of power and calibration of meters **(K3)**

CO3 - Estimate the performance of DC and induction motor by conducting load and no-load tests **(K3)**

CO4 - Acquire hands on experience of conducting various tests on induction machines and obtaining their performance indices using standard analytical as well as graphical methods.**(K3)**

CO5 - Acquire hands on experience of conducting various tests on alternators **(K3)**

List of Experiments

1. Wiring circuits for
   A. Calling bell
   B. Staircase
   C. Ceiling fan and fluorescent lamp wiring
   D. Go-Down Wiring
   E. Doctor's Wiring
2. Load test on single phase transformer
3. Load test on three phase transformer
4. Open circuit and short circuit test on single phase transformer
5. Load characteristics of dc shunt motor
6. Speed control of dc shunt motor.
7. Load characteristics of dc series motor
8. Open circuit characteristics of separately excited dc shunt generator
9. Load test on single phase Induction motor
10. Load test on three phase squirrel cage induction motor
11. Load test on single phase Alternator

Reference Books

1. Umesh Agarwal," Laboratory Manual Basic Electrical Engineering, 2019",Notion Press, 1st Edition, 2019.
2. P. Tiwari & S.Sairola S.K. Kataria &Sons, "Electrical Engineering Laboratory Practice ",Reprint 2010 Edition 2010.
3. Tarnekar S.G. &et Al, "Laboratory Courses in Electrical Engineering", S Chand & Company, Rep. Edition 2006.
4. B.L.Theraja, A.K.Theraja, "A Textbook of Electrical Technology", S Chand & Company, Edition2005.
5. R.K.Rajput, "A Textbook of Electrical Technology", Laxmi Publications Pvt Ltd, Edition2004.

Web References

1. https://nptel. ac. in/courses/108/108/108108076/
2. https://nptel.ac.in/courses/108/105/108105017/
3. http://www.cittumkur.org/eee/em.pdf

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes(PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	-	-	-	-	-	-	-	-	-	-	-	3	-	3
2	3	2	2	-	-	-	-	-	-	-	-	-	3	-	3
3	3	2	2	-	-	-	-	-	-	-	-	-	3	-	3
4	3	2	2	-	-	-	-	-	-	-	-	-	3	-	3
5	3	-	-	-	-	-	-	-	-	-	-	-	3	-	3

Correlation Level: 1-Low, 2-Medium, 3- High

U19ICP43	ANALOG AND DIGITAL CIRCUITS LAB	L	T	P	C	Hrs
		0	0	2	1	30

Course Objectives

- To design and test the basic application of op-amp
- To design an Filter circuit.
- To design an Oscillator circuit
- To design an 555 timer ,PLL and VCO
- To design and test the digital circuits

Course Outcomes

After completion of the course, the students will be able to

CO1 - Design various sequential digital circuits like shift registers, counters **(K3)**

CO2 - Design asynchronous sequential circuits **(K3)**

CO3 - Design various applications of Op-amp **(K4)**

CO4 - Able to design signal conditioning circuits necessary for instrumentation, PLL, VCO **(K3)**

CO5 - Evaluate the analog and digital circuits using PSPICE **(K2)**

LIST OF EXPERIMENTS

PART A

1. Implementation of Boolean Functions, Adder/ Subtractor circuits.
2. Code converters: Excess-3 to BCD and Binary to Gray code converter and vice versa Parity generator and parity checking
3. Encoders and Decoders
4. Counters: Design and implementation of 4-bit modulo counters as synchronous and Asynchronous types using FF IC's and specific counter IC.
5. Shift Registers: Design and implementation of 4-bit shift registers in SISO,SIPO,PISO, PIPO modes using suitable IC's.
6. Study of multiplexer and demultiplexer

PART B

1. Application of Op-Amp: inverting and non-inverting amplifier, Adder, comparator, Integrator and Differentiator.
2. Timer IC application: Study of NE/SE 555 timer in Astable, Monostable operation.
3. Study of VCO and PLL ICs:
   a) Voltage to frequency characteristics of NE/ SE566 IC.
   b) Frequency multiplication using NE/SE 565PLL IC.
4. First order active filters (LPF, HPF and BPF).

Reference Books

1. M. Morris Mano and Michael D. Cilette, Digital Design‖, Prentice Hall, Fifth Edition,2012
2. Thomas L Floyd, " Digital Fundamentals", Prentice Hall,11th Edition,2014.
3. R.P.Jain, "Modern Digital Electronics", 4th Edition,TMH, 2010.
4. AnandKumar,—FundamentalsofDigitalCircuits‖,PrenticeHallofIndia,PvtLtd,NewDelhi,4th Edition, 2016.

5. Donald P.Leach and Albert Paul Malvino, Digital Principles and Applications, 8th Edition, TMH, 2016.

COs/POs/PSOs Mapping

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1	3	3	3	-	-	-	-	-	3	-	-	-	3	1	3
2	3	-	3	-	-	-	-	-	2	-	-	-	3	1	3
3	3	2	3	-	-	-	-	-	2	-	-	-	3	1	3
4	3	-	3	-	-	-	-	-	3	-	-	-	3	1	3
5	3	-	3	-	2	-	-	-	3	-	-	-	3	1	3

Correlation Level: 1-Low, 2-Medium, 3- High

U19ICC4X	CERTIFICATION COURSE-II	L	T	P	C	Hrs
		0	0	4	-	50

Students shall choose an International certification course offered by the reputed organizations like Google, Microsoft, IBM, Texas Instruments, Bentley, Autodesk, Eplan and CISCO, etc. The duration of the course is 40-50 hours specified in the curriculum, which will be offered through Centre of Excellence.

Pass /Fail will be determined on the basis of participation, attendance, performance and completion of the course. If a candidate Fails, he/she has to repeat the course in the subsequent years. Pass in this course is mandatory for the award of degree.

U19ICS41	SKILL DEVELOPMENT COURSE 3: GENERAL PROFICIENCY–II	L	T	P	C	Hrs
		0	0	2	-	30

Course Objectives

- To examine various standardized test in English language
- To recognize the key features of various technical writing
- To integrate LSRW skills to endorse multifarious skill set in practical situation
- To understand the factors that influence the usage of grammar
- To understand the basic concepts of logical reasoning skills

Course Outcomes

After completion of the course, the students will be able to

CO1 - Infer ideas to attend international standardized test by broadening receptive and productive skills **(K2)**

CO2 - Interpret the types of writing in different state of affairs **(K2)**

CO3 - Develop language skills professionally to groom the overall personality through sensitizing various etiquettes in real time situation **(K3)**

CO4 - Identify the rules of grammar in academic discourse settings **(K3)**

CO5 - Extend the skills to compete in various competitive exams like GATE, GRE, CAT, UPSC, etc. **(K2)**

UNIT I –CAREER SKILLS (6 Hrs)

Listening: Listening at specific contexts **speaking:** Mock interview (Personal & Telephonic)-**Reading**: Read and Review -Newspaper, Advertisement, Company Handbooks, and Guidelines (IELTS based) **writing:** Essay Writing (TOEFL) **Vocabulary:** Words at specified context (IELTS)

UNIT II –CORPORATE SKILLS (6 Hrs)

Listening: Listening and replicating **Speaking**: Team Presentation (Work Place Etiquettes) **Reading:** Short texts (signs, emoticons, messages) **Writing:** E-mail writing- Hard skills -Resume' Writing, Job Application Letter, Formal Letter **Vocabulary:** Glossary (IELTS)

UNIT III –FUNCTIONAL SKILLS (6 Hrs)

Listening: Listening TED Talks – **Speaking:** Brainstorming &Individual Presentation, Persuasive Communication – - **Reading:** Text Completion (GRE Based) **Writing:** Expansion of Compound Words **Vocabulary:** Expansion of vocabulary (IELTS)

UNIT IV –TRANSFERABLE SKILLS (6 Hrs)

Listening: Listening Documentaries and making notes –**Speaking:** Conversation practice at formal & informal context **Reading:** Read and transform- report, memo, notice and advertisement, **Writing:** Euphemism, Redundancy, and Intensifiers **Vocabulary:** Refinement of vocabulary (IELTS)

UNIT V- APTITUDE (6 Hrs)

Transformational Grammar: Phrases & Clauses, Concord, Conditional Clauses, Voice, Modals

Verbal Ability Enhancement: Letter Series, Coding &Decoding**,** Sentence Completion (GATE), Critical Reasoning & Verbal Deduction (GATE), Syllogism

Reference Books

1. Lougheed, Lin. “Barron's Writing for the TOEFL IBT: With Audio CD”. Barron's Educational series, 2008.
2. Tulgan, Bruce**.** “Bridging the soft skills gap: How to teach the missing basics to today’s young talent”. John Wiley & Sons, 2015.
3. Sherfield, Robert M. “Cornerstone: Developing Soft Skills”. Pearson Education India, 2009.
4. Cullen, Pauline, Amanda French, and Vanessa Jakeman**.** “The official Cambridge guide to IELTS for academic & general training”. Cambridge, 2014.
5. Ramesh, Gopalaswamy. “The ace of soft skills: attitude, communication and etiquette for success”. Pearson Education India, 2010

Web References

1. https://www.englishclub.com/grammar/nouns-compound.htm
2. https://lofoya.com/Verbal-Test-Questions-and-Answers/Sentence-Completion/l3p1
3. https://www.grammarwiz.com/phrases-and-clauses-quiz.html
4. https://www.clarkandmiller.com/25-english-euphemisms-for-delicate-situations/
5. http://www.englishvocabularyexercises.com/general-vocabulary/

COs/POs/PSOs Mapping

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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	1	-	-	-	-	-	-	1	-	3	-	1	1	-	-
2	1	-	-	-	-	-	-	1	-	3	-	1	1	-	-
3	1	-	-	-	-	-	-	-	-	3	-	1	-	-	-
4	1	-	-	-	-	-	-	1	-	3	-	1	-	-	-
5	1	-	-	-	-	-	-	-	-	3	-	1	1	-	-

Correlation Level: 1-Low, 2-Medium, 3- High

U19ICS42	SKILL DEVELOPMENT COURSE 4 (Choose anyone of the below three courses)	L	T	P	C	Hrs
		0	0	2	-	30

1. CALIBRATION OF MEASURING INSTRUMENTS

Course Content:

1. Parts of the Typical Control Loop
2. Process& Instrument Diagrams (P&ID's).
3. Introduction to Measurement System.
4. Commonly used process control signals.
5. Signal quality terminology (accuracy, linearity, span, etc.)
6. System standards and instrument calibration.
7. Study of measurement errors-zero, span, hysteresis, non-linear, dead-band errors.
8. Sensor/Transducer and Transmitter principles
9. Pressure Instruments – Principle, construction and operation
10. Calibration of low and high Pressure Bourden's Gauges.
11. Principle and operation of Strain gauge Pressure Sensors.
12. Principle and operation of Strain gauge Pressure Transmitters. (2 wire and 4 wire configuration).
13. Operation and calibration of Differential Pressure Switch & Safety Valve.
14. Calibration of Temperature Indicators (RTD & Thermocouple).

(OR)

2. INTRODUCTION TO ROBOTICS

Course Content:

1. Robot kinematics: position analysis, differential motions and velocities.
2. Trajectory planning. Actuators, sensors and simple sensor processing algorithms.
3. Robot programming and control architectures.
4. Selected topics from mobile robotics (localization, mapping, navigation and motion planning).

(OR)

3. LABVIEW IMPLEMENTATION

Course Content:

1. Basics of LABVIEW
2. Data handling instruction

Hardware Interface

3. Process 1: – Acquiring and generation of Digital signals
4. Process 2: – Acquiring analog values in DE and RSE method
5. Process 3: – Generating analog output
6. Process 4: – Integration of DAQ card with embedded devices
7. Embedded device with LABVIEW
8. Matrix
9. Remote panel creation and testing
10. Web server monitoring with LABVIEW
11. Hardware interfacing with LABVIEW

U19ICM41	INDIAN CONSTITUTION	L	T	P	C	Hrs
		2	0	0	-	30

The Constitution of India is the supreme law of India. Parliament of India cannot make any law which violates the Fundamental Rights enumerated under the Part III of the Constitution. The Parliament of India has been empowered to amend the Constitution under Article 368, however, it cannot use this power to change the “basic structure” of the constitution, which has been ruled and explained by the Supreme Court of India in its historical judgments. The Constitution of India reflects the idea of “Constitutionalism” – a modern and progressive concept historically developed by the thinkers of “liberalism” – an ideology which has been recognized as one of the most popular political ideology and result of historical struggles against arbitrary use of sovereign power by state. The historic revolutions in France, England, America and particularly European Renaissance and Reformation movement have resulted into progressive legal reforms in the form of “constitutionalism” in many countries. The Constitution of India was made by borrowing models and principles from many countries including United Kingdom and America. The Constitution of India is not only a legal document but it also reflects social, political and economic perspectives of the Indian Society. It reflects India’s legacy of “diversity”. It has been said that Indian constitution reflects ideals of its freedom movement, however, few critics have argued that it does not truly incorporate our own ancient legal heritage and cultural values. No law can be “static” and therefore the Constitution of India has also been amended more than one hundred times. These amendments reflect political, social and economic developments since the year 1950.

Course content

1. Meaning of the constitution law and constitutionalism
2. Historical perspective of the Constitution of India
3. Salient features and characteristics of the Constitution of India
4. Scheme of the fundamental rights
5. The scheme of the Fundamental Duties and its legal status
6. The Directive Principles of State Policy – Its importance and implementation
7. Federal structure and distribution of legislative and financial powers between the Union and the States
8. Parliamentary Form of Government in India – The constitution powers and status of the President of India
9. Amendment of the Constitutional Powers and Procedure
10. The historical perspectives of the constitutional amendments in India
11. Emergency Provisions : National Emergency, President Rule, Financial Emergency
12. Local Self Government – Constitutional Scheme in India
13. Scheme of the Fundamental Right to Equality
14. Scheme of the Fundamental Right to certain Freedom under Article 19
15. Scope of the Right to Life and Personal Liberty under Article 21.

U19ICE41	ELECTRIC DRIVES AND CONTROL	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To impart basic knowledge on the development of drives and the types of control
- To expose students to the operation, application electric drives to cater the industrial needs.
- To familiarize the operation principles, and design of starting, braking, and speed control arrangements for electric motors and their applications
- To provide a strong foundation to assess performance of different industrial drives considering issues such as, energy efficiency, power quality, economic justification, environmental issues, and practical viabilities.
- To impart knowledge on digital control techniques.

Course Outcomes

After completion of the course, the students will be able to

CO1 - Understand the basics of electric drive to handle it in industrial areas where use of electric drives is essential. **(K2)**

CO2 - Examine the induction motor and DC drives in the aspects of control techniques.**(K3)**

CO3 - Understand the operation of synchronous and BLDC motor drives **(K2)**

CO4 - Elucidate the principle and working of Reluctance Motor drives **(K2)**

CO5 - Acquaintance knowledge on digital control and drive applications.**(K3**)

UNIT – I INTRODUCTION TO ELECTRIC DRIVES (9 Hrs)

History and development of electric drives, Characteristics of Electrical & mechanical loads, Classification of electric drives, Basic elements & advantages of variable speed drives. Modes of operation, closed loop control of drives - Selection of power rating for drive motors with regard to thermal overloading and load variation.

UNIT II DC DRIVES AND INDUCTION MOTOR DRIVES (9 Hrs)

DC Drives: Speed control of DC motors - Chopper fed DC drives - Single, two and four quadrant operations

Induction Motor Drives**:** Speed control of 3 phase Induction Motors - Stator control: PWM &V/f control, rotor control: Rotor resistance control - Static control of rotor resistance using DC chopper - Static Krammer and Scherbius drives – Introduction to Vector Controlled Induction Motor Drives.

UNIT III SYNCHRONOUS MOTOR AND BLDC MOTOR DRIVES (9 Hrs)

Speed control of 3 phase Synchronous Motors - True synchronous and self-controlled modes of operation - PMSM: principle-flux density distribution-Types. BLDC motor: Principle-drive scheme - converter topologies.

UNIT IV RELUCTANCE MOTOR DRIVES (9 Hrs)

DC servo drives -principle of operation - AC servo drives- principle of operation - Stepper motor –principle of operation –SRM drives - principle of operation - drives. Introduction to syn RM drives.

UNIT V DIGITAL CONTROL AND DRIVE APPLICATIONS (9 Hrs)

Digital techniques in speed control - Advantages and limitations - Microprocessor/Microcontroller and PLC based control of drives, networking of drives - Selection of drives and control schemes for Steel rolling mills, Paper mills, Cement mills, Machine tools, Lifts and Cranes. Solar and battery powered drives.

Text Books

1. Dubey G K, "Fundamentals of Electrical Drives", Narosa Publishing House, New Delhi, 2012.
2. Bose B K, —Modern Power Electronics and AC Drives", Pearson Education, New Delhi, 2009.

3. Nagrath .I.J. and Kothari .D.P, Electrical Machines, Tata McGraw-Hill, 2006

Reference Books

1. Ion Boldea and Nasar S All, Electric Drivesll, CRC Press LLC, New York, 2005.
2. Krishnan R, —Electric Motor Drives: Modeling, Analysis and Control, Prentice Hall of India, New Delhi, 2010.
3. Frank D. Petruzella, Industrial Electronics, McGraw Hill International Editions, 1996
4. S.K. Bhattacharya and S. Chatterjee, Industrial electronics and control, Tata Mc Graw Hill 1995
5. Pillai.S.K A First Course on Electric Drives, Wiley Eastern Limited, 2012

Web References

1. https://learnengineering.in/ee6351-electrical-drives-and-controls/
2. https://easyengineering.net/ee6351-electrical-drives-and-controls/
3. https://lecturenotes.in/subject/655/electrical-drives-and-controls-edc

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	1	2	-	-	-	-	-	-	-	-	-	2	-	1
2	3	1	2	-	-	-	-	-	-	-	-	-	2	-	1
3	3	1	1	-	-	-	-	-	-	-	-	-	2	-	1
4	3	1	2	-	-	-	-	-	-	-	-	-	2	-	1
5	3	1	2	-	-	-	-	-	-	-	-	-	2	-	1

Correlation Level: 1-Low, 2-Medium, 3- High

U19ICE42	ELECTRIC AND HYBRID VEHICLES	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To expose the working of different configurations of electric vehicles
- To incorporate different energy storage technologies used for hybrid electric vehicles and their control
- To provide a comprehensive overview of a electric and hybrid electric vehicle
- To impart knowledge on the sources utilized for hybrid electric vehicle.
- To impart knowledge on the electric propulsion system

Course Outcomes

After completion of the course, the students will be able to

CO1 - Understand the architecture of electric vehicles. **(K2)**

CO2 - Understand the basic concept of Hybrid electric vehicles **(K2)**

CO3 - Critically evaluate the strength and limitations of electric propulsion systems.**(K3)**

CO4 - Examine various storage technologies and sizing of storage for independent systems. **(K2)**

CO5 - Design and develop a solar based vehicle with suitable techniques and ability to acknowledge the society about the need of hybrid vehicle system. **(K3)**

UNIT I ELECTRIC VEHICLES (9 Hrs)

Architecture of an electric vehicle, impact of modern drive, essentials and performance of electric vehicles – Traction motor characteristics, attractive effort, transmission requirements, vehicle performance, energy consumption, advantage and limitations.

UNIT II HYBRID VEHICLES (9 Hrs)

Hybrid electric drive trains – Basic concepts of hybrid traction, Introduction to various hybrid drive-train topologies, Power flow control in hybrid drive-train topologies, fuel efficiency analysis, Merits and Demerits.

UNIT III ELECTRIC PROPULSION SYSTEMS (9 Hrs)

DC motor drives, induction motor drives, permanent magnet motor drives and switched reluctance motor drives. Basic concept of electric traction, introduction to various electric drive-train topologies, power flow control in electric drive-train topologies, fuel efficiency analysis

UNIT IV ENERGY STORAGE DEVICES (9 Hrs)

Introduction to Energy Storage Requirements in Hybrid and Electric Vehicles -Electrochemical batteries – Reactions, thermodynamic voltage, lead-acid batteries, nickel-based batteries, lithium-based batteries, flywheel and ultra-capacitors, Battery management systems.

UNIT V HYBRID SOLAR VEHICLES (9 Hrs)

Impact on hybrid Solar vehicles, Fuel cell thermodynamics, operating principle, fuel cell technologies, fuel reforming, hydrogen production and storage. Photovoltaic cell, maximum power point tracking, solar powered accessories, hybrid solar vehicles.

Text Books

1. Mehrdad Ehsani, Yimin Gao, sebastien E. Gay and Ali Emadi, —Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design‖, CRC Press, second edition,2010.
2. Iqbal Husain, —Electric and Hybrid Vehicles: Design Fundamentals, CRC Press, 2011.

3. Chris Mi, M. Abul Masrur, David Wenzhong Gao, Hybrid Electric Vehicles Principles And Applications With Practical Perspectives, Wiley Publication, 2011.

Reference Books

1. SerefSoylu —Electric Vehicles - The Benefits and Barriers‖, InTech Publishers, Croatia, 2011.
2. AuliceScibioh M. and Viswanathan B., —Fuel Cells – Principles and Applications‖, University Press, India,2007
3. James Larminie, John Lowry, Electric Vehicle Technology Explained, Wiley, 2003.
4. Mehrdad Ehsani, YimiGao, Senastian E. Gay, Ali Emandi, Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design, CRC Press, 2004.
5. M. Ehsani, Y. Gao, S. Gay and Ali Emadi, Modern Electric, Hybrid Electric, and Fuel Cell Vehicles: Fundamentals, Theory, and Design, CRC Press, 2005

Web References

1. https://nptel.ac.in/courses/108103009/
2. http://ceb.ac.in/knowledge-center/E-BOOKS/Modern%20Electric%2C%20Hybrid%20Electric%20%26%20Fuel%20Cell%20Vehicles%20-%20Mehrdad%20Ehsani.pdf
3. https://www.youtube.com/watch?v=uoBuOQn9XAQ

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	1	2	-	-	2	2	-	1	-	1	1	2	-	1
2	3	1	3	-	-	2	2	-	1	-	1	1	2	-	1
3	3	1	3	-	-	2	2	-	1	-	1	1	2	-	1
4	3	1	3	-	-	2	2	-	1	-	1	1	2	-	1
5	3	1	3	-	-	2	2	-	1	-	1	1	2	-	1

Correlation Level: 1-Low, 2-Medium, 3- High

U19ICE43	COMMUNICATION SYSTEMS	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To introduce different methods of analog communication and their significance
- To introduce Digital Communication methods for high bit rate transmission.
- To impart knowledge on the concepts of source and line coding techniques for enhancing rating of transmission of minimizing the errors in transmission.
- To enhance knowledge on Fiber optical communications
- To enhance the knowledge on mobile communication.

Course Outcomes

After completion of the course, the students will be able to

CO1 - Ability to understand and analyze, linear and digital electronic circuits. **(K2)**
CO2 - Understand the Pulse and digital modulation systems. **(K2)**
CO3 - Use data and pulse communication techniques in microwave and satellite communication systems. **(K1)**
CO4 - Understand the importance of fiber optic techniques in communication field. **(K2)**
CO5 - Apply the concepts and techniques in real time applications. **(K3)**

UNIT I ANALOG MODULATION SYSTEMS (9 Hrs)

Need for modulation - Amplitude modulation – Frequency spectrum of AM wave – Representation of AM – Power relation –Frequency modulation – Frequency spectrum of FM wave –AM transmitter – FM transmitter – Super heterodyne AM receiver –FM receivers.

UNIT II PULSE AND DIGITAL MODULATION SYSTEMS (9 Hrs)

Principles of pulse modulation – sampling theorem, PAM – PWM – PPM– Conversion of PWM wave to PPM wave – Generation of PAM, PPM and PWM waves – Demodulation of PAM, PWM, PPM – An introduction to digital modulation systems – PCM, ASK, FSK and PSK.

UNIT III MICROWAVE AND SATELLITE COMMUNICATION SYSTEMS (9 Hrs)

Microwave communication systems: advantage, block diagram of a microwave radio system, microwave radio stations-Terminal station and repeater station. Satellite Communication system: Satellite Orbits, launch vehicles, look angles, satellite parameters, satellite link model, personal communication systems- GPS services

UNIT IV FIBER OPTICAL COMMUNICATION SYSTEMS (9 Hrs)

Need for fiber optics, introduction to optical fiber, principle of light transmission through a fiber, fiber characteristics and classification, various fiber losses- Light sources and photo detectors- Block diagram of a fiber optic system- Power budget analysis for a optical link-Recent applications of fiber optics

UNIT V CELLULAR MOBILE COMMUNICATION (9 Hrs)

Cellular concept, basic cellular concept and its operation, uniqueness of mobile radio environment- Performance metrics in cellular system-Elements of cellular mobile radio-Handoff- Frequency management and channel assignment- Introduction to various cellular standards like AMPS, GSM, GPRS, IS-95A, IS-95B, CDMA-2000 and WCDMA

Text Books

1. Kennedy Davis, “Electronic Communication Systems”, Tata McGraw Hill Publishing Company Limited, New Delhi, 1999.
2. Wayne Tomasi, “Electronic Communication Systems”, Pearson education Private Limited, Delhi, 2004.
3. Taub & Schiling “Principles of Communication Systems” Tata McGraw Hill 2007.

Reference Books

1. Roddy D and Coolen J, “Electronic Communications”, Prentice Hall of India Private Limited, fourth edition, 2007.
2. William C.Y. Lee, “Mobile Cellular Telecommunication Systems”, McGraw Hill International Edition, Second edition, 2006.
3. Gerd Keiser, “Optical fiber Communications”, McGraw Hill International Edition, Fourth edition, 2006
4. Sklar “Digital Communication Fundamentals and Applications“ Pearson Education, 2001.
5. Bary le, Memuschmidt, Digital Communication, Kluwer Publication, 2004.

Web References

1. https://easyengineering.net/ec6651-communication-engineering/
2. https://lecturenotes.in/subject/50/communication-engineering-ce
3. https://nptel.ac.in/courses/117102059/

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	-	1	-	-	2	1	-	-	-	-	-	2	-	-
2	3	-	1	-	-	2	1	-	-	-	-	-	2	-	-
3	3	-	1	-	-	2	2	-	-	-	-	-	2	-	-
4	3	-	1	-	-	2	2	-	-	-	-	-	2	-	-
5	3	-	1	-	-	2	2	-	-	-	-	-	3	-	-

Correlation Level: 1-Low, 2-Medium, 3- High

		L	T	P	C	Hrs
U19ICE44	**SIGNALS AND SYSTEMS**	**2**	**2**	**0**	**3**	**60**

Course Objectives

- To study about the basic concepts of signals
- To know about continuous time signals like Laplace transform
- To study about the continuous time laplace transform
- To learn about the discrete time signals
- To Learn about the LTI systems and Z-Transforms

Course Outcomes

After completion of the course, the students will be able to

CO1 - Recall about the basic concepts of signals and systems **(K1)**
CO2 - Illustrate the different types of relativity of fourier transform **(K2)**
CO3 - Knowing the linear invariant systems **(K2)**
CO4 - Analyzing the discrete time signals **(K3)**
CO5 - Knowing the Convolution sum and frequency response **(K3)**

UNIT I CLASSIFICATION OF SIGNALS AND SYSTEM (12 Hrs)

Continuous time signals (CT Signals) and Discrete time signals (DT Signals)- Step, Ramp, Pulse, Impulse, Exponential - Classification of CT and DT signals - Periodic, aperiodic and Random signals - Energy and power signals – Representation of signals. Continuous time and discrete time systems: Classification of systems – Properties of systems.

UNIT II ANALYSIS OF CONTINUOUS TIME SIGNALS (12 Hrs)

Definition - Continuous time Fourier transform and Laplace transform analysis with examples - Decaying exponential - Rising exponential - Double exponential - Basic properties - Linearity - Convolution in time and frequency domain - Time shifting & Time reversal - Relation between Fourier transform and Laplace transform

UNIT III LINEAR TIME INVARIANT CONTINUOUS TIME SYSTEMS (12 Hrs)

CT systems - Linear time invariant systems - Basic properties of continuous time systems - Linearity, Causality, Time invariance, Stability - Frequency response of LTI systems - Analysis and characterization of LTI systems using Laplace transform - computation of impulse response and transfer function using Laplace transform.

UNIT IV ANALYSIS OF DISCRETE TIME SIGNALS (12 Hrs)

Discrete Time Fourier Transform (DTFT), Discrete Fourier Transform (DFT) - Z-Transform definition - Region of convergence - Properties of Z Transform - Inverse Z-Transform using - power series expansion and Partial fraction expansion.

UNIT V LINEAR TIME INVARIANT DISCRETE TIME SYSTEMS (12 Hrs)

LTI-DT systems - Characterization using difference equation - properties of convolution and interconnection of LTI systems - Causality and Stability of LTI Systems - Impulse response , convolution sum and Frequency Response - Computation of Impulse response and Transfer function using Z-Transform.

Text Books

1. Allan V.Oppenheim, Alan.S.Willsky, “Signals and systems”, Prentice Hall of India, 2013.
2. Roger E.Ziemer, “Signals and Systems Continuous and discrete”, McMillan, 2008.

3. Signals and Systems-Anandkumar, Ph Publications,2015

Reference Books

1. P.Ramesh Babu et al, 'Signals and Systems', 4th Edition, Scitech publishers, 2014.
2. Signals and Systems- Narayan Iyer and K Satya Prasad,Cenage Learning, 2011.
3. Signals and systems-Alan V.Oppenheim, Alan S.Willsky, Pearsen 2015
4. Barry Van Veen Simon Haykin, "Signals And Systems" by,2012
5. Dr. J S Chitode, "Signals and Systems", Pearson pubilications,2013

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2. https://lecturenotes.in/subject/36/signals-and-systems-ss
3. http://www.ktunotes.in/ktu-s4-ece-signals-systems-notes/
4. https://ocw.mit.edu/resources/res-6-007-signals-and-systems-spring-2011/
5. https://www.khanacademy.org/science/electrical-engineering/ee-signals

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	3	3	-	-	-	-	1	-	1	1	3	-	3
2	3	3	3	3	-	-	-	-	1	-	1	1	3	-	3
3	3	3	3	3	-	-	-	-	1	-	1	1	3	-	3
4	3	3	3	3	-	-	-	-	1	-	1	1	3	-	3
5	3	3	3	3	-	-	-	-	1	-	1	1	3	-	3

Correlation Level: 1-Low, 2-Medium, 3- High

U19ICE45	ELECTRICAL MACHINES	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To provide an introduction about the magnetic circuits.
- To introduce the concepts of transformers.
- To introduce the principles of operations of DC machines.
- To introduce the principles of operations of Induction motors
- To study special machines and give an overview of domestic wiring.

Course Outcomes

After completion of the course, the students will be able to

CO1 - Gain Knowledge about the basic concepts of magnetic circuits. **(K2)**

CO2 - Describe the working of transformer, auto transformer and assess the regulation and efficiency of transformer.**(K2)**

CO3 - Demonstrate the operation of DC machines and their performance characteristics.**(K3)**

CO4 - Explain the working concept of single phase, three phase induction motor and analyze the Operating behavior of induction motor and special machines. **(K3)**

CO5 - Gain knowledge about stepper motor, servo motors and electric traction. **(K2)**

UNIT I MAGNETIC CIRCUITS (9 Hrs)

Definition of MMF, Flux and Reluctance - Leakage Factor - Reluctances in Series and Parallel (Series and Parallel Magnetic Circuits) - Electromagnetic Induction - Fleming's Rule - Lenz's Law - Faraday's laws - statically and dynamically induced EMF - Self and mutual inductance - Analogy of Electric and Magnetic Circuits.

UNIT II TRANSFORMERS (9 Hrs)

Construction and Principle of operation of Single Phase Transformer - EMF Equation - Phasor Diagram on No Load and Loaded Transformer –load test - Open Circuit and Short Circuit Test on Transformer- Equivalent Circuit - Regulation and Efficiency - Introduction to auto transformers- copper savings in auto transformers- 3-phase transformer – Types of connections

UNIT III D.C MACHINES (Qualitative Analysis Only) (9 Hrs)

Construction, Principles of operation of DC Generators - Types –EMF Equation - Performance Characteristics of Series and Shunt Generators - Armature Reaction. DC Motor - Torque Equation- Speed - Torque Characteristics of Series and Shunt Motors –Load Test – No Load Test -Speed Control methods and Applications. Need for starter – types.

UNIT IV INDUCTION MOTORS (Qualitative Treatment Only) (9 Hrs)

Constructional Details of Three Phase Induction Motor - Slip Ring and Squirrel Cage Rotor- Principle of operation- Torque Equation - Torque / Slip Characteristics - Starters - Applications Introduction to Single Phase Induction Motors - Capacitor Start Capacitor Run Motor -Shaded Pole Motor.

UNIT V SYNCHRONOUS MACHINES AND SPECIAL MACHINES (9 Hrs) (Qualitative Treatment Only)

Principles of Alternator - Construction Details - Types Special Machines: Stepper motor- AC and DC Servomotor - Universal Motor - Hysteresis Motor -Permanent Magnet Synchronous Motor - Switched Reluctance Motor - Brushless D.C Motor - Construction, Working And Applications. **Utilization:** Domestic wiring – principle of electrical heating –laws of illumination – Electric lamps – Photometers – Electroplating – Electric Traction – Air conditioning – Earthing.

Text Books

1. J.B. Gupta, “Theory and Performance of Electrical Machines”, S.K.Kataria & Sons, 4thEdition, 2013.
2. B.L. Theraja and A.K.Theraja, “A TextBook of Electrical Technology, Vol.II”, S.Chand& Company Ltd., 2009.
3. R.K. Rajput, “Electrical Engineering” Lakshmi Publications Pvt Limited, 4th Edition, 2008.

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1. S.K.Bhattacharya, “Electrical Machines”, Tata Mc Graw Hill Company Ltd, 4th Edition, 2014.
2. D P Kothari and I.J Nagarath, “Electrical Machines”, McGraw Hill Education(India) Private Limited, Fifth edition, 2017.
3. Edward Hughes “Electrical and Electronic Technology”, Pearson Education, 10th Edition,2011.
4. R.K. Rajput, “Utilization of electrical power”, First edition, Lakshmi publications, 2006
5. Venkataratnam K., “Special Electrical Machines”, Universities Press Private Limited, 1stEdition, 2009.

Web References

1. https://www.electricaltechnology.org/
2. https://nptel.ac.in/courses/108105053/
3. https://www.youtube.com/watch?v=FAjM4C7dssM

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	-	-	-	-	-	-	3	2	-	2	3	3	2	3
2	3	-	-	2	3	-	-	3	2	-	2	3	3	2	3
3	3	2	1	2	3	-	-	3	2	-	2	3	3	2	3
4	3	2	1	2	3	-	-	3	2	-	2	3	3	2	3
5	3	2	1	2	3	-	-	3	2	-	2	3	3	2	3

Correlation Level: 1-Low, 2-Medium, 3- High

		L	T	P	C	Hrs
U19EEO41	**SOLAR PHOTOVOLTAIC FUNDAMENTALS AND APPLICATIONS** (Common to ECE, ICE, MECH, CIVIL, Mechatronics)	**3**	**0**	**0**	**3**	**45**

Course Objectives

- To impart fundamental knowledge of solar cell formation and its properties.
- To understand the various technologies used to improve solar cells.
- To discuss the various components in On-grid connected systems.
- To gain knowledge on components in Off-grid connected systems using Solar PV.
- To design the PV systems for various real load applications with cost benefits.

Course Outcomes

After completion of the course, the students will be able to

CO1 -Explain the fundamentals of solar cells. **(K2)**
CO2 -Recognize the various solar PV technologies and their up gradations along with their benefits. **(K2)**
CO3 -Design and analyze on–grid PV applications. **(K4)**
CO4 -Design and analyze off–grid PV applications. **(K4)**
CO5 -Realize cost benefit analysis of PV installations. **(K4)**

UNIT I ESSENTIAL BASICS OF SOLAR CELL (9 Hrs)

Solar cell – physics – Photovoltaics in Global Energy Scenario – Fundamentals of Semiconductors, Energy band, Charge carriers – Motion, PN Junction diode, Solar cells – Design characteristics, Solar radiation.

UNIT II COMMERCIAL AND DEVELOPING TECHNOLOGIES (9 Hrs)

Commercial technologies – Mono crystalline and Multi crystalline, Silicon – Wafer based Solar cell, Thin film solar cells – A–Si, Cd–Te and CIGS, Concentrated PV cells, Developing technologies – Organic cells, Dye sensitized cells.

UNIT III SOLAR PV FOR ON-GRID APPLICATIONS (9 Hrs)

Solar cells to solar array – On–Grid PV system – With and Without storage – Balance of system – DC–DC converters – Inverters – Net Metering – Design and analysis – Performance evaluation and monitoring – Field visit – Grid tied PV power plant.

UNIT IV SOLAR PV FOR OFF–GRID APPLICATIONS (9 Hrs)

Off–Grid stand alone PV system – System sizing – Module and Battery – Storage – Batteries for PV systems – Sun Tracking mechanism – Types of tracking – One–axis, Two–axis – Maximum power point tracking – Design and analysis – Performance evaluation and monitoring – Field visit – Off–grid PV system

UNIT V COST BENEFIT ANALYSIS FOR SOLAR PV INSTALLATIONS (9 Hrs)

Cost and manufacturability – Manufacturing economics – Scaling – Pricing – Trends in retail pricing – Energy economics – Grid tied power plant – Solar street lighting system

Text Books

1. C.S. Solanki, “Solar Photovoltaics – Fundamentals, Technologies and Applications”, PHI Learning Pvt. Ltd., 2nd Edition, 2011.
2. Martin A. Green, “Solar Cells Operating Principles, Technology, and System Applications”, Prentice - Hall, 1st Edition, 2008.

Reference Books

1. J. Nelson, “The Physics of Solar Cells”, Imperial College Press, 1st Edition, 2003.
2. Thomas Markvart, “Solar Electricity”, John Wiley and Sons, 2nd Edition, 2000.

3. Stuart R. Wenham, Martin A. Green, Muriel E. Watt, Richard Corkish , “Applied Photovoltaics”, Earthscan, 3rd Edition, 2011.
4. Michael Boxwell, “The Solar Electricity Handbook”, Green stream Publishing, 10th Edition, 2016.
5. RikDe Gunther, “Solar Power-Your Home for Dummies”, Wiley Publishing Inc, 2nd Edition, 2010.

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1. https://swayam.gov.in/nd1_noc20_ph21/preview
2. https://swayam.gov.in/nd2_nou20_ag13/preview
3. https://www.studentenergy.org/topics/solar-pv
4. https://www.eia.gov/energyexplained/solar/photovoltaics-and-electricity.php
5. https://www.energysage.com/solar/
6. https://www.bca.gov.sg/publications/others/handbook_for_solar_pv_systems.pdf
7. http://www.oas.org/dsd/publications/unit/oea79e/ch05.htm

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	3	3	2	-	3	-	-	-	-	3	1	-	1
2	3	3	3	3	2	-	3	-	-	-	-	3	1	-	1
3	3	3	3	3	2	-	3	-	-	-	-	3	3	3	3
4	3	3	3	3	2	-	3	-	-	-	-	3	3	3	3
5	3	3	3	3	2	-	3	-	-	-	-	3	-	-	1

Correlation Level: 1-Low, 2-Medium, 3- High

		L	T	P	C	Hrs
U19EEO42	**ELECTRICAL SAFETY** (Common to ECE, ICE, MECH, CIVIL, Mechatronics, BME, IT, CSE)	**3**	**0**	**0**	**3**	**45**

Course Objectives

- To familiarize the Indian Electricity Rules and Act related with electrical safety.
- To provide a knowledge about electrical shocks and safety precautions.
- To create awareness of the electrical safety associated with installation of electrical equipment.
- To analyze different Hazardous areas for electrical safety.
- To expose knowledge about necessity of safety policy and safety management.

Course Outcomes

After completion of the course, the students will be able to

CO1 - Describe the Indian Electricity (IE) acts and various rules for electrical safety. **(K2)**

CO2 - Expose safety measures to prevent electrical shock in handling of domestic electrical appliances**. (K3)**

CO3 - Evaluate the safety aspects during installation of plant and equipment**. (K3)**

CO4 - Describe the various hazardous area and application of electrical safety in various places**. (K3)**

CO5 - Acquire knowledge about importance of electrical safety training to improve quality management in electrical systems**. (K3)**

UNIT I CONCEPTS AND STATUTORY REQUIREMENTS (9 Hrs)

Objective and scope of electrical safety - National electrical Safety code - Statutory requirements – Indian Electricity acts related to electrical Safety - Safety electrical one line diagram - International standards on electrical safety safe limits of current and voltage - Grounding of electrical equipment of low voltage and high voltage systems - Safety policy - Electrical safety certificate requirement

UNIT II ELECTRICAL SHOCKS AND THEIR PREVENTION (9 Hrs)

Primary and secondary electrical shocks - Possibilities of getting electrical shock and its severity - Effect of electrical shock of human being - Shocks due to flash/ Spark over's - Firing shock - Multi storied building - Prevention of shocks - Safety precautions - Safe guards for operators - Do's and Don'ts for safety in the use of domestic electrical appliances - Case studies on electrical causes of fire and explosion

UNIT III SAFETY DURING INSTALLATION, TESTING AND COMMISSIONING, OPERATION AND MAINTENANCE (9 Hrs)

Need for inspection and maintenance - Preliminary preparations - Field quality and safety - Personal protective equipment - Safe guards for operators - Safety equipment - Risks during installation of electrical plant and equipment - Effect of lightning current on installation and buildings - Safety aspects during installation -Safety during installation of electrical rotating machines - Importance of earthing in installation– Agricultural pump installation

UNIT IV HAZARDOUS ZONES (9 Hrs)

Primary and secondary hazards - Hazardous area classification and of electrical equipments (IS, NFPA, API and OSHA standards) - Explosive gas area classifications: Class I(Division 1) - Zone 0, Zone 1, zone 2 classified locations, Design Philosophy for Equipment and installations-Classification of equipment enclosure for various hazardous gases and vapors - flash hazard calculation and approach distances- calculating the required level of arc protection

UNIT V SAFETY MANAGEMENT OF ELECTRICAL SYSTEMS (9 Hrs)

Principles of Safety Management - Occupational safety and health administration standards - Safety organization - Safety auditing - Employee electrical safety teams - Electrical safety training to improve Quality management - Total quality control and management – Importance of high load factor - Causes of low power factor - Disadvantages of low power factor - Power factor improvement - Importance of P.F. improvement - Case studies of electrical

workplace safety practices.

Text books

1. John Cadick, Mary CapelliSchellpfeffer, Dennis Neitzel, Al Winfield, “Electrical Safety Handbook”, McGraw-Hill Education, 4th Edition, 2012.
2. Madden, M. John, “Electrical Safety and the Law: A Guide to Compliance”, Wiley publications, 4th Edition, 2002.
3. Mohamed A. El-Sharkawi, “Electric Safety: Practice and Standards”, CRC Press; 1st Edition, 2013.

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1. Rob Zachariason, “Electrical Safety”, Delmar Cengage Learning, 1st Edition, 2011.
2. Peter E. Sutherland, “Principles of Electrical Safety”, Wiley-IEEE Press; 1st Edition, 2014.

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1. https://www.apeasternpower.com/downloads/elecact2003.pdf
2. https://safetyculture.com/topics/electrical-hazards/
3. https://www.jove.com/science-education/10114/electrical-safety-precautions-and-basic-equipment
4. https://electrical-engineering-portal.com/21-safety-rules-for-working-with-electrical-equipment
5. https://www.electrical4u.com/safety-precautions-for-electrical-system/
6. https://www.constellation.com/energy-101/electrical-safety-tips.html

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	3	2	-	2	-	-	-	-	-	-	1	2	1
2	3	3	3	2	-	2	-	-	-	-	-	-	1	2	1
3	3	3	3	2	-	2	-	-	-	-	-	-	1	2	1
4	3	3	3	2	-	2	-	-	-	-	-	-	1	2	1
5	3	3	3	2	-	2	-	-	-	-	-	-	1	2	1

Correlation Level: 1-Low, 2-Medium, 3- High

		L	T	P	C	Hrs
U19ECO41	**ENGINEERING COMPUTATION WITH MATLAB** (Common to ICE, EEE, MECH, CIVIL, BME, Mechatronics)	**3**	**0**	**0**	**3**	**45**

Course Objectives

- To understand basic representation of Matrices and vectors in MATLAB
- To learn various programming structures in MATLAB
- To study built in and user defined functions in MATLAB.
- To become conversant with 2D as well as 3D graphics in MATLAB
- To make a Graphical User Interface (GUI) in MATLAB in order to achieve interactivity

Course Outcomes

After completion of the course, students will be able to

CO1 - State the basics of MATLAB **(K1)**
CO2 - Explain how to work with matrices, and their operations **(K2)**
CO3 - Use the MATLAB functions relevant to communication engineering. **(K3)**
CO4 - Demonstrates various file operations in MATLAB **(K3)**
CO5 - Applying the plotting capabilities of MATLAB effectively to various systems. **(K3)**

UNIT I INTRODUCTION TO MATLAB (9 Hrs)

Menus & Tool bars, Variables - Matrices and Vectors - initializing vectors - Data types- Functions – User defined functions - passing arguments - writing data to a file-reading data from a file - using functions with vectors and matrices- cell arrays & structures - Strings - 2D strings-String comparing - Concatenation - Input and Output statements - Script files .

UNIT II LOOPS& CONTROL STATEMENTS (9 Hrs)

Introduction; Relational & Logical operations - Example programs - Operator precedence - Control & Decision statements- IF - IF ELSE - NESTED IF ELSE - SWITCH - TRY & CATCH - FOR -WHILE - NESTED FOR - FOR with IF statements, MATLAB program organization, Debugging methods - Error trapping using eval & lastern commands.

UNIT III PLOTS IN MATLAB & GUI (9 Hrs)

Basic 2D plots, Labels, Line style, Markers, plot, subplot, LOG, LOG-LOG, SEMILOG-POLARCOMET, Grid axis, labeling, fplot, ezplot, ezpolar, polyval, exporting figures, HOLD, STEM, BAR, HIST, Interactive plotting, Basic Fitting Interface – Polyfit - 3D plots – Mesh - Contour - Example programs. GUI - Creation Fundamentals – Capturing mouse actions

UNIT IV MISCELLANEOUS TOPICS (9 Hrs)

File & Directory management - Native Data Files - Data import & Export - Low Level File I/O – Directory management - FTP File Operations - Time Computations -Date & Time – Format Conversions - Date & Time, Functions - Plot labels - Optimization - zero Finding - Minimization in one Dimension - Minimization in Higher Dimensions- Practical Issues. Differentiation & Integration using MATLAB, 1D & 2D Data Interpolation

UNIT V SIMULINK & APPLICATIONS (9 Hrs)

How to create & run Simulink, Simulink Designing - Using SIMULINK Generating an AM signal & 2nd order systems - Designing of FWR & HWR using Simulink - Creating a subsystem in Simulink. Applications Programs -Frequency response of filters. Open Loop gain of OPAMP, I/P characteristics of BJT, Plotting the graph between Breakdown voltage & Doping Concentration.

Text Books

1. RudraPratap, Getting Started with MATLAB 6.0 ,1st Edition, Oxford University Press-2004.
2. Duane Hanselman ,Bruce LittleField, “Mastering MATLAB 7”, Pearson Education Inc, 2005
3. William J.Palm, “Introduction to MATLAB 6.0 for Engineers”, McGraw Hill & Co, 2001.

Reference Books

1. M.Herniter, “Programming in MATLAB”, Thomson Learning, 2001
2. John OkyereAltla, “Electronics and circuit analysis using MATLAB”, CRC press, 1999
3. K.K.Sharma, “MATLAB Demustifyied”, Vikas Publishing House Pvt Ltd. 2004

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1. https://www.mathworks.com/products/matlab.html
2. https://www.tutorialspoint.com/matlab/index.htm
3. https://www.cmu.edu/computing/software/all/matlab/
4. https://ctms.engin.umich.edu/CTMS/index.php?aux=Home

COs Mapping with POs and PSOs

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	-	2	3	-	-	-	-	-	-	-	2	2	3
CO2	2	2	-	2	3	-	-	-	-	-	-	-	2	2	3
CO3	2	2	-	2	3	-	-	-	-	-	-	-	2	2	3
CO4	2	2	-	2	3	-	-	-	-	-	-	-	2	2	3
CO5	2	2	-	2	3	-	-	-	-	-	-	-	2	2	3

Correlation Level: 1-Low, 2-Medium, 3- High

	CONSUMER ELECTRONICS	L	T	P	C	Hours
U19ECO42	(Common to EEE, ICE, CSE, MECH, IT, CIVIL, BME, Mechatronics)	**3**	**0**	**0**	**3**	**45**

Course Objectives

- To enable the troubleshoot of different types of microphones and loudspeakers
- To make the students to analyze the working of digital console, digital FM tuner and troubleshoot audio systems
- To train to test the working of various colour TV
- To empower them to troubleshoot colour TV receivers
- To equip them to maintain various electronic home and office appliances

Course Outcomes

After completion of the course, students will be able to

CO1- Describe the fundamental audio characteristics and measurements, operating principles of microphone and loudspeaker **(K1)**

CO2 - Explain the working of digital console, digital FM tuner and troubleshoot the audio systems **(K2)**

CO3 - Distinguish the salient features of colour TV and Monochrome and troubleshoot TV camera **(K2)**

CO4 - Demonstrate various interfaces in digital TV, the working of DTH receiver, CD/DVD players **(K3)**

CO5 - Explain the working of FAX, Microwave oven, Washing machine, Air conditioner, Refrigerators and camera **(K2**)

UNIT -1 AUDIO FUNDAMENTALS AND DEVICES (9 Hrs)

Basic characteristics of sound signal, Microphone- working principle, sensitivity, nature of response. Types of Microphone, Loud speaker- working principle, Woofers and Tweeters, characteristics. Types of Loudspeaker. Sound recording

UNIT-II AUDIO SYSTEMS (9 Hrs)

Introduction to audio system, Digital Console- Block diagram, working principle, applications, FM tuner-concepts of digital tuning, ICs used in FM tuner TD702IT, PA address system- Planning, speaker impedance matching, characteristics, Power amplifier specification

UNIT -III TELEVISION SYSTEMS (9 Hrs)

Monochrome TV standards, Components of TV system, scanning process, aspect ratio, persistence of vision and flicker, interlace scanning, picture resolution. Composite video signal, Colour TV standards, colour theory, hue, brightness, saturation, luminance and chrominance. Different types of TV camera.

UNIT -IV TELEVISION RECEIVERS AND VIDEO STANDARDS (9 Hrs)

Colour TV receiver- block diagram, Digital TVs- LCD, LED , PLASMA, HDTV, 3-D TV, projection TV, DTH receiver, Video interface: Composite, Component, Separate Video, Digital Video, SDI, HDMI, Digital Video Interface, CD and DVD player: working principles, interfaces

UNIT -V HOME AND OFFICE APPLIANCES (9 Hrs)

Microwave Oven: Types, technical specifications. Washing Machine: hardware and software. Air conditioner and Refrigerators: Components features, applications, and technical specification. Digital camera and cam coder: - pick up devices, picture processing, picture storage

Text Books

1 Bali S.P. , 'Consumer Electronics', **copyright 2008**,Pearson Education India
2 Bali R and Bali S.P. 'Audio video systems : principle practices & troubleshooting', Khanna Book Publishing Co. (P) Ltd
3 Gulati R.R., 'Modern Television practices', 5th edition, 2015, New Age International Publication (P) Ltd

Reference Books

1 Gupta R.G., 'Audio video systems', 2nd edition,2017, Tata Mcgraw Hill, New Delhi, India
2 Whitaker Jerry & Benson Blair, 'Mastering Digital Television', McGraw-Hill Professional, 2006
3 Whitaker Jerry & Benson Blair, 'Standard handbook of Audio engineering', 2nd edition,2002, McGraw-Hill Professional

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1 http://www.scientificamerican.com/article.cfm?id = experts. bluetooth-work
2 http://www.cosc.brocku.ca/Offerings/3P92/seminars/HDTV.ppt
3 http://www.circuitstoday.com/blu-ray-technology-working
4 http://www.freevideolectures.com

COs Mapping with POs and PSOs

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	-	2	1	-	1	-	-	-	-	-	-	2	1	1
CO2	2	-	2	1	-	1	-	-	-	-	-	-	2	1	1
CO3	2	-	2	1	-	1	-	-	-	-	-	-	2	1	1
CO4	2	-	2	1	-	1	-	-	-	-	-	-	2	1	1
CO5	2	-	2	1	-	1	-	-	-	-	-	-	2	1	1

Correlation Level: 1-Low, 2-Medium, 3- High

	ANALYSIS OF ALGORITHMS	L	T	P	C	Hrs
U19CSO42	(Common to EEE, ECE, ICE, MECH, CIVIL, BME, Mechatronics)	**3**	**0**	**0**	**3**	**45**

Course Objectives

- To analyze the performance of algorithms in terms of time and space complexity.
- To understand the performance of the algorithms such as divide and conquer, greedy method
- To solve problems using Dynamic Programming and derive the time complexity.
- To solve problems using Backtracking technique and derive the time complexity.
- To solve problems using Branch and Bound technique and derive the time complexity.

Course Outcomes

After completion of the course, students shall have ability to

CO1 - Choose the appropriate data structure and algorithm design method for a specified application.**(K2)**

CO2 - Ability to understand the design technique such as divide and conquer, greedy method applied to realistic problems and analyse them. **(K3)**

CO3 - Ability to understand the dynamic programming design technique and how it is applied to realistic problems and analyze them. **(K3)**

CO4 - Ability to understand the backtracking design technique and how it is applied to realistic problems and analyze them. **(K3)**

CO5 - Ability to understand Branch and Bound design technique and how it is applied to realistic problems and analyze them. **(K2)**

UNIT I INTRODUCTION (9 Hrs)

Introduction: Algorithm, Pseudo code for expressing algorithms, Performance Analysis – Time complexity, Space complexity, Asymptotic Notation – Big oh notation, Omega notation, Theta notation and Little oh notation.

UNIT II DIVIDE AND CONQUER METHOD AND GREEDY METHOD (9 Hrs)

Divide and Conquer method: Applications – Binary search, Merge sort, Quick sort. Greedy method: General method, applications – Knapsack problem, Minimum cost spanning trees, Single source shortest path problem.

UNIT III DYNAMIC PROGRAMMING (9 Hrs)

Dynamic Programming: Applications - Multistage graphs, 0/1 knapsack problem, All pairs shortest path problem, Traveling salesperson problem, Reliability design.

UNIT IV BACK TRACKING (9 Hrs)

Backtracking: General method, Applications – N-queen problem, Sum of subsets problem, Graph Coloring – Hamiltonian Cycles.

UNIT V BRANCH AND BOUND (9 Hrs)

Branch and Bound**:** General method, Applications – Traveling sales person problem, 0/1 Knapsack problem, LC Branch and Bound solution, FIFO Branch and Bound solution.

Text Books

1. E. Horowitz and S.Sahni, “Fundamentals of Algorithms”, Galgotia Publications, 2nd Edition, 2010.
2. T.H.Cormen, C.E.Leiserson, R.L.Rivest, and C.Stein, “Introduction to Algorithms”, PHI/Pearson Education, 3rdEdition, 2009.
3. Anany Levitin, “Introduction to the Design and Analysis of Algorithms”, Pearson Education, Third Edition, 2012.

Reference Books

1. Michael T. Goodrich and Roberto Tamassia, “Algorithm Design: Foundations, Analysis and Internet Examples”, Wiley India, 2006.
2. Sara Baase and Allen Van Gelder, “Computer Algorithms Introduction to Design and Analysis”, Pearson Education Asia, 3rd Edition, 2010.
3. Donald E Knuth, “The Art of Computer Programming, Volume I & II”, Addison Wessely, Third Edition, 2011.
4. Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman, “Data Structures and Algorithms”, Pearson Education, 2006.
5. Harsh Bhasin, ”Algorithms Design and Analysis”, Oxford university press, 2016.

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1. https://swayam.gov.in/nd1_noc20_cs71/preview
2. https://www.tutorialspoint.com/design_and_analysis_of_algorithms/
3. https://www.javatpoint.com/daa-tutorial
4. https://www.guru99.com/design-analysis-algorithms-tutorial.html
5. https://www.geeksforgeeks.org/fundamentals-of-algorithms/

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
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2	3	2	3	3	2	2	1	-	-	-	-	-	-	-	-
3	3	3	3	3	2	2	2	-	2	-	-	-	-	-	-
4	3	2	3	3	3	2	2	-	-	-	3	-	-	-	-
5	3	3	3	3	2	2	2	-	-	-	3	2	-	-	-

Correlation Level: 1-Low, 2-Medium, 3- High

	WEB DEVELOPMENT	L	T	P	C	Hrs
U19CSO41	(Common to EEE, ECE, ICE, MECH, CIVIL, BME, Mechatronics)	**3**	**0**	**0**	**3**	**45**

Course Objectives

- To study the fundamentals of web application development
- To understand the design components and tools using CSS
- To learn the concepts JavaScript and programming fundamentals.
- To study about advance scripting and Ajax applications.
- To understand the working procedure of XML

Course Outcomes

After the completion of the course, the students will be able to

CO1 - Develop basic web applications. **(K5)**
CO2 - Design the web applications using CSS. **(K5)**
CO3 - Validate the web pages using java scripts functions. **(K5)**
CO4 - Demonstrate the web 2.0 application to advance scripts. **(K3)**
CO5 - Update the knowledge of XML Data. **(K4)**

UNIT I INTRODUCTION TO WWW & HTML (9 Hrs)

Protocols – Secure Connections – Application and development tools – Web browser – Server definition – Dynamic IP. Web Design: Web site design principles – Planning the site and navigation. HTML: Development process – Html tags and simple HTML forms – Web site structure.

UNIT II STYLE SHEETS (9 Hrs)

Introduction to CSS: Need for CSS – Basic syntax and structure using CSS – Background images – Colors and properties – Manipulating texts using fonts, borders and boxes – Margins, padding lists, positioning using CSS – CSS2.

UNIT III JAVA SCRIPTS (9 Hrs)

Client side scripting: Basic JavaScript – Variables – Functions – Conditions – Loops. Applications: Page Validation – Reporting.

UNIT IV ADVANCE SCRIPT (9 Hrs)

JavaScript and objects – DOM and Web browser environments – Forms and Validations – DHTML. AJAX: Introduction – Web applications – Alternatives of AJAX.

UNIT V XML (9 Hrs)

Introduction to XML – Uses of XML – Simple XML – XML key components – DTD and Schemas – Well-formed XML document – Applications of XML – XSL and XSLT.

Text Books

1. Keith Wald, Jason Lengstorf," Pro PHP and jQuery", Paperback, 2016.
2. Semmy Purewal, "Learning Web App Development", O'Reilly Media, 2014.
3. P.J. Deitel AND H.M. Deitel," Internet and World Wide Web - How to Program", Pearson Education, 2009.

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1. Yakov Fain, Victor Rasputnis, Anatole Tartakovsky and Viktor Gamov, “Enterprise Web Development “, O’Reilly Media, 2014.
2. Steven Suehring, Janet Valade, “PHP, MySQL, JavaScript & HTML5 All-in-One”, John Wiley & Sons, Inc, 2013.
3. UttamK.Roy, “Web Technologies”, Oxford University Press, 2010.
4. Rajkamal, “Web Technology”, Tata McGraw-Hill, 2009.
5. Shklar, Leon, Rosen, Rich, “Web Application Architecture: Principles, Protocols and Practices”, Wiley Publication, 2009.

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2. https://www.geeksforgeeks.org/web-technology/
3. https://www.guru99.com/cakephp-tutorial.html
4. https://www.ithands.com/blog/cms-or-php-framework-which-technology-is-better-for-my-business
5. http://Oriel.ly/learning-web-app

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	3	3	3	3	3	3	-	-	3	-	-	-	-
2	2	2	2	2	-	2	-	2	-	2	-	2	-	-	-
3	3	3	3	3	3	3	3	3	-	-	3	-	-	-	-
4	2	2	2	2	-	2	-	2	-	2	-	2	-	-	-
5	2	2	2	2	-	2	-	2	-	2	-	2	-	-	-

Correlation Level: 1-Low, 2-Medium, 3- High

U19ITO41	DATABASE SYSTEM: DESIGN & DEVELOPMENT (Common to EEE, ECE, ICE, BME)	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- Understand the various data models, conceptualize E-R diagram and depict using relational model
- Gain knowledge about database languages and frame query using Relational Algebra and SQL
- Understand and design an efficient database schema using the various normal forms
- Impart knowledge on data storage and transaction processing, concurrency control techniques and recovery procedures
- Explore knowledge on tools and practice case studies

Course Outcomes

After completion of the course the students will be able to:

CO1 - Explain the concepts of Database Management System and develop Entity Relationship model and Relational Models for a given application**(K2)**

CO2 - Manipulate and build database queries using Structured Query Language and relational algebra**(K2)**

CO3 - Apply data normalization principles to develop a normalized database for a given application.**(K3)**

CO4 - Explain various storage & indexing techniques, transactions and recovery techniques**(K2)**

CO5 - Apply tools like NoSQL, MongoDB, Cassandra on real time applications**(K3)**

UNIT I INTRODUCTION (9 Hrs)

Database Systems– Data Models – Database System Architecture - Entity-Relationship Model - ER Diagram-Extended ER Model –ER into Relational Model - **Relational Model**: Structure of Relational Databases, Database Schema,Keys,Tables

UNIT II DATABASE LANGUAGES (9 Hrs)

Relational Algebra – Extended-Relational Algebra Operations –**SQL**: Introduction – DDL – DML –Integrity Constraints-Set Operations-Joins – Nested Queries -View- Trigger - Stored Procedures

UNIT III RELATIONAL-DATABASE DESIGN (9 Hrs)

Introduction to Schema Refinement – Decomposition – Lossless Decomposition – Functional Dependencies – Normal Forms - First Normal Form, Second Normal Form, Third Normal Form, Boyce-Codd Normal Form, Fourth Normal Form.

UNIT IV DATA STORAGE (9 Hrs)

RAID - File Organization - Indexing, Ordered Index, Index files, Hashing - Static and dynamic hashing.

Transactions: Transaction concepts and states– Concurrent Execution-Serializability-Concurrency Control: Lock based Protocol - Timestamp based Protocol - **Recovery System**: – Log-Based Recovery – Shadow Paging

UNIT V CASE STUDY (9 Hrs)

NoSQL – Document Database : MongoDB - Multi-dimensional: Cassandra

Text Books

1. Silberschatz, Korth, Sudarshan, *Database System Concepts*, 7thEdition – McGraw-Hill Higher Education, International Edition, 2019.
2. RamezElmasri, and Shamkant B. Navathe, Fundamentals of Database Systems (7th edition), Publisher: Pearson,2016

Reference Books

1. Raghu Ramakrishnan, —Database Management Systems, Fourth Edition, McGraw-Hill College Publications, 2015.
2. Date C J, Kannan A and Swamynathan S, —An Introduction to Database Systems‖, 8th Edition, Pearson Education, New Delhi, 2006.
3. Alan Beaulieu, Mastering SQL Fundamentals, Second Edition, O'Reilly,2009
4. Kristina Chodorow; Shannon Bradshaw MongoDB: The Definitive Guide, 3rd Edition, O'Reilly Media, Inc., 2018.
5. Pramod J. Sadalage (Author), Martin Fowler, NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence 1stEdition, Kindle Edition

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2. http://cassandra.apache.org/
3. https://www.mongodb.com/

CO-POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	1			-	-	-	-	-	-	-	-	-	-	-
2	3	2	1	1	-	-	-	-	-	-	-	-	-	-	-
3	3	2	1	1	-	-	-	-	-	-	-	-	-	-	-
4	2	1			-	-	-	-	-	-	-	-	-	-	-
5	3	2	1	1	-	-	-	-	-	-	-	-	-	-	-

Correlation Level: 1-Low, 2-Medium, 3- High

U19ITO42	R PROGRAMMING (Common to EEE, ECE, ICE, BME, MECH, Mechatronics)	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To understand the basics in R programming in terms of constructs, control statements, string functions
- To learn to apply R programming for Text processing
- To understand the use of data frames and tables
- To able to appreciate and apply the R programming from a statistical perspective
- To understand the interface model

Course Outcomes

After completion of the course the students will be able to:

CO1 - Create artful graphs to visualize complex data sets and functions.**(K3)**
CO2 - Write more efficient code using parallel R and vectorization.**(K3)**
CO3 - Create data frames and working with tables.**(K3)**
CO4- Interface R with C/C++ and Python for increased speed or functionality.**(K2)**
CO5 - Find new packages for text analysis, image manipulation &perform statistical analysis.**(K4)**

UNIT I INTRODUCTION (9 Hrs)

Introducing to R – R Data Structures – Help functions in R – Vectors – Scalars – Declarations – recycling – Common Vector operations – Using all and any – Vectorized operations – NA and NULL values – Filtering – Vectorised if-then else – Vector Equality – Vector Element names

UNIT II MATRICES AND ARRAYS (9 Hrs)

Matrices, Arrays And Lists Creating matrices – Matrix operations – Applying Functions to Matrix Rows and Columns – Adding and deleting rows and columns – Vector/Matrix Distinction – Avoiding Dimension Reduction – Higher Dimensional arrays – lists – Creating lists – General list operations – Accessing list components and values – applying functions to lists – recursive lists.

UNIT III DATA FRAMES (9 Hrs)

Data Frames Creating Data Frames – Matrix-like operations in frames – Merging Data Frames – Applying functions to Data frames – Factors and Tables – factors and levels – Common functions used with factors – Working with tables - Other factors and table related functions

UNIT IV FUNCTIONS AND ARGUMENTS (9 Hrs)

Control statements – Arithmetic and Boolean operators and values – Default values for arguments - Returning Boolean values – functions are objects – Environment and Scope issues – Writing Upstairs - Recursion – Replacement functions – Tools for composing function code – Math and Simulations in R Creating Graphs – Customizing Graphs – Saving graphs to files – Creating three-dimensional plots

UNIT V INTERFACING (9 Hrs)

Interfacing R to other languages – Parallel R – Basic Statistics – Linear Model – Generalized Linear models – Non-linear models – Time Series and Auto-correlation – Clustering.

Text Books

1. Norman Matloff, “The Art of R Programming: A Tour of Statistical Software Design”, No Starch Press, 2011.
2. Jared P. Lander, “R for Everyone: Advanced Analytics and Graphics”, Addison-Wesley Data &Analytics Series, 2013.

Reference books

1. Mark Gardener, " Beginning R – The Statistical Programming Language", Wiley, 2013
2. Robert Knell, "Introductory R: A Beginner's Guide to Data Visualisation, Statistical Analysis and Programming in R", Amazon Digital South Asia Services Inc, 2013.

Web References

1. https://www.coursera.org/learn/r-programming
2. https://www.r-project.org/

CO-POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	3	2	1	1	-	-	-	-	-	-	-	-	-	-	-
3	3	2	1	1	-	-	-	-	-	-	-	-	-	-	-
4	3	2	1	1	-	-	-	-	-	-	-	-	-	-	-
5	2	1	-	-	-	-	-	-	-	-	-	-	-	-	-

Correlation Level: 1-Low, 2-Medium, 3- High

U19MEO41	RAPID PROTOYPING (Common to EEE, ECE, ICE, CIVIL, BME)	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To understand the development of RP systems
- To learn the classification of liquid based and solid based rapid prototyping systems
- To understand the powder based rapid prototyping systems
- To learn about the materials for rapid prototyping systems
- To discuss about the reverse engineering and new technologies

Course Outcomes

After completion of the course, students will be able to

CO1 - Acquire knowledge about the product development**(K1)**
CO2 - Analyse the classification of liquid based and solid based rapid prototyping systems**(K4)**
CO3 - Analyse the powder based rapid prototyping systems**(K4)**
CO4 - Acquire knowledge about the materials for rapid prototyping systems**(K1)**
CO5 - Acquire knowledge about reverse engineering and new technologies**(K1)**

UNIT I INTRODUCTION (9 Hrs)

History – Development of RP systems – Applications in Product Development, Reverse Engineering, Rapid Tooling, Rapid Manufacturing- Principle – Fundamental – File format– Other translators – medical applications of RP - On demand manufacturing – Direct material deposition - Shape Deposition Manufacturing.

UNIT IILIQUID BASED AND SOLID BASED RAPID PROTOTYPING SYSTEMS (9 Hrs)

Classification – Liquid based system - Stereolithography Apparatus (SLA), details of SL process, products, Advantages, Limitations, Applications and Uses. Solid based system- Fused Deposition Modeling, principle, process, products, advantages, applications and uses - Laminated Object Manufacturing**.**

UNIT III POWDER BASED RAPID PROTOTYPING SYSTEMS (9 Hrs)

Selective Laser Sintering – principles of SLS process, principle of sinter bonding process, Laser sintering materials, products, advantages, limitations, applications and uses. Three Dimensional Printing – process, major applications, research and development. Direct shell production casting – key strengths, process, applications and uses, case studies, research and development. Laser Sintering System, e-manufacturing using Laser sintering, customized plastic parts, customized metal parts, e-manufacturing - Laser Engineered Net Shaping (LENS).

UNIT IV MATERIALS FOR RAPID PROTOTYPING SYSTEMS (9 Hrs)

Nature of material – type of material – polymers, metals, ceramics and composites liquid based materials, photo polymer development – solid based materials, powder based materials - case study.

UNIT V REVERSE ENGINEERING AND NEW TECHNOLOGIES (9 Hrs)

Introduction, measuring device- contact type and non-contact type, CAD model creation from point clouds-preprocessing, point clouds to surface model creation, medical data processing - types of medical imaging, software for making medical models, medical materials, other applications - Case study.

Text Books

1. Rafiq I. Noorani, Rapid Prototyping – Principles and Applications, Wiley & Sons,2006.
2. 2. Chua C.K, Leong K.F and Lim C.S, Rapid Prototyping: Principles and Applications, second edition, World Scientific, 2003.

3. Amitav Ghosh Introduction to Rapid Prototyping, North West Publication, New Delhi,2008.

Reference Books

1. Hopkinson N, R.J.M, Hauge, P M, Dickens, “Rapid Manufacturing – AnIndustrial revolution for the digital age”, Wiley, 2006
2. Ian gibson, “Advanced Manufacturing Technology for Medical applications:Reverse Engineering, Software conversion and Rapid Prototying”, Wiley, 2006
3. Paul F.Jacobs, Rapid Prototyping and Manufacturing, “Fundamentals of Stereolithography”, McGraw Hill 1993.
4. Pham D.T and Dimov, “Rapid Manufacturing”, Springer Verlog 2001.
5. Liou W.Liou, Frank W.Liou ,”Rapid Prototyping and Engineering applications : A tool box for prototype development”, CRC Press, 2007.

Web References

1. https://nptel.ac.in/courses/112/104/112104265/
2. https://www.digimat.in/nptel/courses/video/112104265/L01.html
3. https://nptel.ac.in/courses/112/107/112107078/
4. https://www.youtube.com/watch?v=oDdOqLblmVQ
5. https://www.youtube.com/watch?v=OhNnKTaciVI

COs Mapping with POs and PSOs

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	3	3	1	-	-	-	-	-	-	2	3	2	2
2	3	3	3	3	1	-	-	-	-	-	-	2	3	2	2
3	3	3	3	3	1	-	-	-	-	-	-	2	3	2	2
4	3	3	3	3	1	-	-	-	-	-	-	2	3	2	2
5	3	3	3	3	1	-	-	-	-	-	-	2	3	2	2

Correlation Level: 1-Low, 2-Medium, 3- High

U19MEO42 **MATERIAL HANDLING SYSTEM** **L T P C Hrs**

(Common to EEE, ICE, CIVIL, Mechatronics) **3 0 0 3 45**

Course Objectives

- To understand the principal groups of material handling equipment's
- To learn about the Flexible hoisting appliances
- To learn about the material handling attachments, hook bearings, crane attachment
- To understand about the basic material handling system, selection
- To introduce concepts of ergonomics of material handling equipment and safety in handling

Course Outcomes

After completion of this course, the student will be able to

CO1- Describe the principal groups of material handling equipment's.**(K2)**
CO2- Describe about the flexible hosting appliances.**(K2)**
CO3- Explains about the material handling attachments, hook bearings, crane attachment.**(K1)**
CO4- Illustrate the basic material handling system, selection.**(K1)**
CO5- Define theergonomics related to material handling equipment.**(K1)**

UNIT I MATERIAL HANDLING EQUIPMENTS (9 Hrs)

Types of intraplant transporting facility - principal groups of material handling equipments - choice of material handling equipment - hoisting equipment, screw type, hydraulic and pneumatic conveyors- - general characteristics of hoisting machines, surface and overhead equipments, general characteristics of surface and overhead equipments and their applications - Introduction to control of hoisting equipments.

UNIT II FLEXIBLE HOSTING APPLIANCES (9 Hrs)

Flexible hoisting appliances like ropes and chains, welded load chains, roller chains - selection of hemp rope chains and steel wire rope - selection of ropes - fastening of chain sand ropes - different types of load suspension appliances - fixed and movable pulleys, different types of pulley systems, multiple pulley systems - Chain and rope sheaves and sprockets.

UNIT III MATERIAL HANDLING ATTACHMENTS (9 Hrs)

Load handling attachments - standard forged hook, hook weights, hook bearings, cross piece and casing of hook - crane grab for unit and piece loads - carrier beams and clamps - load platforms and side dump buckets- electric lifting magnets - grabbing attachments for loose materials - crane attachments for handling liquid materials.

UNIT IV MATERIAL HANDLING SYSTEMS (9 Hrs)

Basic Material Handling systems - Selection, Material Handling method - path, Equipment - function oriented systems.

UNIT V METHODS TO MINIMIZE COST OF MATERIAL HANDLING (9 Hrs)

Methods to minimize cost of material handling- Maintenance of Material Handling Equipments - Safety in handling - Ergonomics of Material Handling equipment - Design, Miscellaneous equipment

Text Books

1. Rudenko N , Materials Handling Equipment , Envee Publishers, New Delhi, 2017
2. Alexandrov M.P Materials Handling Equipment, Mie publications, Moscow, 2013
3. **White**, John A., **Pence**, Ira W, Materials handling and logistics,Envee Publishers, New Delhi, 2016

Reference Books

1. K.C, AroraVikas, V. Shinde, Aspects of Material handling, Laxmi Publications; First edition, 2015.
2. Siddhartha Ray, Introduction to Material Handling, New Age International, Edition: 2, 2017.
3. RB Chowdary , G. R. N. Tagore,Plant Layout and Material Handling-, Khanna publishers; 2nd edition 2016.
4. James A Apple, Plant layout and Material Handlin, Krieger Pub Co, 2016.
5. P.B Mahapatra, Operations Management, PHI, 2016.

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1. https://nptel.ac.in/courses/112/102/112102011/
2. https://nptel.ac.in/courses/112/107/112107142/
3. https://nptel.ac.in/courses/112/107/112107143/
4. https://www.youtube.com/watch?v=WXmIdbVDJqE
5. https://www.youtube.com/watch?v=BBWPIByOEfI

COs Mapping with POs and PSOs

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	3	3	-	-	-	-	-	-	-	1	3	1	2
2	3	3	3	3	-	-	-	-	-	-	-	1	2	1	2
3	3	3	3	3	-	-	-	-	-	-	-	1	2	1	2
4	3	3	3	3	-	-	-	-	-	-	-	1	3	1	2
5	3	3	3	3	-	-	-	-	-	-	-	1	3	1	2

Correlation Level: 1-Low, 2-Medium, 3- High

		L	T	P	C	Hrs
U19BMO41	**MEDICAL ELECTRONICS** (Common to EEE, ECE, CSE, IT, ICE, MECH, Mechatronics)	**3**	**0**	**0**	**3**	**45**

Course Objectives

- To gain knowledge about the various physiological parameters measurements
- To understand the various biochemical and nonelectrical sensors
- To study about the assist devices
- To gain knowledge on surgical equipments and telemetry in healthcare
- To understand the concepts of recent advancements in healthcare

Course Outcomes

After completion of the course, the students will be able to

CO1 - Explain the electro- physiological parameters and bio-potentials recording **(K2)**
CO2 - Measure the biochemical and non-electrical physiological parameters **(K2)**
CO3 - Interpret the various assist devices used in the hospitals **(K3)**
CO4 - Identify physical medicine methods and biotelemetry **(K3)**
CO5 - Analyse recent trends in medical instrumentation **(K3)**

UNIT I ELECTRO-PHYSIOLOGY AND BIO-POTENTIAL RECORDING (9 Hrs)

Sources of bio medical signals, Bio-potentials, Bio potential electrodes, biological amplifiers, ECG, EEG, EMG, PCG, typical waveforms and signal characteristics

UNIT II BIO-CHEMICAL AND NON ELECTRICAL PARAMETER MEASUREMENT (9 Hrs)

pH, PO2, PCO2, Colorimeter, Blood flow meter, Cardiac output, respiratory, blood pressure, temperature and pulse measurement, Blood Cell Counters.

UNIT III ASSIST DEVICES (9 Hrs)

Artificial kidney, Dialysis action, hemodialyser unit, membrane dialysis, portable dialyser monitoring and functional parameters, Heart-Lung Machine.

UNIT IV PHYSICAL MEDICINE AND BIOTELEMETRY (9 Hrs)

Diathermies - Shortwave, ultrasonic and microwave type and their applications, Surgical Diathermy, Biotelemetry - Single Channel and Multiple Channel.

UNIT V RECENT TRENDS IN MEDICAL INSTRUMENTATION (9 Hrs)

Telemedicine, Insulin Pumps, Radio pill, Endo-microscopy, Brain machine interface, Lab on a chip, Cryogenic Technique.

Text Books

1. Leslie Cromwell, “Biomedical Instrumentation and Measurement”, Prentice Hall of India, New Delhi, 2011.
2. Khandpur, R.S., “Handbook of Biomedical Instrumentation”, TATA McGraw-Hill, New Delhi, 2017.
3. John G.Webster, “Medical Instrumentation Application and Design”, Third Edition, Wiley India , 2012.

Reference Books

1. Joseph J.Carr and John M.Brown, “Introduction to Biomedical Equipment Technology”, John Wiley and Sons, New York, 2011.
2. R.Anandanatarajan, “Biomedical Instrumentation and Measurements”, Second Edition, PHI Learning, 2016.

3. Mandeep singh, “Introduction to Biomedical Instrumentation”, Second Edition, Prentice Hall of India, New Delhi,2014
4. Shakti Chatterjee, Aubert Miller, “Biomedical Instrumentation Systems”, Cengage Learning, 2012
5. C.Raja Rao, Sujoy K.Guha, “ Principles of Medical Electronics and Biomedical Instrumentation”, Universities Press, 2010

Web References

1. https://www.nap.edu/read/21794/chapter/7
2. https://www.embs.org/about-biomedical-engineering/our-areas-of-research/diagnostic-therapetic systems
3. https://nptel.ac.in/courses/127/106/127106136/
4. medicinenet.com/script/main/art.asp?articlekey=6414
5. https://www.verywellhealth.com/cardiopulmonary-bypass-machine-used-for-surgery-3157220

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	-	2	2	2	-	1	-	-	-	-	2	-	1
2	3	2	-	2	2	2	-	1	-	-	-	-	2	-	1
3	3	-	-	2	3	3	-	1	-	-	-	-	2	-	1
4	3	-	2	2	3	2	-	1	-	-	-	-	2	-	1
5	3	2	2	3	3	2	-	1	-	-	-	-	2	-	1

Correlation Level: 1-Low, 2-Medium, 3- High

U19BMO42	TELEMEDICINE (Common to EEE, ECE, CSE, IT, ICE)	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives:

- To understand the classification of telemetry.
- To gain knowledge about biotelemetry principles
- To know about the applications of telemetry in various fields
- To provide the idea about the value of telemedicine
- To know the various applications in telemedicine.

Course Outcomes:

After completion of the course, the students will be able to

CO1 - Categorize the telemetry systems **(K2)**
CO2 - Understand the principles of biotelemetry in transmission of biological signals **(K3)**
CO3 - Apply the various Biotelemetry applications for diagnostics **(K3)**
CO4 - Acquire clear idea about the fundamentals of telemedicine **(K2)**
CO5 - Know about various applications of telemedicine **(K3)**

UNIT I INTRODUCTION TO TELEMETRY (9 Hrs)

Basic system, Classification, Non electrical telemetry systems, Mechanical and Pneumatic type, Voltage and Current telemetry systems, Local transmitters and Converters, Frequency telemetry system, Power Line carrier communication (PLCC).

UNIT II BIOTELEMETRY (9 Hrs)

Radio Telemetry principles, FM, AM, PCM, Transmission of biological data through radio telemetry.

UNIT III APPLICATION OF BIOTELEMETRY (9 Hrs)

Wireless Telemetry - Single Channel and Multi-channel Telemetry systems, Multi Patient Telemetry, Implantable Telemetry Systems, Ambulatory patient monitoring.

UNIT IV FUNDAMENTALS OF TELEMEDICINE (9 Hrs)

History and advancements in telemedicine, Benefits of telemedicine, Functional Block of a telemedicine system, Use of computers in distance mode of healthcare delivery, Familiarizing with technology of telemedicine, scanner, electro stethoscope, data reception equipment, Scope for telemedicine, Limitations of telemedicine.

UNIT V APPLICATIONS OF TELEMEDICINE (9 Hrs)

Telemedicine in Neuroscience, Telecardiology, Telepathology, Telepediatrics, Telepharmacy, Telepsychiatry and mental health, Veterinary.

Text Books

1. Marilyn J. Field , “A Guide to Assessing Telecommunications in Health Care”, Fourth Edition, Academy Press,2011.
2. Bashshur , R. L. , Sanders, J. H and Shannon, G, “Telemedicine: Theory and Practice”, Eight Edition, Springer,2014.
3. Olga (EDT), Ferre Roca, M. Sosa, “Handbook of Telemedicine”, Third Edition, IOS press 2009.

Reference Books

1. Bemmel, J.H. van, Musen, M.A. (Eds.), “Handbook of Medical Informatics”, Second Edition, Springer, 2010.
2. Simpson, W, “Video over IP. A practical guide to technology and applications’”, Ninth Edition, Focal Press, Elsevier, 2009.

3. Ferrer-Roca, O., Sosa-Iudicissa, , “Handbook of Telemedicine”, IOS Press, 2012
4. Norris, A.C, “Essentials of Telemedicine and Telecare”, Eight Edition, Wiley, 2017
5. Wotton, R., Craig, J., Patterson, V. (Eds.), “Introduction to Telemedicine”, Fifth Edition, Royal Society of Medicine Press Ltd., 2014.

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1. https://en.wikipedia.org/wiki/Biotelemetry
2. https://www.who.int/goe/publications/goe_telemedicine_2010.pdf
3. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5927731/

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	-	-	-	2	1	-	1	-	2	-	-	-	-	-
2	3	2	-	-	2	1	-	1	-	2	-	-	-	-	-
3	3	2	3	2	2	1	-	1	-	2	-	-	-	-	-
4	3	2	-	2	2	1	-	1	-	2	-	-	-	-	-
5	3	2	3	2	2	1	-	1	-	2	-	-	-	-	-

Correlation Level: 1-Low, 2-Medium, 3- High

		L	T	P	C	Hrs
U19CCO41	**BASIC DBMS** (Common to EEE, ECE, MECH, CIVIL, ICE, Mechatronics, BME Branches)	**3**	**0**	**0**	**3**	**45**

Course Objectives

- To understand about basics of Database Management System.
- To provide a general introduction to relational model and relational algebra.
- To study about normalization and SQL.
- To acquire knowledge about storage indexing and transaction management.
- To gain knowledge about the backup and recovery in database.

Course Outcomes

After completion of the course, the students will be able to

CO1 – Explain the concept of database management system. (**K2**)
CO2 – Create conceptual data model using entity relationship diagram.(**K2**)
CO3 – Analyze the various normalization.(**K4**)
CO4 – Describe the concept of storage indexing and transactions.(**K2**)
CO5 – Explain the database recovery and security.(**K2**)

UNIT - I INTRODUCTION TO DATABASE MANAGEMENT (9 Hrs)

Introduction to Database Management systems – History - Characteristics – Users- three-level architecture- Entity-- relationship data model.

UNIT – II - THE RELATIONAL DATA MODEL AND RELATIONAL ALGEBRA (9 Hrs)

Data structures – Mapping E-R Model to Relational model – data manipulation – integrity – advantages – rules for fully relational systems – relational algebra – relational algebra queries.

UNIT - III - STRUCTURED QUERY LANGUAGE AND NORMALIZATION (9 Hrs)

SQL – Data definition – manipulation – views SQL in procedural programming – data integrity and constraints – triggers – data control – database security. Normalization – Undesirable properties – single-valued normalization – desirable properties of decompositions – multivalued dependencies

UNIT –IV STORAGE INDEXING AND TRANSACTIONS MANAGEMENT (9 Hrs)

Different types of memories – secondary storage – buffer management – file structures – heap files – sorted files – index and types – indexed sequential file – B-tree – B+ tree. Transaction management – concepts – examples – schedules – serializability – concurrency control – deadlocks – lock and multiple granularity – nonlocking techniques.

UNIT –V DATABASE BACKUP, RECOVERY AND SECURITY (9 Hrs)

Database system failure – backup – recovery and concept of log – log-based recovery techniques – types of recovery – log-based immediate update recovery technique. Database Security – violations – identifications and authentication – authorization / access control – security of statistical databases – audit policy – internet applications and encryption.

Text Books

1. Gupta.G.K, “Database Management Systems”, Tata McGraw Hill, 2011
2. Abraham Silberschatz, Henry F Korth, S Sudharshan, Database System Concepts 7th Edition, McGraw-Hill International Edition, 2019.

3. Ramez Elmasri and Shamkant Navathe, Durvasula V L N Somayajulu, Shyam K Gupta, "Fundamentals of Database Systems", Pearson Education, United States of America, 2018.

Reference Books

1. Silberschatz, Korth.H and Sudarshan.S, "Database System Concepts", 6th Edition, McGraw-HillInternational, 2011.
2. Hector Garcia-Molina, Jeffrey D.Ullman, Jennifer Widom, "Database System The Complete Book, 1st Edition, Pearson 2002.
3. Date CJ, Kannan A, Swamynathan S, An Introduction to Database System, 8th Edition, Pearson Education-2006.
4. Raghu Ramakrishna, Johannes Gehrke, Database Management Systems, 3rd Edition, McGraw Hill, 2014.
5. Ramez Elmasri, Durvasul VLN Somyazulu, Shamkant B Navathe, Shyam K Gupta, Fundamentals of Database Systems", 7th Edition, Pearson Education, 2016.

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2. http://dev.mysql.com/doc/
3. http://www.rjspm.com/PDF/BCA-428%20Oracle.pdf
4. http://www.w3schools.com/
5. https://www.codecademy.com/learn/learn-

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	1	-	1	-	-	-	-	-	1	1	-	1	-
CO2	3	1	1	-	1	-	-	-	-	-	1	1	-	1	-
CO3	3	3	1	-	1	-	-	-	-	-	1	1	-	1	-
CO4	3	1	1	-	1	-	-	-	-	-	1	1	-	1	-
CO5	3	1	1	-	1	-	-	-	-	-	1	1	-	1	-

Correlation Level: 1-Low, 2-Medium, 3- High

		L	T	P	C	Hrs
U19CCO42	**INTRODUCTION TO COMMUNICATION SYSTEMS** (Common **to** EEE, CSE, IT, MECH, CIVIL, ICE, Mechatronics)	**3**	**0**	**0**	**3**	**45**

Course Objectives

- To provide basic knowledge of signals
- To study the various analog and digital modulation techniques
- To study the pulse modulation and multiplexing
- To infer Digital transmission techniques
- To provide knowledge about various multiple access technology and advanced communication techniques

Course Outcomes

After completion of the course, the students will be able to

CO1- Comprehend the basic Characteristics of the signals.(**K2**)
CO2- Comprehend needs of modulation and various analog modulation techniques (**K2**)
CO3- Illustrate pulse modulation and multiplexing (**K3**)
CO4- Explain Digital transmission techniques (**K2**)
CO5- Describe multiple access techniques and advanced communication systems.(**K2**)

UNIT I SIGNAL ANALYSIS (9 Hrs)

Introduction to Signals- Representation and classification of Signals, Representation of signal in frequency domain, introduction to Spectrum of signal- Introduction to Fourier series and Fourier Transform

UNIT II ANALOG COMMUNICATION (9 Hrs)

Need for Modulation-– Block diagram of analog communication System- Amplitude Modulation – AM, DSBSC, SSBSC, modulators and demodulators – Angle modulation – PM and FM – modulators and demodulators – Superheterodyne receivers

UNIT III PULSE COMMUNICATION (9 Hrs)

Low pass sampling theorem – Quantization – PAM – PCM, DPCM, DM, and ADPCM And ADM - Time Division Multiplexing, Frequency Division Multiplexing

UNIT IV DIGITAL COMMUNICATION (9 Hrs)

Comparison of digital and analog communication system- Block diagram of digital communication system Phase shift keying – BPSK, DPSK, QPSK

UNIT V MULTIPLE ACCESS TECHNIQUES AND ADVANCED COMMUNICATION (9 Hrs)

Multiple Access techniques- FDMA, TDMA, CDMA- Frequency reuse, Handoff- Block diagram of advanced communication systems – satellite communication – Cellular Mobile Communication – Fibre Optical Communication System.

Text Books

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COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	1	-	1	-	-	-	-	-	1	1	-	1	-
CO2	3	1	1	-	1	-	-	-	-	-	1	1	-	1	-
CO3	3	3	1	-	1	-	-	-	-	-	1	1	-	1	-
CO4	3	1	1	-	1	-	-	-	-	-	1	1	-	1	-
CO5	3	1	1	-	1	-	-	-	-	-	1	1	-	1	-

Correlation Level: 1-Low, 2-Medium, 3- High

Annexure V

SRI MANAKULA VINAYAGAR ENGINEERING COLLEGE
(An Autonomous Institution)
(Approved by AICTE, New Delhi & Affiliated to Pondicherry University)
(Accredited by NBA-AICTE, New Delhi, ISO 9001:2000 Certified Institution & Accredited by NAAC with "A" Grade)
Madagadipet, Puducherry - 605 107

DEPARTMENT OF INSTRUMENTATION AND CONTROL ENGINEERING

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