SRI MANAKULA VINAYAGAR ENGINEERING COLLEGE

(An Autonomous Institution)

Puducherry

B.TECH. INSTRUMENTATION AND CONTROL ENGINEERING

ACADEMIC REGULATIONS 2019
(R-2019)

CURRICULUM AND SYLLABUS
VOLUME 3

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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)

PEO1: Core Competency.
To provide the students with strong foundation in Mathematical, Scientific and Engineering fundamentals to analyze and solve problems related to Instrumentation and Control Engineering.

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 OBJECTIVES (PSOs)

PSO1: Basic Knowledge in ICE:
Apply the knowledge of Instrumentation and Control Engineering to calibrate and troubleshoot various process control instruments commonly used in industry.

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	U19ICC3X	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

**** 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	Linear Control System	PC	2	2	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	Instrumentation system design Lab	PC	0	0	2	1	50	50	100
9	U19ICP53	Microprocessor and Embedded system design lab	PC	0	0	2	1	50	50	100
10	U19ICP54	Simulation 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

Sl. No	Course Code	Course Title	Category	Periods L	Periods T	Periods P	Credits	Max. Marks CAM	Max. Marks ESM	Max. Marks Total
SEMESTER – VI										
Theory										
1	U19ICT61	Analytical Instrumentation	PC	3	0	0	3	25	75	100
2	U19ICT62	Industrial Instrumentation-II	PC	3	0	0	3	25	75	100
3	U19ICT63	Internet of Things (IoT) for automation	PC	3	0	0	3	25	75	100
4	U19ICT64	Process Control	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	Industrial Instrumentation lab	PC	0	0	2	1	50	50	100
8	U19ICP62	Internet of Things lab	PC	0	0	2	1	50	50	100
9	U19ICP63	Process Control 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	U19ICM61	Professional Ethics	MC	2	0	0	-	100	0	100
							21	800	600	1400

Sl. No	Course Code	Course Title	Category	Periods L	Periods T	Periods P	Credits	Max. Marks CAM	Max. Marks ESM	Max. Marks Total
SEMESTER – VII										
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
**** Certification Courses are to be selected from the list given in Annexure III**

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	Industrial Unit Operations
5	U19ICE55	Robotics and Automation
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	Virtual Instrumentation
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
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

S.No	Course Code	Course Title	Offering Department	Permitted Departments
Open Elective – I (Offered in Semester IV)				
1	U19EEO41	Solar Photovoltaic Fundamental 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	EEE, 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, BME
21	U19ADO41	Knowledge Representation and Reasoning	AD	EEE, ECE, CSE, IT, ICE, MECH, CIVIL, BME, Mechatronics

22	U19ADO42	Introduction to Data Science	AD	EEE, ECE, CSE, IT, ICE, MECH, CIVIL, BME, Mechatronics
Open Elective – II (Offered in Semester V)				
1	U19HSO51	Product Development and Design	MBA	Common to B.Tech (EEE, ECE, ICE, BME, CIVIL)
2	U19HSO52	Intellectual Property and Rights	MBA	
3	U19HSO53	Marketing Management and Research	MBA	
4	U19HSO54	Project Management for Engineers	MBA	
5	U19HSO55	Finance for Engineers	MBA	
Open Elective – III (Offered in Semester VI)				
1	U19EEO63	Conventional and Non-Conventional Energy Sources	EEE	ECE, ICE, MECH, CIVIL, BME, Mechatronics
2	U19EEO64	Industrial Drives and Control	EEE	ECE, ICE, MECH, Mechatronics
3	U19ECO63	Electronic Product Design and Packaging	ECE	EEE, CSE, IT, ICE MECH, BME, Mechatronics
4	U19ECO64	Automotive Electronics	ECE	EEE, ECE, ICE, MECH
5	U19CSO64	Platform Technology	CSE	EEE, ECE, ICE, MECH, CIVIL, BME
6	U19CSO65	Graphics Designing	CSE	EEE, ECE, ICE, MECH, CIVIL, BME
7	U19ITO63	Essentials of Data Science	IT	EEE, ECE, ICE, MECH, CIVIL, BME
8	U19ITO64	Mobile App Development	IT	EEE, ECE, ICE, MECH, CIVIL, BME, Mechatronics
9	U19ITO65	Data Structures	IT	MECH
10	U19ICO63	Fuzzy logic and neural networks	ICE	CSE, IT, CIVIL, BME
11	U19ICO64	Measurement and Instrumentation	ICE	ECE, Mechatronics
12	U19MEO64	Heating, ventilation, and air conditioning system (HVAC)	MECH	EEE, ECE, ICE, CIVIL
13	U19MEO65	Creativity Innovation and New Product Development	MECH	EEE, ECE, ICE, CIVIL, BME, Mechatronics
14	U19CEO63	Disaster Management	CIVIL	EEE, ECE, CSE, IT, ICE, MECH, BME
15	U19CEO64	Air Pollution and Solid Waste Management	CIVIL	EEE, ECE, CSE, IT, ICE, MECH, BME
16	U19BMO63	Biometric Systems	BME	EEE, ECE, CSE, IT, ICE, MECH, Mechatronics

17	U19BMO64	Medical Robotics	BME	EEE, ECE, CSE, IT, ICE, MECH, CIVIL , Mechatronics
18	U19CCO63	Network Essentials	CCE	EEE, MECH, CIVIL, ICE, Mechatronics, BME
19	U19CCO64	Web Programming	CCE	EEE, ECE, MECH, CIVIL, ICE, Mechatronics, BME
20	U19ADO63	Principle of Artificial Intelligence and Machine Learning	AD	EEE, ECE, CSE, IT, ICE, MECH, CIVIL
21	U19ADO64	Data science Application of Vision	AD	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	Sensors for Industrial Applications	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	Industrial Automation	ICE	EEE, ECE, CSE, MECH, IT, CIVIL, BME, Mechatronics.
10	U19ICO76	Ultrasonic 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	U19ADO75	Data Science Application of NLP	AD	EEE, ECE, CSE, IT, ICE, MECH, CIVIL, BME, Mechatronics
22	U19ADO76	Artificial Intelligence Applications	AD	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*

T101	MATHEMATICS – I (Common to all branches)	L	T	P	C	Hrs
		3	1	0	4	60

Course Objectives

- To introduce the idea of applying calculus concepts to problems in Engineering.
- To understand the concept of partial differentiation
- To develop logical thinking and analytic skills in evaluating multiple integrals.
- To introduce mathematical tools to solve first order differential equations.
- To learn linear differential equations of higher order with constant coefficients.

Course Outcomes

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

CO1 – Understand the concept of curvature. **(K2)**
CO2 – Solve different types of partial differential equation. **(K3)**
CO3 – Understand the concept of double and triple integrals. **(K2)**
CO4 – Solve differential equations. **(K3)**
CO5 – Solve higher order differential equations.**(K3)**

UNIT I CALCULUS **(12 Hrs)**

Curvature, radius of curvature, evolutes and involutes. Beta and Gamma functions and their properties.

UNIT II FUNCTIONS OF SEVERAL VARIABLES **(12 Hrs)**

Partial derivatives, Total derivatives, Differentiation of implicit functions, Change of Variables, Jacobians and their properties, Taylor's series for functions of two variables, Maxima and minima, Lagrange's method of undetermined multipliers.

UNIT III MULTIPLE INTEGRALS AND APPLICATIONS **(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 IV DIFFERENTIAL EQUATIONS **(12 Hrs)**

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

UNIT V 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, simultaneous linear Differential equations, solution by Variation of parameters method simple application to Electric circuits.

Text Books

1. Venkataraman M.K, Engineering Mathematics-First year, National Publishing Company, Chennai,2010 (For Units I, III, IV & VI only)
2. Grewal B.S., Higher Engineering Mathematics, Khanna Publishers, New Delhi,1st Edition, 2011. (For Unit II only)
3. Dr. A. Singaravelu, "Engineering Mathematics - I", Meenakshi publications, Tamil Nadu, 2011.

Reference Books

1. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.
2. Kandasamy P. et al, Engineering Mathematics, Vol.1 & 2, S. Chand & Co., New Delhi.
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, 8th Edition.
5. Bali N.P and Goyal M., Advanced Engineering Mathematics, Lakshmi Publications Pvt. Ltd., New Delhi, 7th Edition, 2010.

Web Resources

1. https://www.youtube.com/watch?v=rAof9Ld5sOg
2. https://nptel.ac.in/courses/111/104/111104092/
3. https://nptel.ac.in/courses/111/107/111107108/
4. https://www.youtube.com/watch?v=BJ_0FURo9RE
5. https://www.youtube.com/watch?v=p_di4Zn4wz4

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

T102	PHYSICS	L	T	P	C	Hrs
		4	0	0	4	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
		4	0	0	4	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

T110	BASIC CIVIL AND MECHANICAL ENGINEERING	L	T	P	C	Hrs
		4	0	0	4	45

(Common to all branches)

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	1	0	4	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.

Web References

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

		L	T	P	C	Hrs
T112	**COMMUNICATIVE ENGLISH**	4	0	0	4	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

Web References

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 LAB	L	T	P	C	Hrs
		0	0	3	2	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 LAB	L	T	P	C	Hrs
		0	0	3	2	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
	(Common to all branches)	0	0	3	2	30

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

Web References

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.

Web References

1. https://www.youtube.com/watch?v=1wjXVdwzgX8
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
	(Common to all branches)	4	0	0	4	45

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.

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	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
		4	0	0	4	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

Web References

1. www.ifpri.org/topic/environment-and-natural-resources
2. https://www.iucn.org/content/biodiversity
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 (Common to all branches)	L	T	P	C	Hrs
		3	1	0	4	45

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 ANDPOWER 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.

Web References

1. https://nptel.ac.in/courses/108/108/108108076/
2. https://www.electrical4u.com/
3. https://nptel.ac.in/courses/108/102/108102146/
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	1	0	4	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 GASPOWER 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.

Web References

1. https://nptel.ac.in/courses/112105266/
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
	(Common to all branches)	3	1	0	4	60

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.

Web References

1. https://www.geeksforgeeks.org/classification-of-computers/
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

Web References

1. https://www.javatpoint.com/factorial-program-in-c
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	2	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

<u>**List of Experiments**</u>

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

<u>**List of Experiments**</u>

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**	**0**	**-**

- 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 (Common to EEE,ICE,MECH & Mechatronics)	L	T	P	C	Hrs
		2	2	0	3	60

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..

Web References

1. https://nptel.ac.in/courses/122107036/
2. https://nptel.ac.in/courses/111107119/
3. https://youtu.be/W3HXK1Xe4nc
4. https://youtu.be/Mwpz1zjPlzl
5. https://youtu.be/CnrAivf9l6o

COs/POs/PSOs Mapping

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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

U19ICT32	DATA STRUCTURES	L	T	P	C	Hrs
		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.

Web References

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

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

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.

UNIT II 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)**

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, 2[nd] 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

U19ICP31	DATA STRUCTURES 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 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

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	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/

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	-	-	-	-	2	-	2	2	3	2	3
2	3	2	3	2	-	-	-	-	2	-	2	2	3	2	3
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

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.cardano.pv.it/progetti/clil/materiali/Elettrotecnica.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

		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.

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. 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

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

U19ICT42	PROGRAMMING IN JAVA	L	T	P	C	Hrs
	(Common to CSE, ECE, EEE, IT, ICE, MECH, CIVIL, BME, Mechatronics,)	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, 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.

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)												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 DesignI, 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 DesignI, 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,—FundamentalsofDigitalCircuitsI,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

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

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

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	-	-	-	-	-	-	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.

		L	T	P	C	Hrs
U19ICT51	NUMERICAL METHODS	2	2	0	3	60

Course Objectives

- To know the solution of algebraic and transcendental equations.
- To learn the techniques of solving simultaneous equations.
- To introduce the numerical techniques of differentiation and integration.
- To solve ordinary differential equations by using numerical methods.
- To know the solution of partial differential equations by using numerical methods.

Course Outcomes

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

CO1 - Use numerical techniques to solve algebraic and transcendental equations. .**(K2)**

CO2 - Find the solution of simultaneous equations. .**(K2)**

CO3 - Analyze and apply the knowledge of differentiation and integration by using numerical methods. **(K3)**

CO4 - Solve the solution of ordinary differential equations by RungeKutta methods. **(K3)**

CO5 - Solve the partial differential equations in iterative methods. .**(K3)**

UNIT I SOLUTION OF ALGEBRAIC AND TRANSCENDENTAL EQUATIONS AND EIGEN VALUE PROBLEMS

(12Hrs)

Bisection method - Method of false position - Newton Raphson method (single and system of two equations) -Eigen value and Eigenvector by power method.

UNIT II LINEAR SIMULTANEOUS EQUATIONS **(12 Hrs)**

Solution of linear simultaneous equations and matrix inversion - Gauss elimination method - Gauss Jordan method - Iterative methods of Gauss Jacobi and Gauss Seidel.

UNIT III INTERPOLATION **(12 Hrs)**

Finite Differences - Relation between operators - Interpolation by Newton's forward and backward difference formula for equal intervals - Newton's divided difference method and Lagrange's method for unequal intervals - Differentiation based on finite differences - Integrations by Trapezoidal and Simpson's rules.

UNIT IV SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS **(12 Hrs)**

Single step methods -Taylor series method -Picard's method -Euler method and Improved Euler method- RungeKutta method of fourth order only.

UNIT V SOLUTION OF PARTIAL DIFFERENTIAL EQUATIONS **(12 Hrs)**

Solution of Laplace and Poisson equations -Leibmann's iterative method -Diffusion equation: Bender-Schmitt method and Crank-Nicholson implicit difference method -Wave equation: Explicit difference method

Text Books

1. Grewal B.S., "Numerical Methods in Engineering and Science", Mercury learning andInformation, Kindle Edition, 2018
2. Rajesh Kumar Gupta, "Numerical Methods - Fundamentals and Applications", CambridgeUniversity Press, 2019
3. M.K. Jain, R.K. Jain, S.R.K. Iyengar, "Numerical Methods for Scientific and Engineering Computation", New Age International Pvt. Ltd., 7th Edition, 2019.

Reference Books

1. Steven C. Chapra, "Applied Numerical Methods W/Mat lab", Tata McGraw Hill, 4thEdition, 2017
2. P. Siva Ramakrishna Das, "Numerical Analysis", Kindle Edition, 2016
3. Timo Heister, Leo G. Rebholz, FeiXue, "Numerical Analysisan Introduction", De Gruyter, 2019.
4. Graham W. Griffiths, "Numerical Analysis using R solutions to ODEs and PDEs", Kindle 1st Edition,Cambridge University Press, 2016
5. K. SankaraRao, "Numerical Methods for Scientists and Engineers", 3rd Edition, PHI Learning Pvt. Ltd., New Delhi, 2018.
6. C.B. Gupta, Shree Ram Singh, M. Kumar, "Engineering Mathematics for semesters III & IV", Tata McGraw Hill, 1st Edition, 2016.

Web References

1. http://nptel.ac.in/courses/111107063
2. http://nptel.ac.in/courses/122102009
3. https://nptel.ac.in/courses/111/107/111107105/
4. http://www.math.iitb.ac.in/~baskar/book.pdf
5. https://www.math.ust.hk/~machas/numerical-methods.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	3	-	-	-	-	-	-	-	-	-	1	-	-	-
2	1	3	-	-	-	-	-	-	-	-	-	1	-	-	-
3	2	3	-	-	-	-	-	-	-	-	-	1	-	-	-
4	1	2	-	-	-	-	-	-	-	-	-	1	-	-	-
5	2	2	-	-	-	-	-	-	-	-	-	1	-	-	-

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

U19ICT52	INDUSTRIAL INSTRUMENTATION-I	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To introduce the measurement techniques of force, torque and speed.
- To introduce the measurement techniques of acceleration, Vibration and density
- To equip the students with the knowledge of level measurements.
- To equip the students with the knowledge of temperature measurements.
- To introduce the Measurement techniques of pressure.

Course Outcomes

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

CO1- Understand the measurement techniques of force, torque and speed. **(K1)**
CO2- Explicate the measurement techniques of acceleration, Vibration and density. **(K2)**
CO3- Analyze the various types of level measurement .**(K3)**
CO4 -Understand the measurement of temperature. **(K2)**
CO5- Acknowledge the measurement of pressure **(K1)**

UNIT I MEASUREMENT OF FORCE, TORQUE AND SPEED **(9 Hrs)**

Different types of load cells: Hydraulic, Pneumatic, Strain gauge, Magneto-elastic and Piezoelectric load cells - Different methods of torque measurement: Strain gauge, Relative angular twist. Speed measurement: Capacitive tacho, Drag cup type tacho, D.C and A.C tacho generators - Stroboscope.

UNIT II MEASUREMENT OF ACCELERATION, VIBRATION AND DENSITY **(9 Hrs)**

Accelerometers: LVDT, Piezoelectric, Strain gauge and Variable reluctance type accelerometers - Mechanical type vibration instruments - Seismic instruments as accelerometer – Vibration sensor - Calibration of vibration pickups - Units of density and specific gravity – Baume scale and API scale – Densitometers: Pressure type densitometers, Float type densitometers, Ultrasonic densitometer and gas densitometer.

UNIT III LEVEL MEASUREMENT **(9 Hrs)**

Level measurement: Float gauges - Displacer type – D/P methods -Bubbler system-Load cell – Electrical types – Conductivity sensors – Capacitive sensors – Nucleonic gauge - Ultrasonic gauge – Boiler drum level measurement :– Differential pressure method and Hydrastep method - Solid level measurement.

UNIT IV TEMPERATURE MEASUREMENT **(9 Hrs)**

Temperature scales, Bimetallic thermometer, filled- in Thermometers, Vapour pressure thermometers, Resistance thermometers, Thermistors, Thermostat, Thermocouples - types and ranges, characteristics, laws of thermocouples, cold junction compensation, IC temperature sensors AD 590, Pyrometers - radiation and optical pyrometers.

UNIT V PRESSURE MEASUREMENT **(9 Hrs)**

Units of pressure – Manometers: Different types, Elastic type pressure gauges: Bourdon tube, Bellows, Diaphragms and Capsules - Electrical methods: Elastic elements with LVDT and strain gauges - Capacitive type pressure gauge - Piezo resistive pressure sensor-Resonator pressure sensor - Measurement of vacuum: McLeod gauge, Thermal conductivity gauge, Iionization gauges, Cold cathode type and hot cathode type – Pressure gauge selection, installation and calibration using dead weight tester

Text Books

1. Doebelin, 'Measurement Systems – Application and Design', Tata McGraw Hill publishing company, 2012.
2. R.K. Jain, 'Mechanical and Industrial Measurements', Khanna Publishers, New Delhi,2019.
3. D. Patranabis, 'Principles of Industrial Instrumentation', Tata McGraw Hill Publishing Company Ltd, 2013.

Reference Books

1. A.K. Sawhney and P. Sawhney, 'A Course on Mechanical Measurements, Instrumentation and Control', Dhanpath Rai and Co, 2013.
2. S.K. Singh, 'Industrial Instrumentation and Control', Tata McGraw Hill, 2014.
3. D.P. Eckman', Industrial Instrumentation', Wiley Eastern Ltd., 2012.
4. P.Holman, "Experimental Methods for Engineers", International Student Edition, McGraw Hill Book Company, 2013.
5. Andrew W.G, "Applied Instrumentation in Process Industries – A survey", Vol. 1 & Vol.2, Gulf Publishing Company, Houston, 2012.

Web References

1. https://lecturenotes.in/subject/42/industrial-instrumentation-ii
2. https://www.scribd.com/presentation/260674587/Industrial-Instrumentation-Notes.
3. https://nptel.ac.in/courses/108/105/108105064/.
4. https://www.youtube.com/playlist?list=PLUtfVcb-iqn_Dq6RnkCaOaLjPDu3cmxpo.
5. https://nptel.ac.in/courses/108/106/108106074/

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

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

U19ICT53	LINEAR CONTROL SYSTEM	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 EngineeringI, 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. SmarajithGhosh, —Control Systems Theory and Applications‖, Pearson Education, Singapore, Sixth Edition, 2015
3. Richard C. Dorf, Robert H Bishop, —Modem Control Systems‖, 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 Feedback 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	-	-
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

U19ICT54	MICROPROCESSOR AND EMBEDDED SYSTEM DESIGN	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To impart basic knowledge about 8085 microprocessor.
- To provide basics knowledge of 8051 microcontroller architecture and programming
- To study LPC 2148 microcontroller hardware features and internal peripherals
- To study various hardware interfacing with microcontrollers
- To discuss the major components that constitutes an embedded system

Course Outcomes

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

CO1- Elucidate the architecture of 8085 microprocessor. **(K4)**
CO2- Elucidate the architecture and addressing modes of 8051 microcontroller **(K4)**
CO3- The student will gain conceptual understanding of LPC 2148 microcontroller **(K3)**
CO4- The students will gain knowledge about hardware interfacing **(K4)**
CO5- The students will learn the components of embedded 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 LPC 2148 MICROCONTROLLER **(9 Hrs)**

ARM 7 Architecture –LPC2148 microcontroller introduction – Internal memory map – Peripheral details– Implementation of GPIO, Timer/Counter, UART, Interrupt architecture – ADC and DAC. SPI,I2C and USB features of LPC2148.

UNIT IV HARDWARE INTERFACING **(9 Hrs)**

Design of Simple I/O systems using Switches, LEDs, Buzzers – Interfacing Character and Graphical LCD Displays - Interfacing External ADC and DAC - DC Motor Speed Control System –Speed Measurement – Design of Digital Frequency meter - Stepper Motor Interfacing – Relays – Keypads – Signal processing applications – PC based Control systems.

UNIT V INTRODUCTION TO EMBEDDED SYSTEM **(9 Hrs)**

Embedded system - characteristics of embedded system- categories of embedded system- requirements of embedded systems- challenges and design issues of embedded system- trends in embedded system-system integration- hardware and software partition- applications of embedded system - control system and industrial automation-biomedical-data communication system-network information appliances- IVR systems- GPS systems.

Text Books

1. Ramesh S Gaonkar, —Microprocessor Architecture: Programming andApplications with the8085,Penram International Publishing , Prentice Hallof India, New Delhi, 2013.
2. Mohammed Ali Mazidi and Janice GillispieMazidi, "The 8051 Microcontroller and Embedded System" Pearson Education Asia, New Delhi, 2012
3. TrevorMartin,"The Insider's Guide to the PhilipsARM7- Based Microcontrollers", Hitex Pubications(UK),2005
4. Kenneth J. Ayala, Dhananjay V. Gadre, "The 8051 Microcontroller & Embedded Systems Using Assembly and C", Cengage Learning India Publication,2007
5. Raj Kamal, "Embedded Systems Architecture, Programming, and Design". (2/e), Tata McGraw Hill, 2008

Reference Books

1. N.Senthil Kumar, M.Saravanan and S.Jeevananthan, Microprocessor and Microcontrollers, OXFORD UNIVERSITY PRESS, November,2010
2. MykePredko, "Programming and Customizing the 8051 Micro-controller", Tata McGraw-Hill edition, 2007
3. R A Gaonkar, "Fundamentals of Microcontrollers and Applications in Embedded Systems, PenramPublishing India,2007

Web References

1. http://www.ycetnnl.edu.in/downloads/files/n53295805ee2b6.pdf
2. https://www.youtube.com/watch?v=8In1TBcnuNQ

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

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

U19ICP51	NUMERICAL METHODS LAB	L	T	P	C	Hrs
		0	0	2	1	30

Course Objectives

- To learn the techniques of nonlinear equations using c program.
- To know the techniques of solving simultaneous equations.
- To introduce the numerical techniques of differentiation and integration using c programming.
- To study about the numerical solution of the Laplace equation.
- To understand the numerical solution of ordinary differential equations.

Course Outcomes

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

CO1 - Solve polynomial equations using C programming. **(K3)**

CO2 - Find out the root of the algebraic and transcendental equations using C programming. **(K3)**

CO3 -Know the iterative interpolation formula using C programming. **(K3)**

CO4 - Implement Gauss forward and backward interpolation formula using C programming. **(K3)**

CO5 - Apply interpolation formula using C programming. **(K3)**

List of Experiments

1. Determine the roots of non-linear equation using bisection method.
2. Determine the roots of non-linear equation using Newton's method.
3. Solve the system of linear equations using Gauss - elimination method.
4. Solve the system of linear equations using Gauss - Seidal iteration method.
5. Solve the system of linear equations using Gauss - Jordan method.
6. Find the area using Trapezoidal rule.
7. Find the area using Simpson's rules.
8. Find the largest eigen value of a matrix by power - method.
9. Find the numerical solution of wave equation
10. Find the numerical solution of the heat equation.

Web References

1. http://nptel.ac.in/courses/111107063
2. http://nptel.ac.in/courses/122102009

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

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

U19ICP52	INSTRUMENTATION SYSTEM DESIGN LAB	L	T	P	C	Hrs
		0	0	2	1	30

Course Objectives

- To learn the basics of designing and testing electronic instruments like digital voltmeters, function generators and Power supplies.
- To learn the design, testing and calibration of instruments used in process control industries.
- To obtain adequate knowledge in design of various signal conditioning circuits and instrumentation system.
- To impart design knowledge of controller, control valve and transmitter.
- To provide awareness of industry project, planning and scheduling.

Course Outcomes

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

CO1 - Design, test and calibrate the industrial instruments. **(K1)**
CO2 - Understand design of signal conditioning circuits and instrumentation systems.**(K2)**
CO3 - Calibrate different instruments used in industries.**(K3)**
CO4 - Design the multi-channel data acquisition system and transmitter. **(K3)**
CO5 - Design and implement computer based control schemes for different processes. **(K2)**

List of Experiments

1. Design, Testing and calibration of Monolithic function Generator using XR 2206
2. Design, Testing and calibration of Batch counter using TTL ICs.
3. Design, Testing and calibration of Regulator Power supplies.
4. Design, Testing and calibration of Electronic P, PI, PID & ON/OFF controllers.
5. Design, Testing and calibration of DAC and ADC
6. Design, Testing and calibration of Programmable Timers
7. Design, Testing and calibration of Cold Junction compensation of a Thermocouple.
8. Design, Testing and calibration of Digital Thermometer.
9. Design and simulation of digital controller using Dahlin's algorithm
10. Design and simulation of digital controller using Dead beat algorithm.
11. Design and simulation of digital controller using Kalman's algorithm

Reference Books

1. Jacob Fraden, "Handbook of Modern Sensors Physics, design and Applications", springer publication, 4th edition 2010.
2. Ganji Vasu, "Design of Controller for Higher Order Discrete Systems", LAP Lambert Academic Publishing, 26 November 2012.
3. D. Patranabis, "Principles of Industrial Instrumentation", Tata McGraw Hill Publishing Ltd., New Delhi, 1999.
4. A.K. Sawhney, "A course in Electrical and Electronic Measurement and Instrumentation", Dhanpat Rai and Sons, New Delhi, 1999.

Web References

1. https://dl.acm.org/doi/book/10.5555/269184.
2. https://nptel.ac.in/courses/108/105/108105064/

3. https://lecturenotes.in/subject/42/industrial-instrumentation-ii
4. https://www.scribd.com/presentation/260674587/Industrial-Instrumentation-Notes.
5. https://nptel.ac.in/courses/108/105/108105064/.

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

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

U19ICP53	MICROPROCESSOR AND EMBEDDED 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 8051Microcontrollers
- To gain conceptual understanding of LPC 2148microcontroller.
- To become knowledgeable about Digital and Analog I/O of microcontrollers
- To gain knowledge about Sensor Interfacing with microcontrollers.
- To learn about design of communication interfaces with microcontroller.

Course Outcomes

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

CO1 - The students will learn about interfacing of various peripheral devices with 8051 Microcontrollers **(K2)**

CO2 - The student will gain conceptual understanding of LPC 2148 microcontroller. **(K3)**

CO3 - The students will become knowledgeable about Digital and Analog I/O of Microcontroller **(K3)**

CO4 - The students will gain knowledge about Sensor Interfacing with Microcontroller **(K3)**

CO5 -The students will learn about design of communication interfaces with Microcontroller **(K3)**

List of Experiments

1. Interfacing of switches and display devices using 8051Microcontrollers
2. Interfacing of interrupt using 8051 Microcontrollers
3. PC interface using 8051 Microcontrollers 4 ADC interface using 8051Microcontrollers
5. LCD interface using 8051Microcontrollers
6. Real time clock using 7 segment display and8051
7. Implementation of GPIO of ARMLPC2148
8. Interfacing Timer using ARMLPC2148.
9. Implementation of UART featureof ARMLPC2148.
10. Implementation of ADC and DAC of ARMLPC2148.
11. Real time clock implementation using LCD and ARM LPC2148
12. Interfacing Graphical LCD usingLPC2148.

Reference Books

1. Mohammed Ali Mazidi and Janice GillispieMazidi, "The 8051 Microcontroller and Embedded System" Pearson Education Asia, New Delhi, 2012
2. TrevorMartin,"The Insider's Guide to the PhilipsARM7- Based Microcontrollers",HitexPubications(UK),2005

Web References

1. https://www.tutorialspoint.com/embedded_systems/es_overview.htm
2. https://www.watelectronics.com/classification-of-embedded-systems/

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

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

U19ICP54	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. LiupingWang,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

U19ICC5X	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 is40-50 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.

U19ICS51	SKILL DEVELOPMENT COURSE 5 (Foreign Language / IELTS–I)	L	T	P	C	Hrs
		0	0	2	-	30

Student should choose the Foreign Language / IELTS course like Japanese / French / Germany / IELTS, etc. approved by the Department committee comprising of HoD, Programme Academic Coordinator, Class advisor and language Experts. The courses are to be approved by Academic Council on the recommendation of HoD at the beginning of the semester if necessary, subject to ratification in the next Academic council meeting. Students have to complete the courses successfully. The Committee will monitor the progress of the student and recommend the grade (100% Continuous Assessment pattern) based on the completion of course. The marks attained for this course is not considered for CGPA calculation

U19ICS52	SKILL DEVELOPMENT COURSE 6: (Presentation Skills using ICT)	L	T	P	C	Hrs
		0	0	2	-	30

The methodology used is "learning by doing", a hands-on approach, enabling the students to follow their own pace. The teacher, after explaining the project, became a tutor, answering questions and helping students on their learning experience.

CT skills

- Understand ICT work flow in cloud computing.
- Manage multitasking.
- Deal with main issues using technology in class.
- Record, edit and deliver audio and video.
- Automate assessments and results.

Teaching tools

- Different ways to create audio visual activities.
- Handle audio visual editors.
- Collaborative working.
- Individualize learning experience.
- Get instant feedback from students.

Each one of the students will be assigned an ICT Topic and the student has to conduct a detailed study and have to prepare a report, running to 15 or 20 pages for which a demo to be performed followed by a brief question and answer session. The demo will be evaluated by the internal assessment committee for a total of100marks. The marks attained for this course is not considered for CGPA calculation.

U19ICM51	ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE	L	T	P	C	Hrs
		2	0	0	-	30

Course Objectives

The course will introduce the students to

- To get a knowledge in Indian Culture
- To Know Indian Languages and Literature and the fine arts in India
- To explore the Science and Scientists of Medieval and Modern India

Course Outcomes

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

CO1 - Understand philosophy of Indian culture.
CO2 - Distinguish the Indian languages and literature.
CO3 - Learn the philosophy of ancient, medieval and modern India.
CO4 - Acquire the information about the fine arts in India.
CO5 - Know the contribution of scientists of different eras.

UNIT I Introduction to Culture:

Culture, civilization, culture and heritage, general characteristics of culture, importance of culture in human literature, Indian Culture, Ancient India, Medieval India, Modern India

UNIT II Indian Languages, Culture and Literature:

Indian Languages and Literature-I: the role of Sanskrit, significance of scriptures to current society, Indian philosophies, other Sanskrit literature, literature of south India Indian Languages and Literature-II: Northern Indian languages & literature

UNIT III Religion and Philosophy

Religion and Philosophy in ancient India, Religion and Philosophy in Medieval India, Religious Reform Movements in Modern India (selected movements only)

UNIT IV Fine Arts in India (Art, Technology & Engineering)

Indian Painting, Indian handicrafts, Music, divisions of Indian classic music, modern Indian music, Dance and Drama, Indian Architecture (ancient, medieval and modern), Science and Technology in India, development of science in ancient, medieval and modern India

UNIT V Education System in India

Education in ancient, medieval and modern India, aims of education, subjects, languages, Science and Scientists of Ancient India, Science and Scientists of Medieval India, Scientists of Modern India

Reference Books

1. Kapil Kapoor, "Text and Interpretation: The India Tradition", ISBN:81246033375,2005
2. "Science in Samskrit", Samskrita Bharti Publisher,ISBN13:978-8187276333,2007
3. NCERT, "Position paper on Arts, Music, Dance and Theatre", ISBN 81-7450494-X,200
4. S.Narain,"ExaminationsinancientIndia",AryaBookDepot,1993
5. SatyaPrakash,"FoundersofSciencesinAncientIndia",VijayKumarPublisher,1989
6. M. Hiriyanna, "Essentials of Indian Philosophy", Motilal Banarsidass Publishers, ISBN 13: 978-8120810990,2014

U19ICT61	ANALYTICAL INSTRUMENTATION	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To understand the principles of spectrophotometry.
- To impart fundamental knowledge on gas chromatography and liquid chromatography.
- To impart knowledge on the important measurement in many chemical processes and laboratories handling liquids or solutions
- To get knowledge on PH meters and dissolved component analyzers
- To understand the working principle, types and applications of NMR and Mass spectroscopy.

Course Outcomes

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

CO1 - Understand the fundamental principle and application of spectrophotometry. **(K3)**
CO2 - Assess the chromatographic behaviour of solutes in gas and liquid state. **(K2)**
CO3 - Critically evaluate the strengths and limitations of the various pollution monitoring instrumental methods. **(K2)**
CO4 - Develop knowledge on PH meters and dissolved component analyzers. **(K1)**
CO5 - Understand the working principle, types and applications of NMR and Mass spectroscopy. **(K2)**

UNIT I SPECTROPHOTOMETRY (9 Hrs)

Spectral methods of analysis – Beer-Lambert law – UV-Visible spectroscopy – IR Spectrophotometer - FTIR spectrophotometer – Atomic absorption spectrophotometer - Flame emission and atomic emission photometry – Construction, working principle, sources detectors and applications.

UNIT II CHROMATOGRAPHY (9 Hrs)

General principles – classification – chromatographic behaviour of solutes – quantitative determination – Gas chromatography – Liquid chromatography – High Pressure liquid spectrometry, application.

UNIT III INDUSTRIAL GAS ANALYZERS AND POLLUTION MONITORING INSTRUMENTS (9 Hrs)

Gas analyzers – Oxygen, NO2 and H2S types, IR analyzers, thermal conductivity detectors, analysis based on ionization of gases. Air pollution due to carbon monoxide, hydrocarbons, nitrogen oxides, sulphur dioxide estimation - Dust and smoke measurements

UNIT IV PH METERS AND DISSOLVED COMPONENT ANALYZERS (9 Hrs)

Selective ion electrodes - Principle of pH and conductivity measurements – dissolved oxygen analyzer – Sodium analyzer – Silicon analyzer – Water quality Analyzer.

UNIT V NUCLEAR MAGNETIC RESONANCE AND MASS SPECTROMETRY (9 Hrs)

NMR – Basic principles – Continuous and Pulsed Fourier Transform NMR spectrometer – Mass Spectrometry – Sample system – Ionization methods – Mass analyzers – Types of mass spectrometry.

Text Books

1. Willard, H.H., Merritt, L.L., Dean, J.A., Settle, F.A., "Instrumental methods of analysis", CBS publishing & distribution, 7th Edition, 2012.
2. Braun, R.D., "Introduction to Instrumental Analysis", PharmaBookSyndicate,Singapore,2nd

edition,2012

3. Robert E. Sherman., "Analytical Instrumentation", Instruments Society of America, 1996.

Reference Books

1. Khandpur, R.S., "Handbook of Analytical Instruments", Tata McGraw-Hill publishing Co. Ltd., 2nd Edition 2007.
2. Ewing, G.W., "Instrumental Methods of Chemical Analysis", McGraw-Hill, 5th Edition reprint 1985.
3. Liptak, B.G., "Process Measurement and Analysis", CRC Press, 5th Edition, 2015.
4. NPTEL lecture notes on, "Modern Instrumental methods of Analysis" by Dr. J.R. Mudakavi, IISC, Bangalore

Web References

1. https://www.slideshare.net/ErFarukBinPoyen/analytical-instrumentation-introduction.
2. https://www.youtube.com/watch?v=AkXRYGwlbL4
3. https://webstor.srmist.edu.in/web_assets/srm_mainsite/files/files/IC0309%20Analytical%20Instumentation.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	-	-	1	-	-	-	-	1	-	2	1	1
2	3	-	1	1	-	1	-	-	-	-	1	-	2	1	1
3	3	-	1	1	-	1	-	-	-	-	1	-	2	1	1
4	3	-	1	-	-	1	-	-	-	-	1	-	2	1	1
5	3	-	1	1	-	1	-	-	-	-	1	-	2	1	1

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

U19ICT62	INDUSTRIAL INSTRUMENTATION-II	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To introduce variable head type flow meters.
- To introduce quantity meters, air flow meters and mass flow meters.
- To educate on electrical type flow meters.
- To educate on Viscosity, Humidity and Moisture content.
- To educate on smart transmitters.

Course Outcomes

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

CO1 - Understand the working of different variable head type flow meters. **(K1)**
CO2 -Understand the working and calibration of quantity flow meters, variable area flow meters and mass flow meters. **(K1)**
CO3 - Understand the working of electrical type flow meters. **(K1)**
CO4 - Gain knowledge about the measurement of viscosity, humidity and moisture. **(K2)**
CO5 - Acquire knowledge on smart transmitters. **(K3)**

UNIT I VARIABLE HEAD TYPE FLOWMETERS (9 Hrs)

Expression for flow rate through restriction(compressible and incompressible flow) -Orifice plate: different types of orifice plates – Cd variation – pressure tappings – Venturi tube – Flow nozzle – Dall tube – Pitot tube: combined pitot tube, averaging pitot tube – Installation and applications of head flow meters.

UNIT II QUANTITY METERS, AREA FLOW METERS AND MASS FLOW METERS (9 Hrs)

Positive displacement flow meters: Nutating disc, Reciprocating piston and Oval gear flow meters – Inferential meter – Turbine flow meter – Variable Area flow meter: Rotameter –theory, characteristics, installation and applications – Mass flow meter– Angular momentum – Thermal, Coriolis type mass flow meters – Calibration of flow meters: – Dynamic weighing method.

UNIT III ELECTRICAL TYPE FLOW METERS (9 Hrs)

Principle and constructional details of Electromagnetic flow meter – Ultrasonic flow meters – Laser Doppler anemometer – Vortex shedding flow meter – Target flow meter – Guidelines for selection of flow meter – Open channel flow measurement – Solid flow rate measurement.

UNIT IV MEASUREMENT OF VISCOSITY, HUMIDITY AND MOISTURE (9 Hrs)

Viscosity: Saybolt viscometer - Rotameter type and Torque type viscometers – Consistency Meters – Humidity: Dry and wet bulb psychrometers – Resistive and capacitive type hygrometers – Dew cell – Commercial type dew meter. Moisture: Different methods of moisture measurements –Thermal, Conductivity and Capacitive sensors, Microwave, IR and NMR sensors, Application of moisture measurement - Moisture measurement in solids.

UNIT V SMART TRANSMITTERS (9 Hrs)

Pneumatic transmitter: Operation - Electronic transmitter: Study of 2 wire and 4 wire transmitters – Operation of Electronics and Smart transmitters – Principle of operation of flow, level, temperature and pressure transmitters – Installation and Calibration of smart and conventional transmitters.

Text Books

1. Doebelin, 'Measurement Systems – Application and Design', Tata McGraw Hill publishing company, 2012.
2. R.K. Jain, 'Mechanical and Industrial Measurements', Khanna Publishers, New Delhi,2019.
3. D. Patranabis, 'Principles of Industrial Instrumentation', Tata McGraw Hill Publishing Company Ltd, 2013.

Reference Books

1. A.K. Sawhney and P. Sawhney, 'A Course on Mechanical Measurements, Instrumentation and Control', Dhanpath Rai and Co, 2013.
2. S.K. Singh, 'Industrial Instrumentation and Control', Tata McGraw Hill, 2014.
3. D.P. Eckman', Industrial Instrumentation', Wiley Eastern Ltd., 2012.
4. P. Holman, "Experimental Methods for Engineers", International Student Edition, McGraw Hill Book Company, 2013.
5. Andrew W.G, "Applied Instrumentation in Process Industries – A survey", Vol. 1 & Vol.2, Gulf Publishing Company, Houston, 2012.

Web References

1. https://lecturenotes.in/subject/42/industrial-instrumentation-ii
2. https://www.scribd.com/presentation/260674587/Industrial-Instrumentation-Notes.
3. https://nptel.ac.in/courses/108/105/108105064/.
4. https://www.youtube.com/playlist?list=PLUtfVcb-iqn_Dq6RnkCaOaLjPDu3cmxpo.
5. https://nptel.ac.in/courses/108/106/108106074/

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

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

U19ICT63	INTERNET OF THINGS FOR AUTOMATION	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To understand fundamental concepts of IoT.
- To study about software and hardware components of IoT.
- To introduce the Python Scripting Language which is used in many IoT devices
- To understand framework used in IoT applications development
- To study about application of IoT.

Course Outcomes

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

CO1 - Understand the terminology and technology of IoT. **(K2)**
CO2 - Analyse software and hardware components of IoT. **(K2)**
CO3 - Gain knowledge of python scripting language. **(K3)**
CO4 - Gain knowledge on IoT applications development. **(K3)**
CO5 - Implement basic IoT applications on embedded platform. **(K3)**

UNIT I INTRODUCTION TO INTERNET OF THINGS (9 Hrs)

Architectural Overview, Design principles and needed capabilities, IoT Applications, Sensing, Actuation, Basics of Networking, M2M and IoT Technology Fundamentals- Devices and gateways, Data management, Business processes in IoT, Everything as a Service(XaaS), Role of Cloud in IoT, Security aspects in IoT.

UNIT II ELEMENTS OF IoT (9 Hrs)

Hardware Components- Computing (Arduino, Raspberry Pi), Communication, Sensing, Actuation, I/O interfaces. Software Components- Programming API's (using Python/Node.js/Arduino) for Communication Protocols-MQTT, ZigBee, Bluetooth, CoAP, UDP, TCP.

UNIT III INTRODUCTION TO PYTHON (9 Hrs)

Introduction to Python - Language features of Python, Data types, data structures, Control of flow, functions, modules, packaging, file handling, data/time operations, classes, Exception handling. Python packages - JSON, XML, HTTP Lib, URL Lib, SMTP Lib.

UNIT IV IoT APPLICATION DEVELOPMENT (9 Hrs)

Solution framework for IoT applications- Implementation of Device integration, Data acquisition and integration, Device data storage- Unstructured data storage on cloud/local server, Authentication, authorization of devices..

UNIT V IoT APPLICATIONS (9 Hrs)

IoT applications - Home Automation-Agriculture- Healthcare – Surveillance Applications – Smart Grid - Introduction to Industrial IoT (IIoT).

Text Books

1. Internet of Things - A Hands-on Approach, Arshdeep Bahga and Vijay Madisetti, Universities Press, 2015, ISBN: 9788173719547

2. Perry Lea, "Internet of Things for Architects: Architecting IoT solutions by implementing sensors, communication infrastructure, edge computing, analytics, and security", Packt, 2018.
3. Getting Started with Raspberry Pi, Matt Richardson & Shawn Wallace, O'Reilly (SPD), 2014
4. Olivier Hersent, David Boswarthick, Omar Elloumi, "The Internet of Things: Key Applications and Protocols", 2nd Edition.

Reference Books

1. Deitel and Deitel, "Java: How to Program", 9th Edition Printice Hall 2012
2. Vijay Madisetti, Arshdeep Bahga, "Internet of Things: A Hands-On Approach", 2014.
3. David Hanes, "IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things", Cisco press, 2017
4. B.K.Tripathy and J.Anuradha, "Internet of Things – Technologies, Applications, Challenges and Solutions",Taylor& Francis, CRC Press, 2018.
5. Qusay F. Hassan, Attaur Rehman Khan, Sajjad A. Madani, "Internet of Things - Challenges, Advances, and Applications", Taylor& Francis, CRC Press, 2017

Web References

1. https://lecturenotes.in/notes/21082-note-for-internet-of-things-iot-by-srikant-vas
2. https://lecturenotes.in/subject/370/internet-of-things-iot
3. https://nptel.ac.in/courses/106/105/106105166/
4. https://internetofthingsagenda.techtarget.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	2	-	-	-	-	-	-	-	-	-	2	3	2	1
2	2	3	-	-	2	-	-	-	2	2	-	1	2	2	1
3	2	3	-	-	2	-	-	-	2	2	-	-	2	2	1
4	3	3	-	-	-	-	-	-	-	-	-	1	2	2	1
5	3	3	-	-	-	-	-	-	-	-	-	1	2	2	1

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

U19ICT64	PROCESS CONTROL	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives:

- To introduce technical terms and nomenclature associated with Process control domain.
- To familiarize the students with characteristics, selection, sizing of control valves.
- To provide an overview of the features associated with Industrial type PID controller.
- To make the students understand the various PID tuning methods.
- To elaborate different types of control schemes such as cascade control, feed forward control and Model Based control schemes.

Course Outcomes:

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

CO1 - Introduce the dynamics of various processes. **(K1)**
CO2 - Acquire knowledge on the characteristics, Selection and Sizing of final control elements. **(K2)**
CO3 - Learn the effect of various control actions. **(K2)**
CO4 - Understand the evaluation criteria and tuning techniques of controllers. **(K1)**
CO5 - Understand the concept of multi loop control techniques. **(K1)**

UNIT I PROCESS MODELLING AND DYNAMICS (9 Hrs)

Need for process control – Mathematical Modelling of Processes: Level, Flow, Pressure and Thermal processes – Interacting and non-interacting system - Continuous and batch processes – Self regulation – Servo and regulatory operations – Lumped and Distributed parameter models – Heat exchanger – CSTR – Linearization of nonlinear systems.

UNIT II FINAL CONTROL ELEMENTS (9 Hrs)

Actuators: Pneumatic and electric actuators — Control Valves-Characteristic of Control Valves: Inherent and Installed characteristics - Valve Positioner – Modelling of a Pneumatically Actuated Control Valve – Valve body:-Commercial valve bodies-Control Valve Sizing – Cavitation and flashing.

UNIT II CONTROL ACTIONS (9 Hrs)

Characteristic of ON-OFF, Proportional, Single speed floating, Integral and Derivative controllers – P+I, P+D and P+I+D control modes – Practical forms of PID Controller – PID Implementation Issues: Bumpless, Auto/manual Mode transfer, Anti-reset windup Techniques – Direct/reverse action.

UNIT IV PID CONTROLLER TUNING (9 Hrs)

PID Controller Design Specifications: Criteria based on Time Response and Criteria based Frequency Response - PID Controller Tuning: Z-N and Cohen-Coon methods, Continuous cycling method and Damped oscillation method, optimization methods, Auto tuning- Evaluation criteria – IAE, ISE, ITAE and ¼ decay ratio.

UNIT V CONTROL TECHNIQUES AND APPLICATIONS (9 Hrs)

Feed-forward control – Ratio control – Cascade control – Inferential control – Split-range and introduction to multivariable control – Applications from distillation column and boiler systems – IMC– Adaptive control – P&ID diagram.

Text Books

1. Seborg, D.E., Edgar, T.F. and Mellichamp, D.A., "Process Dynamics and Control", Wiley John and Sons, 3rd Edition, 2010.
2. Bequette, B.W., "Process Control Modeling, Design and Simulation", Prentice Hall of India, 2008.
3. Stephanopoulos, G., "Chemical Process Control", Prentice Hall of India, 2003.

Reference Books

1. Coughanowr, D.R., "Process Systems Analysis and Control", McGraw - Hill International Education, 3rd edition ,2013.
2. Curtis D. Johnson, "Process Control Instrumentation Technology", 8th Edition, Pearson, 2013.
3. Considine, D.M., Process Instruments and Controls Handbook, Second Edition, McGraw, 5th edition 2009.
4. Bela. G. Liptak., "Process Control and Optimization", Instrument Engineers' Handbook., volume 2CRC Press and ISA, 2005
5. D. P. Eckman, "Automatic Process control", 7th Edition, John Wiley, New York, 1990.

Web References

1. http://www.pc-education.mcmaster.ca/
2. https://controlguru.com/
3. https://www.youtube.com/watch?v=eYrZcxOPVPE
4. http://www.instrumentationworld.com/instrumentation_tutorial.htm
5. http://www.pc-education.mcmaster.ca/instrumentation/go_inst.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	-	-	1	1	-	1	-	1	1	3	1	2
2	3	1	3	-	-	1	1	-	1	-	1	1	3	1	2
3	3	3	3	-	-	1	1	-	1	-	1	1	3	1	3
4	3	3	3	-	-	1	1	-	1	-	1	1	3	1	3
5	3	3	3	-	-	1	1	-	1	-	1	1	3	1	3

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

U19ICP61	INDUSTRIAL INSTRUMENTATION LAB	L	T	P	C	Hrs
		0	0	2	1	30

Course Objectives

- To impart an adequate knowledge and expertise to handle equipment generally available in an industry.
- To make the students aware about calibration of meters and sensors.
- To make the students aware about calibration of transmitters.
- To make the students conscious about the working and operation of different types of analytical Instruments.
- To identify, formulate, and analyze problems regarding sensors and transmitters.

Course Outcomes

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

CO1 - Experimentally measure the flow of the industrial process. **(K1)**
CO2 - Measure the level parameter of the industrial process. **(K2)**
CO3 - Experimentally measure the temperature of industrial process. **(K1)**
CO4 - Measure and analyze pH value of different solutions. **(K2)**
CO5 - Measure and analyze physiological parameters such as BP, ECG, pulse rate. **(K3)**

List of Experiments

1. Measurement of torque, Viscosity and vacuum.
2. Calibration of pressure gauge using dead weight tester.
3. Measurement of level using d/p transmitter.
4. Measurement of flow using
   a) Discharge coefficient of orifice plate
   b) Calibration of manometer.
5. Calibration of Control valves.
6. Calibration of I to P and P to I converters.
7. Calibration of Pressure Switch, RTD and Thermocouple.
8. Measurement of Absorbance and Transmittance of Test solutions using UV-Spectrometer
9. Standardization and measurement of pH values of different solutions
10. Measurement and analysis of ECG and pulse rate.

Reference Books

1. O. Doebelin, "Measurement Systems – Application and Design", Tata McGraw Hill publishing company, 2012.
2. R.K. Jain, "Mechanical and Industrial Measurements", Khanna Publishers, New Delhi, 2019.
3. D. Patranabis, "Principles of Industrial Instrumentatio"', Tata McGraw Hill Publishing Company Ltd, 2013.

Web References:

1. https://nptel.ac.in/courses/108/105/108105064/
2. https://dl.acm.org/doi/book/10.5555/269184.
3. https://lecturenotes.in/subject/42/industrial-instrumentation-ii
4. https://www.scribd.com/presentation/260674587/Industrial-Instrumentation-Notes.
5. https://nptel.ac.in/courses/108/105/108105064/

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

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

U19ICP62	INTERNET OF THINGS LAB	L	T	P	C	Hrs
		0	0	2	1	30

Course Objectives

- To study various Linux command used in Raspberry Pi
- To learn python programming for implementing simple arithmetic and string operations.
- To study the design of implementing input/ output system of Raspberry Pi
- To study sensor and actuator interface with raspberry Pi.
- To study cloud data storage implementation

Course Outcomes

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

CO1 -Acquire knowledge on linux commands in command terminal **(K2)**
CO2- Illuminate LED light through various programming logic. **(K1)**
CO3- Exposure to the system design aspects of Raspberry Pi. **(K2)**
CO4 - Design applications for customized requirements. **(K1)**
CO5- Understand cloud data storage implementation. **(K2)**

List of Experiments

1. Start Raspberry Pi and try various Linux commands in command terminal window: (ls, cd, touch, mv, rm, man, mkdir, rmdir, tar, gzip, cat, more, less, ps, sudo, cron, chown, chgrp, ping etc)
2. Run some python programs on Pi like:
   - Read your name and print Hello message with name
   - Read two numbers and print their sum, difference, product and division.
   - Word and character count of a given string
   - Area of a given shape (rectangle, triangle and circle) reading shape and appropriate values from standard input
3. Light an LED through Python program
4. Get input from two switches and switch on corresponding LEDs
5. Flash an LED at a given on time and off time cycle, where the two times are taken from a file.
6. Flash an LED based on cron output (acts as an alarm)
7. Switch on a relay at a given time using cron, where the relay's contact terminals are connected to a load.
8. Get the status of a bulb at a remote place (on the LAN) through web
9. Reading Temperature sensor data using Raspberry Pi
10. Cloud data storage implementation using Raspberry Pi

Text Books

1. Deitel and Deitel, "Java: How to Program", 9th Edition Printice Hall 2012
2. Vijay Madisetti, Arshdeep Bahga, "Internet of Things: A Hands-On Approach", 2014.
3. David Hanes, "IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things", Cisco press, 2017

Reference Books

1. B.K. Tripathy and J. Anuradha, " Internet of Things – Technologies, Applications, Challenges and Solutions", Taylor& Francis, CRC Press, 2018.

2. Qusay F. Hassan, Attaur Rehman Khan, Sajjad A. Madani, "Internet of Things - Challenges, Advances, and Applications", Taylor& Francis, CRC Press, 2017

Web References

1. https://lecturenotes.in/notes/21082-note-for-internet-of-things-iot-by-srikant-vas
2. https://lecturenotes.in/subject/370/internet-of-things-iot
3. https://nptel.ac.in/courses/106/105/106105166/
4. https://internetofthingsagenda.techtarget.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	2	-	-	-	-	-	-	-	-	-	2	3	2	1
2	2	3	-	-	2	-	-	-	2	2	-	1	2	2	1
3	2	3	-	-	2	-	-	-	2	2	-	-	2	2	1
4	3	3	-	-	-	-	-	-	-	-	-	1	2	2	1
5	3	3	-	-	-	-	-	-	-	-	-	1	2	2	1

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

U19ICP63	PROCESS CONTROL LAB	L	T	P	C	Hrs
		0	0	2	1	30

Course Objectives

- To understand the process plant and Piping and Instrumentation diagrams.
- To get adequate knowledge about practical issues of various controller modes and methods of tuning of PID controller
- To get adequate knowledge about practical issues of closed loop control of processes.
- To implement tuning in the PID controller for soft processes.
- To impart knowledge on interacting and non-interacting system.

Course Outcomes

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

CO1 - Understand the practical issues of closed loop control of processes. **(K1)**

CO2 - Design process control system components to meet desired needs within realistic constraints. **(K2)**

CO3 - Understand tuning of level, flow, temperature and pressure process. **(K1)**

CO4 - Evaluate the dynamic behaviour of Interacting and Non-interacting System. **(K2)**

CO5 - Acquire knowledge on PID enhancements. **(K1)**

List of Experiments

1. Study of Process Control Training System and Piping and Instrumentation diagram of a plant.
2. Study of Inherent and Installed Characteristics of Control Valves.
3. Tuning and Closed loop control of Level Process.
4. Tuning and Closed loop control of Flow Process.
5. Tuning and Closed loop control of Temperature Process.
6. Tuning and Closed loop control of Pressure Process.
7. Design and implementation of ON/OFF Controller for the Temperature Process.
8. Tuning PID Controller for soft processes. (Mathematically described processes).
9. Tuning and closed loop control of Electronic Processes.
10. Design and implementation of interacting and non-interacting system
11. Simulation study on PID Enhancements

Reference Books

1. N.A. Anderson, Instrumentation for Process Measurement and Control, Chilton Company, 2012.
2. D.M. Considine, Process Instruments and Controls Handbook, McGraw - Hill. reprint 2013.
3. Coughanowr, D.R., "Process Systems Analysis and Control", McGraw - Hill International Education, 3rd edition, 2013.
4. Curtis D. Johnson, "Process Control Instrumentation Technology", 8th Edition, Pearson, 2013.
5. D. P. Eckman, "Automatic Process control", 7th Edition, John Wiley, New York, 1990.

Web References

1. https://nptel.ac.in/courses/103/103/103103037/
2. http://www.nptelvideos.in/2012/11/process-control-and-instrumentation.html
3. https://www.youtube.com/watch?v=J1-tzQtqifU

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

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

U19ICC6X	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, E plan and CISCO, etc. The duration of the course is40-50 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.

U19ICS61	SKILL DEVELOPMENT COURSE 7: (Foreign Language/IELTS–II)	L	T	P	C	Hrs
		0	0	2	-	30

Student should choose the Foreign Language / IELTS course like Japanese / French / Germany / IELTS, etc. approved by the Department committee comprising of HoD, Programme Academic Coordinator, Class advisor and language Experts. The courses are to be approved by Academic Council on the recommendation of HoD at the beginning of the semester if necessary, subject to ratification in the next Academic council meeting. Students have to complete the courses successfully. The Committee will monitor the progress of the student and recommend the grade (100% Continuous Assessment pattern) based on the completion of course. The marks attained for this course is not considered for CGPA calculation

		L	T	P	C	Hrs
U19ICS62	**SKILL DEVELOPMENT COURSE 8:** (Technical Seminar)	0	0	2	-	30

Course Objectives
- To encourage the students to study advanced engineering developments
- To prepare and present technical reports.
- To encourage the students to use various teaching aids such as over head projectors, power point presentation and demonstrative models.

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

CO1 - Review, prepare and present technological developments.

CO2 – Face the placement interviews.

Method of Evaluation:
- During the seminar session each student is expected to prepare and present a topic on engineering/technology, for duration of about 20minutes.
- Ina session of three periods per week, 8 to10 students are expected to present the seminar.
- Each student is expected to present at least twice during the semester and the student is evaluated based on that.
- At the end of the semester, he /she can submit a report on his / her topic of seminar and marks are given based on the report.
- A Faculty guide is to be allotted and he/she will guide and monitor the progress of the student and maintain attendance also.
- Evaluation is 100%internal.Themarks attained for this course is not considered for CGPA calculation.

U19ICS63	SKILL DEVELOPMENT COURSE 9: (NPTEL/MOOC-I)	L	T	P	C	Hrs
		0	0	2	-	30

Student should register online courses like MOOC/SWAYAM/NPTEL etc. approved by the Department committee comprising of HoD, Programme Academic Coordinator, Class advisor and Subject Experts. Students have to complete the relevant online courses successfully. The list of online courses is to be approved by Academic Council on the recommendation of HoD at the beginning of the semester if necessary, subject to ratification in the next Academic council meeting. The Committee will monitor the progress of the student and recommend the grade (100% Continuous Assessment pattern) based on the completion of course / marks secured in online examinations. The marks attained for this course is not considered for CGPA calculation.

U19ICM61	PROFESSIONAL ETHICS	L	T	P	C	Hrs
		2	0	0	-	30

Course Objectives

- To enable the students to create an awareness on Engineering Ethics and Human Values, to instill Moraland Social Values and Loyalty and to appreciate the rights of others.

Course Outcomes

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

Apply ethics in society, discuss the ethical issues related to engineering and realize the responsibilities andrights in the society

UNIT I HUMAN VALUES **(6 Hrs)**

Morals, values and Ethics – Integrity – Work ethic – Service learning – Civic virtue – Respect for others – Livingpeacefully – Caring – Sharing – Honesty – Courage – Valuing time – Cooperation – Commitment – Empathy – Self confidence – Character – Spirituality – Introduction to Yoga and meditation for professional excellence and stress management.

UNIT II ENGINEERING ETHICS **(6 Hrs)**

Senses of „Engineering Ethics" — Variety of moral issues — Types of inquiry — Moral dilemmas — Moral Autonomy – Kohlberg"s theory – Gilligan"s theory – Consensus and Controversy – Models of professional roles
- Theories about right action – Self-interest – Customs and Religion – Uses of Ethical Theories

UNIT III ENGINEERING AS SOCIAL EXPERIMENTATION **(6 Hrs)**

Engineering as Experimentation – Engineers as responsible Experimenters – Codes of Ethics – A BalancedOutlook on Law.

UNIT IV SAFETY, RESPONSIBILITIES AND RIGHTS SAFETY **(6 Hrs)**

and Risk – Assessment of Safety and Risk – Risk Benefit Analysis and Reducing Risk – Respect for Authority
– Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination

UNIT V GLOBAL ISSUES **(6 Hrs)**

Multinational Corporations – Environmental Ethics – Computer Ethics – Weapons Development– Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors – Moral Leadership –Code of Conduct — Corporate Social Responsibility

Reference Books

1. Mike W. Martin and Roland Schinzinger, "Ethics in Engineering", Tata McGraw Hill, New Delhi, 2003.
2. Govindarajan M, Natarajan S, Senthil Kumar V. S, "Engineering Ethics", Prentice Hall of India, New Delhi,2004.
3. Charles B. Fleddermann, "Engineering Ethics", Pearson Prentice Hall, New Jersey, 2004.
4. Charles E. Harris, Michael S. Pritchard and Michael J. Rabins, "Engineering Ethics – Concepts and Cases",Cengage Learning, 2009
5. John R Boatright, "Ethics and the Conduct of Business", Pearson Education, New Delhi, 2003
6. Edmund G Seebauer and Robert L Barry, "Fundametals of Ethics for Scientists and Engineers", OxfordUniversity Press, Oxford, 2001
7. Laura P. Hartman and Joe Desjardins, "Business Ethics: Decision Making for Personal

Web References

1. www.onlineethics.org
2. www.nspe.org
3. www.globalethics.org
4. www.ethics.org

U19ICT71	BIOMEDICAL INSTRUMENTATION	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To understand the concept of basic cell structure and its functions
- To know about the different bio potential electrodes and amplifiers
- To study about the different instruments used for diagnosis
- To familiarize with therapeutic instruments
- To get the basic idea about modern imaging system and telemetry

Course Outcomes

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

CO1 - Recall the structure of cell, physiology of different biological systems and their functions. **(K1)**
CO2 - Illustrate the types of electrodes and measurements of biological parameters. **(K2)**
CO3 - Impart knowledge on the working of diagnostic instruments. **(K2)**
CO4 - Analyse the measurements of therapeutic instruments. **(K2)**
CO5 – Describe the working principle of imaging systems. **(K2)**

UNIT I ELECTRO PHYSIOLOGY (9 Hrs)

Cell Structure and its function- Electrical, Mechanical and Chemical Activities - Action and Resting Potential-Organization of Nervous System - CNS - PNS - Neurons - Axons- Synapse - Propagation of Electrical Impulses along the Nerve-Sodium Pump – Cardiovascular System- Physiology of Heart, Respiratory system - Physiology of Lung, Renal system - Physiology of Kidney.

UNIT II BIO POTENTIAL ELECTRODES AND TRANSDUCERS (9 Hrs)

Design of Medical Instruments - Components of Biomedical Instrument System –Sources of Bio medical signals - Electrodes: Micro Electrodes, Needle Electrodes, Surface Electrodes. Biomedical transducers: Active and Passive Transducers – Bio-signal amplifiers: Instrumentation amplifier, Isolation Amplifier, Preamplifier, Current Amplifier, Chopper Amplifier.

UNIT III INSTRUMENTS USED FOR DIAGNOSIS (9 Hrs)

ECG, Einthoven Triangle, Leads, Vector Cardiograph, Measurement of Cardiac Output, EEG, EMG, Plethysmography, Blood Flow Measurements, Blood Measurements Like pH, PCO2, PO2, Holter Monitor-Respiratory Rate Measurement - Oximeter, Patient Monitoring System, ICCU, Bone Density Measurement.

UNIT IV RECENT TRENDS AND INSTRUMENTS FOR THERAPY (9 Hrs)

Dialysers - Surgical Diathermy - Electro Anaesthetic and Surgical Techniques, Single Channel Telemetry, Multi-channel Telemetry, Implantable Telemetry, Wireless Telemetry, Telemedicine, Telemedicine Applications, Stem Cell Therapy- Sources of Electric Hazards and Safety Techniques.

UNIT V MODERN IMAGING SYSTEMS (9 Hrs)

Ultrasonic Diagnosis, Ultrasonic Scanning, Isotopes in Medical Diagnosis- Pace Makers, Defibrillators, Doppler Monitor(colour), Medical imaging-X-ray generation, DXA, Radiographic and Fluoroscopic Techniques - Image Intensifiers-Computer Aided Tomography, PET, SPECT- Laser Applications-Echocardiography-CT Scan -MRI/ NMR-Endoscopy.

Text Books

1. Khandpur, "Handbook of Biomedical Instrumentation" 2nd Edition, Tata McGraw Hill, 2003.
2. Arumugam M, "Biomedical Instrumentation", Anuradha Publications, Reprint 2009.
3. Khandpur, Raghbir Singh, "Biomedical instrumentation: Technology and applications" 2nd Edition, Mcgraw Hill, 2005.

Reference Books

1. Ananda natarajan, R, "Biomedical Instrumentation and Measurements", 2nd Edition, PHI Learning Pvt. Ltd., 2011.
2. Jog, Nandini K., "Electronics in Medicine and Biomedical Instrumentation", 2nd Edition, PHI Learning Pvt. Ltd., 2013.
3. Singh, Mandeep, "Introduction to biomedical instrumentation", 2nd Edition, PHI Learning Pvt. Ltd., 2014.

Web References

1. https://wne.libguides.com/bme/websites
2. https://researchguides.dartmouth.edu/c.php?g=877404
3. https://www.google.com/search?client=firefox-b-d&q=nptel+bm

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

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

U19ICT72	PROCESS AUTOMATION	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To know about the design of a system using PLC introduced in details.
- To study about PLC Programming
- To study Industrial DCS.
- To have an exposure to HART and Field bus.
- To know about advanced topics in automation.

Course Outcomes

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

CO1 - Understand working of PLC, I/O modules of PLC, automation and applications in industry. **(K1)**
CO2 - Acquire knowledge on the design of systems using PLC and PLC programming. **(K1, K2, K3)**
CO3 -Gain knowledge about the SCADA architecture, communication in SCADA, develop any application based on SCADA along with GUI using SCADA software. **(K1, K2)**
CO4 - Understand the fundamentals of DCS and its importance. **(K1)**
CO5 - Study the fundamentals of advanced Automation. **(K1)**

UNIT I PLC ARCHITECTURE AND INTERFACE MODULES (9 Hrs)

Introduction - Principles of operation – PLC Architecture and specifications – PLC hardware components Analog and digital I/O modules, CPU and memory module – Programming devices -comparative study of industrial PLC's.

UNIT II PLC PROGRAMMING (9 Hrs)

Ladder logic -PLC ladder diagram, Converting simple relay ladder diagram into PLC relay ladder diagram. PLC programming Simple instructions - Latching relays - sequential function instruction set-program counter, data manipulation, chart Arithmetic, shift registers and sequencers – Structured Text Programming.

UNIT III APPLICATION OF PLC AND INTRODUCTION OF SCADA (9 Hrs)

Application of PLC –Simple materials handling application, Automatic control of warehouse door, Motor control, Bottle Label detection and process control application. SCADA:- Hardware and software, Remote terminal units, Master station, Communication architectures and Open SCADA protocols.

UNIT IV DISTRIBUTED CONTROL SYSTEM (9 Hrs)

Evolution – Different architecture – Local control unit functions – Operator Interface – LLOI and HLOI - redundancy concepts – Displays – Communication networks and communications standards in DCS – Engineering Interface – Factors to be considered in selecting a DCS.

UNIT V ADVANCED TOPICS IN AUTOMATION (9 Hrs)

Introduction To networked control systems- Plant wide control - Internet of Things- Cloud based Automation-OLE for process control - Safety PLC - Case studies: PLC - SCADA - DCS.

Text Books

1. Frank. D.Petrezuella, Programmable logic controllers, McGrewhill, Third edition, 2010
2. Lucas. M.P., Distributed control systems,VanNostrand and Reinholdcompany, NY,1986.
3. Hughes. T.Programmable controllers, ISA Press, 2000.

Reference Books

1. McMillan, G. K. , Process Industrial Instrument and controls handbook, McGraw Hill, Newyork, 1999.
2. Berge.J., Field buses for process control: Engineering, operation and maintenance, ISA Press, 2004.
3. Clarke, G., Reynders, D. and Wright, E., "Practical Modern SCADA Protocols: DNP 3,
4. Mikel P. Grover , et. Al. "Industrial Robots – Technology Programming and Applications", McGraw Hill, 1980.
5. Behrouz A. Forouzan, "Data communication and Networking", Tata McGraw-Hill, 2004.

Web References

1. https://nptel.ac.in/courses/108105063/
2. https://www.google.com/amp/s/controlstation.com/what-is-a-distributed-control-system/amp/
3. https://nptel.ac.in/courses/108/105/108105088/
4. https://onlinecourses.nptel.ac.in/noc20_me39/preview
5. https://nptel.ac.in/content/syllabus_pdf/108105088.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	1	-	1	1	2	-	1	-	1	1	2	2	2	2	2
2	2	2	3	2	2	1	-	-	2	3	2	1	3	2	1
3	2	2	2	2	1	2	-	-	2	2	1	1	2	2	1
4	-	-	2	2	2	1	1	-	1	1	2	2	1	1	2
5	1	1	-	-	1	1	-	-	-	1	1	1	1	1	1

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

U19ICP71	BUSINESS BASICS FOR ENTREPRENEUR	L	T	P	C	Hrs
		0	0	2	1	30

Course Objectives

- To develop a clear understanding on Business Plans and their significance.
- To be familiar with various forms of business appropriate for an individual entrepreneur
- To understand various ways of judging a successful opportunity for an entrepreneur
- To know the ways to formulate a successful Operation Plan
- To be aware of things to know to prepare effective financial and marketing plans

Course Outcomes

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

CO1 - Impact comprehensive knowledge of an entrepreneurial ecosystem. **(K6)**
CO2 - Understand the need and significance of Business Plan in the success of an Enterprise **(K2)**
CO3 - Understand the ways to judge the economic and business viability of proposed venture. **(K2)**
CO4 - Utilize the elements of success of entrepreneurial ventures. **(K3)**
CO5 - Evaluate the effectiveness of different entrepreneurial strategies **(K5)**

UNIT I: THE ENTREPRENEURIAL PERSPECTIVE (6 Hrs)

Entrepreneurship and Family Business Management, Entrepreneurship theory and practice, The Nature and Importance of Entrepreneurs, The Entrepreneurial and Intrapreneurial Mind, The Individual Entrepreneur, International Entrepreneurship Opportunities

UNIT II: CREATING AND STARTING THE VENTURE (6 Hrs)

Creativity and the Business Idea, Legal Issues for the Entrepreneur, the Business Plan, the Marketing Plan, the Financial Plan, the Organizational Plan

UNIT III: FINANCING THE VENTURE (6 Hrs)

Raising Finance, scaling up the venture, NDA'S and term sheet, Sources of the Capital, Informal Risk Capital and Venture Capital

Report Submission:

- Grooming Entrepreneurial Mind-set
- Interaction with Business Leaders/Bankers/Venture Capitalists
- Finding and evaluating an idea
- Develop a business plan
- Financing for a company start-up
- Setting up a company-legal entity
- Entrepreneurial development and employment creation
- Effects of creativity and innovation on the entrepreneurial performance of family business

Text Books

1. Friend, G., and Zehle, S. (2004). *Guide to business planning*. Profile Books Limited.
2. Lasher, W. (2010). *The Perfect Business Plan Made Simple: The best guide to writing a plan that will secure financial backing for your business*. Broadway Books.
3. Arjun Kakkar. (2009). *Small Business Management: Concepts and Techniques for improving Decisions*. Global India Publications.

Reference Books

1. Alexander Osterwalder and Yves Pigneur – Business Model Generation.
2. Arthur R. DeThomas – Writing a Convincing Business Plan.
3. Ben Horowitz – The Hard Thing About Hard Things.
4. Guy Kawasaki – The Art of Start 2.0
5. Hal Shelton – The Secrets to Writing a Successful Business Plan.

Web References

1. https://www.waveapps.com/blog/entrepreneurship/importance-of-a-business-plan
2. https://www.entrepreneur.com/article/200516
3. https://smallbusinessbc.ca/article/how-to-use-viability-to-test-if-you-should-invest-in-your-business/
4. https://www.infoentrepreneurs.org/en/guides/strategic-planning/
5. http://www.marketingmo.com/strategic-planning/marketing-plans-budgets/
6. https://www.mbda.gov/page/loan-documentation

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

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

U19ICP72	PROCESS AUTOMATION LAB	L	T	P	C	Hrs
		0	0	2	1	30

Course Objectives

- To understand practical issues of applications of PLC hardware.
- To get adequate knowledge about practical issues of implementations of PLC and DCS.
- To impart practical skills in Programming of PLC.
- To impart practical skills in Sensor data acquisition, data processing and visualization.
- To impart practical skills in Interfacing the various field devices with PLC.

Course Outcomes

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

CO1 - Understand the fundamentals and Programming of PLC. **(K1)**
CO2 - Work with industrial automation systems. **(K1)**
CO3 - Design and implement control schemes in PLC. **(K1,K2, K3)**
CO4 - Interface field devices with PLC. **(K1, K2, K3)**
CO5 - Design and implement computer based control schemes for different processes. **(K1, K3)**

List of Experiments

1. Study of PLC field device interface modules (AI,AO,DI,DO modules)
2. Programming Logic Gates Function in PLC
3. Implementing Mathematical Operations, Timer, Counter operation using PLC
4. Programming Jump-to-subroutine and return operations in PLC
5. PLC Exercises: 1. Traffic Light Control and Filling/Draining Control Operation
6. PLC Exercises: 1. Reversal of DC Motor Direction 2. ON/OFF Controller for Thermal Process
7. Annunciator design using PLC
8. PLC based control of batch Process.
9. Study of Foundation Field bus /IOT/Wireless HART Enabled Transmitter.
10. Case study SCADA

Reference Books

1. Frank. D.Petruzella , Programmable logic controllers, McGraw hill, Third edition.
2. Lucas. M.P., Distributed control systems, Van Nostrand and Reinhold company, NY,1986.
3. Hughes. T. Programmable controllers, ISA Press, 2000
4. M. Chidambaram, Computer control of process, Narosa publishing house.

Web References

1. https://nptel.ac.in/courses/108/105/108105063/.
2. https://nptel.ac.in/courses/112/102/112102011/.
3. https://www.youtube.com/playlist?list=PL874F91C0180417C3

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

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

U19ICP73	VIRTUAL INSTRUMENTATION LAB	L	T	P	C	Hrs
		0	0	2	1	30

Course Objectives

- To provide knowledge on design of process control by using virtual instrumentation techniques
- To provide knowledge in process analysis by VI tools.
- To give basic knowledge in describing function analysis
- Get adequate knowledge VI tool sets
- Get adequate knowledge VI Data Acquisition.

Course Outcomes

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

CO1 - Get adequate knowledge on VI tool sets **(K1)**
CO2 - Describe the data acquisition. **(K1, K2)**
CO3 - Attain knowledge on VI programming techniques. **(K1, K2, K3)**
CO4 - Understand VI programming techniques. **(K1, K2)**
CO5 - Get an adequate knowledge on application of virtual instrumentation **(K1, K2)**

List of Experiments

1. Creating Virtual Instrumentation for simple applications.
2. Programming exercises for loops and charts
3. Programming exercises for clusters and graphs.
4. Programming exercises on case and sequence structures, file Input / Output.
5. Data acquisition through Virtual Instrumentation.
6. Developing voltmeter using DAQ cards.
7. Developing signal generator using DAQ cards.
8. Simulating reactor control using Virtual Instrumentation.
9. Real time temperature control using Virtual Instrumentation.
10. Real time sequential control of any batch process.

Reference Books

1. Sanjay Gupta, "Virtual Instrumentation using LABVIEW" Prentice Hall India Learning Private Limited 2010
2. Jeffrey Y Beyon," Hands-On Exercise Manual for LabVIEW Programming, Data Acquisition and Analysis", Prentice Hall 2000.
3. Saanjay Gupta and Joseph John,"Virtual Instrumentation using LAbVIEW",Tata Mc Graw Hill 2006.
4. S.Sumathi,P.Surekha,"LabVIEW Based Advanced Instrumentation Systems",Springer,2007.
5. JovithaJerome,"Virtual Instrumentation using LAbVIEW",Prentice Hall India Learning Private Limited 2010

Web Resources

1. https://www.ni.com
2. https://www.sciencedirect.com/topics/engineering/virtual-instrument
3.http://jjackson.eng.ua.edu/courses/ece380/assignments/373363c.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	1	2	3	-	-	-	2	2	3	2	1	2
2	2	2	3	2	3	3	-	-	-	2	2	3	3	1	2
3	2	2	3	2	3	2	-	-	-	3	2	3	3	1	2
4	2	3	2	2	2	2	-	-	-	3	2	3	2	1	3
5	3	2	3	3	2	2	-	-	-	2	2	2	2	1	3

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

U19ICP74	COMPREHENSIVE VIVA VOCE	L	T	P	C	Hrs
		0	0	2	1	30

Course Objectives

- To assess the overall knowledge of the student in the relevant field of Engineering acquired over 4 years of study in the undergraduate program.

Course Outcomes

CO 1 - The students will be able to attend the various Competitive examinations such as GATE, IES Examination etc. **(K3)**

KNOWLEDGE LEVEL: **K1** – Remember, **K2** – Understand, **K3** – Apply, **K4** – Analyze and **K5** – Evaluate

Description

- The student will be tested for his understanding of basic principles of the core Instrumentation and Control Engineering subjects. The internal assessment for a total of 50 marks will be made by an internal assessment committee. The committee will conduct two written examinations of objective type from all the core subjects. The external university examination, which carries a total of 50 marks, will be a Viva Voce examination conducted by a committee of one external examiner and one internal examiner appointed by the University.

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	3	3	3	3	3	3	3	3	3	2	3	2	3	3

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

U19ICW71	PROJECT PHASE-I	L	T	P	C	Hrs
		0	0	4	2	60

Course Objectives

This course should enable the students to

- Encouraged to get hands on experience to work in various area of Instrumentation and control engineering.

Course Outcomes

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

CO1 - Perceive the problems and to find suitable solutions. **(K5)**

KNOWLEDGE LEVEL: K1 – Remember, **K2** – Understand, **K3** – Apply, **K4** – Analyze and **K5** – Evaluate

Description

The students to work in groups of not more than four members in each group on a project involving analytical, experimental, design or combination of these in the area of Instrumentation and Control Engineering. Each project shall have an internal guide. The student is required to do literature survey, formulate the problem and form a methodology in arriving at the solution of the problem. The evaluation is based on internal review committee and guide for 50 marks. The End Semester Examination for the project work shall consist of an evaluation of the project report by an external examiner, followed by a viva-voce examination conducted by a committee consisting of the external examiner (25 marks) and an internal examiner (25 marks).

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	3	2	2	2	2	1	3	2	1	2	3	2	2

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

U19ICW72	INTERNSHIP / IN-PLANT TRAINING	L	T	P	C
		0	0	0	2

Course Objectives

This course should enable the students to

- Expose to the industrial environment
- Understand and sharpen the real time technical / managerial skills required in the instrumentation and control engineering job.
- Expose on the current technological developments relevant to instrumentation and control engineering domain.
- Communicate effectively on complex engineering activities
- Create conditions conducive to quest for knowledge and its applicability on the job.

Course Outcomes

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

CO1 - Be a source of highly motivated pre-professionals. **(K3)**
CO2 - Bring new perspectives to problem solving. **(K4)**
CO3 - Implement/Develop Technology solutions which will improve quality of life **(K4)**
CO4 - Develop an ability to communicate effectively (oral and written communication, report writing, presentation skills) **(K4)**
CO5 - Identify and to address their own educational needs in a changing world. **(K4)**

KNOWLEDGE LEVEL: K1 – Remember, **K2** – Understand, **K3** – Apply, **K4** – Analyze and **K5** – Evaluate

DESCRIPTION

Students may undergo training or internship during summer / winter vacation at Industry/ Research organization / University (after due approval from the Mentor, Class advisor and Departmental Consultative Committee (DCC). In such cases, the internship/training should be undergone continuously (without break) in one organization. Normally no extension of time is allowed. However, DCC may provide relaxation based on the exceptional case. The students are allowed to undergo three to four weeks internship in established industry / Esteemed institution during vacation period.

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	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO5	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3

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

U19ICT81	INSTRUMENTATION IN PROCESS INDUSTRIES	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To introduce the complete operation of various industries.
- To understand the measurement of different process parameters for specified industries.
- To impart knowledge on placing the sensors/Transducers in instruments.
- To explore the special measuring devices and sensors for industrial purposes.
- To provide an exposure to the process and instrumentation and control applications in various industries like paper, petrochemical, iron and steel, cement, pharmaceutical, nuclear and power plant industries.

Course Outcomes

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

CO1 - List the basic operation of various industries. **(K1)**
CO2 - Summarize the process parameters with appropriate sensors/transducers. **(K1)**
CO3 - understand the measurement of different process parameters for specified industries. **(K1,K2)**
CO4 - Analyse the working of different Instruments used in specified industries. **(K1, K2)**
CO5 - Compare diverse measurement techniques/control of process parameters. **(K1)**

UNIT I OVERVIEW OF INDUSTRIAL PROCESSES **(9 Hrs)**

Description of process in Paper Industries Description of process in petrochemical industries: Description of process in iron and steel and cement industries - Description of process in pharmaceutical and nuclear industries.

UNIT II INSTRUMENTATION IN PAPER INDUSTRIES **(9 Hrs)**

Measurement of Basic weight, thickness, density, Porosity, smoothness, softness, hardness and compressibility; selection of suitable measurement hardware for flow, pressure, level, temperature, density, solids, consistency - moisture analyzers oxidation - reduction potential and pH.

UNIT III INSTRUMENTATION IN PETROCHEMICAL INDUSTRIES **(9 Hrs)**

P and I diagram of petroleum refinery - measurement and control of absolute pressure, density, conductivity, differential pressure and flow of evaporators. Measurement and control of column pressure, liquid distillate, vapour distillate.

UNIT IV INSTRUMENTATION IN IRON AND STEEL AND CEMENT INDUSTRIES **(9 Hrs)**

Iron and steel: Selection of suitable measurement hardware for temperature, pressure, level, flow, weighing and proportioning - special gauges for measurement of thickness and shape.

Cement Industry: Quarrying and Preparation, Raw Material Blending, Clinker Kilning, Cement Grinding, Instrumentation and control in Raw Material Blending, Cement Kilning, Cement Grinding

UNIT V INSTRUMENTATION IN PHARMACEUTICAL, NUCLEAR AND POWER PLANT INDUSTRIES (9 Hrs)

Pharmaceutical Industries: Flow measurement - pressure measurement - smoke detector.

Nuclear Industries: Radiation detection instruments - Area monitors and in-place detectors - Temperature measuring devices - level sensors.

Power Plant Industries: Metal temperature measurements - flow of feed water - fuel, air, steam with correction factor for temperature and pressure.

Text Books

1. Liptak B G, "Instrumentation in the processing industries", Chilton book Company, 1973.
2. Considine D. M., "Process/Industrial Instruments and Control Handbook", McGraw Hill, 5th edition 1999.
3. Hower P. Kallen, "HandBook of Instrumentation and Control", Tata McGraw Hill, 1961.

Reference Books

1. Liptak B G, "Instrument Engineer's Handbook, Vol. 2: Process Control and Optimization", CRC Press, 2006.
2. BhaskaraRao, "Petrochemicals", Khanna Publishers, New Delhi, 1987.
3. Liptak B.G, "Process Measurement and Analysis", Third Edition, Chilton Book Co., 2003.

Web References

1. https://www.branom.com/instruments-type.html
2. https://www.controlengeuropé.com/features/132/Process-instrumentation/
3. https://new.siemens.com/global/en/products/automation/process-instrumentation.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	2	2	-	3	2	-	3	-	2	-	3	3	2	3
2	3	2	3	-	3	2	-	3	-	2	-	3	2	2	3
3	3	2	2	-	3	2	-	3	-	3	-	3	3	2	3
4	3	2	2	-	3	2	-	3	-	3	-	3	2	2	3
5	3	2	3	-	3	2	-	3	-	2	-	3	1	2	3

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

U19ICP81	ENTREPRENEURSHIP MANAGEMENT	L	T	P	C	Hrs
		0	0	2	1	30

Course Objectives

- To develop an ability to identify the critical challenges hindering growth of entrepreneurs
- To understand the significance of Finance Skills, Branding, and Sales Skills for an Entrepreneur
- To be aware of various Government Schemes and Subsidies available for Entrepreneurs

Course Outcomes

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

CO1- Develop and demonstrate the business models. **(K2)**
CO2- Practice cash management, brand building and enhancing turnover**(K6)**
CO3- Understand various schemes and subsidies that are offered by various Government agencies**(K2)**
CO4- Effectively tackle growth challenges of their venture**(K5)**
CO5- Manage and grow their business in terms of expansion and look for partnerships**(K3)**

UNIT I: ENTRPRENEURIAL SKILLS 1 (6 Hrs)

Introduction to Business Model Generation , Developing Lean Business Model for the Business Idea, Developing Prototype and Evaluating assumptions in Business Model using prototype cheaply, Presentation of Business Model, Business Fair

UNIT II: ENTREPRENEURIAL SKILLS 2 (6 Hrs)

Financial Skills – Cash Management – Problems of Poor Cash Management – Learning to be Frugal.Branding – Building a 'niche' follower for your product/service – Developing and Establishing a Brand, Sales skills – KPI of Success of Entrepreneurship – Ensuring Growth in Turnover

UNIT III: ENTREPRENEURIAL OPPORTUNITIES (6 Hrs)

Awareness of Government Schemes and Subsidies for various Entrepreneurial Categories – Special Schemes for Women Entrepreneurs – Understanding the Procedure and Documentation Process for availing the Government Schemes – Venture Capital – Crowdfunding – Angel Investors.

Report Submission:

1. How can I get first 100 customers to pay for my products/services?
2. Information technology as a resource
3. Marketing skill and promotion for entrepreneurs
4. Assessment of factors affecting performance of women entrepreneurs
5. Entrepreneurship as a tool for sustainable employment
6. Examination of problem facing small scale business
7. Survival strategies in small business
8. The role of insurance in minimizing business risk

Text Books

1. Storey, D. J., and Greene, F. J. (2010). *Small business and entrepreneurship*. Financial Times/Prentice Hall.
2. Scarborough, N. M. (2011). *Essentials of entrepreneurship and small business management*. Prentice Hall.
3. Gupta C.B., and Srinivasan N.P. (2020). *Entrepreneurial Development*. Sultan Chand and Sons

Reference Books

1. Brian Tracy – The Psychology of Selling.
2. Dale Carnegie – How to Win Friends and Influence People.
3. Robert Kiyosaki and Sharon Lechter – Rich Dad, Poor Dad.
4. Reid Hoffman – The Startup of You: Adapt to the Future, Invest in Yourself, and Transform Your Career.
5. Michael E. Gerber – The E-Myth Revisited.
6. Chris Guillebeau – The Art of Non-Conformity.
7. Eric Ries – The Lean Startup.
8. Kevin D. Johnson – The Entrepreneur Mind.

Web References

1. https://www.helpguide.org/articles/stress/stress-management.htm
2. https://bscdesigner.com/8-entrepreneurial-kpis.htm
3. https://www.inc.com/ilya-pozin/5-problems-most-entrepreneurs-face.html
4. https://www.inc.com/jessica-stillman/how-to-network-with-super-successful-people.html
5. https://www.entrepreneur.com/article/251603
6. https://seraf-investor.com/compass/article/understanding-crowdfunding

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

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

U19ICW81	PROJECT PHASE- II	L	T	P	C
		0	0	16	8

Course Objectives

This course should enable the students to

- Expose students to design problem related to various disciplines of instrumentation and control engineering.

Course Outcomes

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

CO1 - Take up any challenging practical problems and find solution by formulating proper methodology. **(K5)**

KNOWLEDGE LEVEL: K1 – Remember, **K2** – Understand, **K3** – Apply, **K4** – Analyze and **K5** – Evaluate

DESCRIPTION

The students will be encouraged to handle the problems independently in Project work phase II with the extension of the project work Phase-I started in the seventh semester. On completion of the work, a project report should be prepared and submitted to the department. The project work and the report will be evaluated by an internal review committee for 40 marks. The End Semester Examination for the project work shall consist of an evaluation of the final project report by an external examiner, followed by a viva-voce examination conducted by a committee consisting of the external examiner (25 marks), an internal examiner (25 marks). Based on the Publication of paper / Prototypes / Patents 10 marks will be awarded.

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	3	2	2	2	2	1	3	2	1	2	3	2	2

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

U19ICS81	SKILL DEVELOPMENT COURSE 10: (NPTEL/MOOC-II)	L	T	P	C
		0	0	0	-

Student should register online courses like MOOC/SWAYAM/NPTEL etc. approved by the department committee comprising of HoD, Programme Academic Coordinator, Class Advisor and Subject Experts. Students have to complete the relevant online courses successfully. The list of online courses is to be approved by Academic Council on the recommendation of HoD at the beginning of the semester if necessary, subject to ratification in the next Academic council meeting. The committee will monitor the progress of the student and recommend the grade (100% Continuous Assessment pattern) based on the completion of course / marks secured in online examinations. The marks attained for this course is not considered for CGPA calculation.

Professional Electives
R-2019

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 AI, Electric DrivesII, 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 Barriersl, InTech Publishers, Croatia, 2011.
2. AuliceScibioh M. and Viswanathan B., —Fuel Cells – Principles and Applicationsl, 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 publications,2013

Web References
1. https://nptel.ac.in/courses/117101055/
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, 4th Edition, 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.

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

U19ICE51	TELEMETRY AND TELECONTROL	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To enable the students to study the fundamentals of Telemetry & Tele control systems.
- To impart knowledge on landline Telemetry systems.
- To impart knowledge on various multiplexing techniques.
- To Impart knowledge on satellite telemetry and optical fibres.
- To Impart knowledge on various Telemetry Control techniques.

Course Outcomes

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

CO1 - Understand about the telemetry principles and methods. **(K1)**
CO2 - Understand about the landline telemetry systems. **(K2)**
CO3 - Study about different multiplexing techniques. **(K2)**
CO4 - Analyze the satellite and optical telemetry systems. **(K1)**
CO5 - Acknowledge the various Telecontrol Methods. **(K2)**

UNIT I TELEMETRY PRINCIPLES (9 Hrs)

Introduction, Functional blocks of Telemetry system, Methods of Telemetry – Non Electrical, Electrical, Pneumatic, Frequency, and Power Line Carrier Communication.

UNIT II LAND LINE TELEMETRY (9 Hrs)

Electrical Telemetry-Current Systems – Voltage Systems – Synchro Systems – Frequency systems – Position and Pulse systems – Example of a landline telemetry system.

UNIT III FREQUENCY DIVISION AND TIME DIVISION MULTIPLEXING (9 Hrs)

FDM, IRIG Standard, FM and PM Circuits, Receiving end, PLL. TDM- PAM systems, PAM /PM and TDM–PCM Systems. PCM reception. Differential PCM. Modems-Introduction, QAM, Modem Protocols.

UNIT IV SATELLITE AND OPTICAL TELEMETRY (9 Hrs)

General considerations, TT&C Service, Digital Transmission systems, TT&C Subsystems, satellite Telemetry and Communications. Optical fibers Cable – dispersion, losses, connectors and splicers, Sources and detectors, Transmitter and Receiving Circuits, Coherent Optical Fiber Communication System, WDM.

UNIT V TELECONTROL METHODS (9 Hrs)

Analog and Digital techniques in Telecontrol, Telecontrol apparatus – Remote adjustment, Guidance and regulation – Telecontrol using information theory – Example of a Telecontrol System.

Text Books

1. D. Patranabis, Telemetry Principles, Tata McGraw2013
2. Swoboda G., Telecontrol Methods and Applications of Telemetry and Remote Control, Reinhold Publishing Corp. 2007.
3. Modern Digital and Analog Communication Systems - B. P. Lathi, Oxford University Press

Reference Books

1. Gruenberg L., Handbook of Telemetry and Remote Control, McGraw Hill, New York, 2016
2. Young R.E., Telemetry Engineering, Little Books Ltd., London, 2012.
3. HousleyT., Data Communication and Teleprocessing System, PH Intl., Englewood Cliffs, New Jersey,

2012.
4. Principles of Electronics Communication Systems - Louise Frenzel TMH2008 3rd edition
5. Frank Carden, Russell P.Jedicka, Robert Henry, "Telemetry System Engineering", Artech house, 2002.

Web References

1. https://new.siemens.com/global/en/products/automation/industrial-communication/industrial-remote-communication/telecontrol.html
2. https://www.youtube.com/watch?v=9ZDP-NffdXQ.
3. https://ocw.mit.edu/courses/aeronautics-and-astronautics/16-851-satellite-engineering-fall-2003/lecture-notes/l20_satellitettc.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	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

U19ICE52	ADVANCED CONTROL SYSTEM	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To provide knowledge on design in state space analysis.
- To provide knowledge on design in state variable form
- To provide knowledge in phase plane analysis.
- To give basic knowledge in describing function analysis.
- To provide knowledge in stability concept.

Course Outcomes

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

CO1 - Apply advanced control theory to practical engineering problems. **(K1)**
CO2 - Design in state space analysis. **(K2)**
CO3 - Study the stability of linear and nonlinear systems by Lyapunov method. **(K1)**
CO4 - Design of digital controller. **(K2)**
CO5 - Study of discrete system design stability concept. **(K1)**

UNIT I STATE SPACE MODEL **(9 Hrs)**

Introduction to State Space, State Variables, Physical Variables, Phase Variables-Matrices, Eigen Values and Eigen vectors - Diagonalization, Canonical and Jordan forms - State Space Models from Differential Equations - Conversion of State Variable Models to Transfer Function.

UNIT II MATHEMATICAL ANALYSIS **(9 Hrs)**

Computation of State Transition Matrix - Laplace Transformation Method, Canonical Transformation - Cayley Hamilton Theorem- Solution of State Equation. Concepts of Controllability and Observability.

UNIT III PHASE PLANE ANALYSIS **(9 Hrs)**

Features of linear and non-linear systems - Common physical non-linearity – Methods of linearization Concept of phase portraits – Singular points – Limit cycles – Construction of phase portraits – Phase plane analysis of linear and non-linear systems – Isocline method.

UNIT IV DESCRIBING FUNCTION ANALYSIS **(9 Hrs)**

General Properties of Non-Linear Systems - Describing Function Method - On / Off, Dead Zone, Saturation and Hysteresis Non Linearity - Determination of Limit Cycle by Describing Function. Stability of oscillations.

UNIT V STABILITY ANALYSIS **(9 Hrs)**

Stability concepts - Equilibrium points - BIBO and asymptotic stability, Lyapunov Theory, Definitions (Stability and Functions). Direct method of Lyapunov, Application to non-linear problems.Stability analysis by describing function method –jump resonance. Frequency domain stability criteria

Text Books

1. Benjamin C. Kuo, 'Digital Control Systems', Oxford University Press, Tenth Edition 2018.
2. George J. Thaler, 'Automatic Control Systems', Jaico Publishers, 2013.
3. Jain R.K., "Mechanical and Industrial Measurements", Khanna Publishers, 11th edition, Reprint 2005.

Reference Books

1. Nagrath I J and Gopal M, Control System Engineering, New Age International Pvt Ltd, Sixth Edition, 2017. Murthy D.V.S., "Transducers and Instrumentation", Prentice Hall of India, 13th printing, 2006.
2. Benjamin C Kuo, —Automatic Control Systemsǁ, Prentice Hall India Pvt. Ltd, Ninth Edition, 2015.
3. Smarajith Ghosh, —Control Systems Theory and Applicationsǁ, Pearson Education, Singapore, Sixth Edition, 2015.

Web References

1. https://lecturenotes.in/subject/111/advanced-control-systems-acs
2. https://nptel.ac.in/courses/108103007/
3. https://freevideolectures.com/course/3488/advanced-control-systems

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

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

U19ICE53	INDUSTRIAL ELECTRONICS	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To provide knowledge on regulated power supplies.
- To educate on higher power rating devices.
- To learn operation of DC motor control using SCR.
- To introduce industrial timers for sequential tasks.
- To understand the principle and working operation of industrial heating applications.

Course Outcomes

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

CO1 - Understand the principle and operation of regulated supplies and types of SCR. **(K1)**
CO2 - Elucidate the applications of SCR in various circuitry operation. **(K2)**
CO3 - Examine the Role of SCR in DC motor control circuit. **(K1)**
CO4- Acquaintance the knowledge on industrial timers. **(K2)**
CO5 - Understand the concept of industrial Heating applications. **(K1)**

UNIT I REGULATED SUPPLIES AND SCRS **(9 Hrs)**

Switched Mode voltage regulator, Comparison of Linear and Switched Mode Voltage Regulators, Servo Voltage Stabilizer, monolithic voltage regulators Fixed and Adjustable IC Voltage regulators, 3- terminal Voltage regulators, Current boosting .Principles of operation and characteristics of SCR, Triggering of Thyristors, Commutation Techniques of Thyristors, Ratings of SCR.

UNIT II APPLICATIONS OF SCRS-I **(9 Hrs)**

Static circuit breaker, Protection of SCR, Inverters, Classification, Single Phase inverters, Converters, single phase Half wave and Full wave. Chopper circuits, Principle, methods and Configurations, Diac and Triac, Triacs, Triggering modes, Firing Circuits, Commutation.

UNIT III APPLICATIONS OF SCRS-II **(9 Hrs)**

Voltage compensator – solid state DC voltage regulation – DC shunt motor – armature control and field control of motor speed – electronic control of DC motor – speed regulator action – full wave motor speed regulation by one SCR.

UNIT IV INDUSTRIAL TIMERS **(9 Hrs)**

Industrial timers -Classification, types, Electronic Timers, Classification, RC and Digital timers, Time base Generators. Electric Welding, Classification, types and methods of Resistance and ARC wielding

.

UNIT V INDUSTRIAL HEATING APPLICATIONS **(9 Hrs)**

High Frequency heating, principle, merits, applications, High frequency Source for Induction heating. Dielectric Heating, principle, material properties, Electrodes and their Coupling to RF generator, Thermal losses and Applications. Ultrasonics, Generation and Applications.

Text Books

1. Industrial and Power Electronics, G.K. Mithal and Maneesha Gupta, Khanna Publishers, 19th Ed., 2003
2. Integrated Electronics, J. Millman and C.C Halkias,McGraw Hill, 2017.

Reference Books

1. Industrial electronics and control, S.K. Bhattacharya and S.chatterjee, Tata Me Graw Hill, 2017.
2. Thyristors and applications – M. Rammurthy, East-West Press, 1977.
3. Frank D. Petruzella, Industrial Electronics, McGraw Hill International Editions, 1996.

Web References

1. https://nptel.ac.in/courses/108/105/108105066/
2. https://swayam.gov.in/nd1_noc19_ee37/

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

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

		L	T	P	C	Hrs
U19ICE54	**INDUSTRIAL UNIT OPERATIONS**	3	0	0	3	45

Course Objectives

- To impart knowledge on pertaining to overview of unit operations.
- To give an idea about unit operations in transport of solids, liquids & gases
- To understand the various unit operations involved in chemical reactors, steam boilers, furnaces.
- To Gain knowledge about the operations of evaporators, crystallizers and dryers.
- To Gain knowledge on the operation of Pumps, compressors, and centrifuges.

Course Outcomes

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

CO1 - Define unit operations, unit process and types of reactions involved in different industries. **(K2)**
CO2 - Understand the unit operations in transportation of solids, liquids and gases. **(K2)**
CO3 - Develop knowledge on the unit operations in different processes of distillation. **(K2)**
CO4 - Outline the working principle and operation of different processes of Dryers, Crystallizers and Evaporators. **(K2)**
CO5 - Analyze the unit operation in pumps compressors with case studies. **(K3)**

UNIT I OVERVIEW OF UNIT OPERATIONS (9 Hrs)

Introduction to industrial processes - Concepts of unit operations and unit processes - Material balance and energy balance -Types of reactions - General idea of controlling operations.

UNIT II TRANSPORT OF SOLIDS, LIQUIDS AND GASES (9 Hrs)

Study of Unit operation in Transport of Solids, liquids and gases - Different crushers and grinders - Adjusting of particle size, Mixing- Separation- Leaching and extraction.

UNIT III DISTILLATION, CHEMICAL REACTORS, STEAM BOILERS, FURNACES (9 Hrs)

Study of Unit operation in Distillation: Flash distillation - Batch distillation- Continuous distillation- Operational features- construction and working principle of Chemical reactors- Steam boilers- Furnaces

UNIT IV DRYERS, CRYSTALLIZERS, EVAPORATORS (9 Hrs)

Study of Unit operation in Dryers, Crystallization, Evaporators, Heat exchangers, Humidification, De-humidification - Different types - operational features, construction and working principle.

UNIT V PUMPS, COMPRESSORS, EXTRUDERS, BLOWERS, CENTRIFUGES (9 Hrs)

Study of Unit operation in Pumps, Compressors, Extruders, Blowers, Centrifuges - operational features, construction and working principle. **Case studies:** Unit Operations and Control schemes applied to Thermal Power plant, Paper and Pulp Industry.

Text Books

1. Balchen ,J.G., and Mumme, K.J., " Process Control structures and applications", Van Nostrand Reinhold Co., New York,1988.
2. Warren L. McCabe, Julian C. Smith and Peter Harriot, "Unit Operations of Chemical Engineering", McGraw-Hill International Edition, New York, Sixth Edition,2001.

3. James R.couper, Roy Penny, W., James R.Fair and Stanley M.Walas, "Chemical Process Equipment Selection and Design", Gulf Professional Publishing,2010.

Reference Books

1. Waddams, A.L., "Chemicals from petroleum", Butler and Taner Ltd., UK,1969.
2. Liptak, B.G., "Process measurement and analysis", Chilton Book Company, USA,1995
3. Luyben W.C., "Process Modeling, Simulation and Control for Chemical Engineers", McGraw- Hill.
4. McCabe, W.L., J.C. Smith and P. Harriot, "Unit Operations of Chemical Engineering". McGraw Hill. Inc. Kosaido Printing Ltd. Tokyo, Japan, 2001 ,
5. Geankoplis C.J.1999. Transport Process and Unit Operations, Prentice-Hall of India Private Limited, New Delhi.

Web References

1. https://www.youtube.com/watch?v=9M0HqQEFL6k
2. https://nptel.ac.in/courses/103107127/
3. https://www.docsity.com/en/ontroductions-unit-operations-lecture-slides/394376/

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
1	3	2	2	1	-	1	1	-	-	-	-	-	3	2	2
2	3	2	3	2	-	1	1	-	-	-	-	-	3	2	3
3	3	3	3	3	-	1	1	-	-	-	-	-	3	2	3
4	3	2	3	2	-	1	1	-	-	-	-	-	3	3	3
5	3	3	3	3	-	1	1	-	-	-	-	-	3	3	3

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

U19ICE55	ROBOTICS AND AUTOMATION	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To study the basic components of robotics and automation systems.
- To study the sensor and grippers used in robotics system
- To study control system of robotics
- To analyze robotic motions
- To study the application of robotics.

Course Outcomes

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

CO1 - Infer the concepts of Robotics and classifications. **(K2)**
CO2 - Classify the different types of sensors and summarize the techniques of image processing. **(K4)**
CO3 - Choose the type of gripper as per requirement and explain the dynamics of robots. **(K3)**
CO4 - Compare the different kinematic techniques.**(K2)**
CO5 - Develop a robot. **(K3)**

UNIT I BASIC CONCEPTS **(9 Hrs)**

Origin & various generation of Robots - Robot definition - Robotics system components - Robot classification Coordinate frames - Asimov's laws of robotics - degree of freedom - dynamic stabilization of robots.- work volume. Need for Automation - types of automation - fixed, programmable and flexible automation.

UNIT II POWER SOURCES AND SENSORS **(9 Hrs)**

Hydraulic, pneumatic and electric drives - determination of HP of motor and gearing ratio - variable speed arrangements - path determination - micro machines in robotics - machine vision - ranging - laser - acoustic - magnetic, fiber optic and tactile sensors.

UNIT III ROBOT CONTROL **(9 Hrs)**

Construction of manipulators - manipulator dynamics and force control - electronic and pneumatic manipulator control circuits - end effectors - various types of grippers - design considerations. Introduction to Robot Dynamics - Lagrange formulation - Newton Euler formulation - Properties of robot dynamic equations

UNIT IV KINEMATICS AND PATH PLANNING **(9 Hrs)**

Forward Kinematics – Denavit Hart enberg Representation- multiple solution jacobian work envelop, Inverse Kinematics - Geometric approach- Hill climbing techniques

UNIT V ROBOT APPLICATIONS **(9 Hrs)**

Robot programming - Fixed instruction, sequence control, General programming language, Specific programming languages.Robots for welding, painting and assembly - Remote Controlled robots - robots in manufacturing and non-manufacturing applications - Robots for nuclear and chemical plants.

Text Books

1. Saeed B Niku, Introduction to Robotics, Analysis, Systems, Applications Prentice Hall, 3 edition 2014.
2. Mikell P. Weiss G.M., Nagel R.N., Odraj N.G., Industrial Robotics, McGraw-Hill Singapore,2015
3. Robert J. Schilling, Fundamentals of Robotics-Analysis and Control, PHI,2007.

Reference Books

1. K.S.Fu, R.C.Gonzalez, CSG. Lee, Robotics, control sensing vision and Intelligence, Tata Mcgraw-Hill, 2008
2. R.K.Mittal and I.J.Nagrath, Robotics and Control, Tata McGraw Hill, New Delhi,4th Reprint,2005
3. Asfahl C.R., "Robots and Manufacturing Automation", John Wiley, USA 1992
4. Craig, "Introduction to Robotics Mechanics and Control", Second edition, Pearson Education, Asia, 2004.
5. R.D. Klafter, T.A. Chimielewski and M. Negin, "Robotic Engineering – An integrated Approach", Prentice Hall of India, NewDelhi, 2010

Web References

1. https://www.ieee-ras.org/educational-resources-outreach/webinars-and-videos
2. https://www.robotics.org/blog
3. https://www.edx.org/learn/robotics

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

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

U19ICE61	APPLIED SOFT COMPUTING	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To expose the students to understand the basic concepts of Soft computing and Artificial Neural Networks (ANN).
- To provide adequate knowledge about feedback and feed forward neural networks
- To provide adequate knowledge about fuzzy and neuro-fuzzy systems
- To provide comprehensive knowledge of fuzzy logic control to real time systems.
- To provide adequate knowledge of genetic algorithms

Course Outcomes

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

CO1 - Understand the concept of ANN, types of ANN, Training of ANN and soft computing techniques. **(K2)**

CO2 - Illustrate the Back propogation, counter propgation algorithm and their applications. **(K2)**

CO3 – Comprehend the concepts of Fuzzification and Defuzzification. **(K3)**

CO4 – Elucidate the various applications of Nero-fuzzy systems. **(K3)**

CO5 – Explain the optimization rule of Genetic Algorithm. **(K2)**

UNIT I INTRODUCTION TO SOFT COMPUTING AND ARTIFICIAL NEURAL NETWORKS (9 Hrs)

Evolution of Computing - Soft Computing Constituents - From Conventional AI to Computational Intelligence - Machine Learning Basics, Fundamentals of ANN - Biological Neurons and Their Artificial Models - Types of ANN - Properties - Different Learning Rules - Types of Activation Functions - Training of ANN - Hebb learning - Perceptron Model (Both Single &Multi Layer) - Training Algorithm - Problems Solving Using Learning Rules and Algorithms.

UNIT II FEEDBACK AND FEEDFORWARD NEURAL NETWORKS (9 Hrs)

Back Propagation Training Algorithm - Counter Propagation Network - Structure & Operation - Training of Kohonen - Applications of BPN & CPN - Hop Field Network -RBF Network, Adaptive Resonance Theory: Architecture and operation, ANN based water level controller.

UNIT III FUZZY LOGIC (9 Hrs)

Introduction to Fuzzy Set Theory - Basic Concepts of Fuzzy Sets - Classical Set Vs Fuzzy Set - Properties of Fuzzy Set - Fuzzy Logic Operation on Fuzzy Sets - Fuzzy Logic Control Principles - Fuzzy Relations - Fuzzy Rules - Defuzzification - Fuzzy Inference Systems - Fuzzy Expert Systems - Fuzzy Decision Making.

UNIT IV FUZZY LOGIC CONTROLLER AND ITS APPLICATION (9 Hrs)

Fuzzy Logic Controller - Fuzzification Interface - Knowledge Base- Decision Making Logic - Defuzzification Interface- Application of Fuzzy Logic to Water Level Controller - Temperature Controller - Control of Blood Pressure during Anesthesia. Introduction to Neuro - Fuzzy Systems - Fuzzy System Design Procedures - Fuzzy Sets and Logic Background - Fuzzy / ANN Design and Implementation.

UNIT V GENETIC ALGORITHMS (9 Hrs)

Introduction - Robustness of Traditional Optimization and Search Techniques - The goals of optimization - Survival of the Fittest - Fitness Computations - Cross over - Mutation -Reproduction- Rank method- Rank space method.

Text Books

1. Laurene Fausett, "Fundamentals of Neural Networks", Pearson Education, 2008
2. Timothy J. Ross , "Fuzzy Logic with Engineering Applications", McGraw- Hill International Editions,2010
3. George J. Klir and Bo Yuan, "Fuzzy sets and Fuzzy Logic", Prentice Hall, USA .2015

Reference Books

1. David E. Goldberg, "Genetic Algorithms in Search, Optimization and Machine Learning", Addison Wesley, 2019
2. Rajasekaran. S, Pai. G.A.V. "Neural Networks, Fuzzy Logic and Genetic Algorithms", Prentice-Hall of India, 2003
3. Jang J.S.R., Sun C.T. and Mizutani E, "Neuro-Fuzzy and soft computing", Pearson Education 2007
4. W.T.Miller, R.S.Sutton and P.J.Webrose, Neural Networks for Control, MIT Press, 1996.
5. C.Cortes and V.Vapnik, Support-Vector Networks, Machine Learning, 1995.

Web References

1. https://lecturenotes.in/subject/922.
2. https://www.ifi.uzh.ch/dam/jcr:00000000-2826-155d-0000-00005e4763e3/fuzzylogicscript.pdf.
3. https://nptel.ac.in/courses/106/105/106105173/.

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

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

U19ICE62 **POWER PLANT INSTRUMENTATION**

L	T	P	C	Hrs
3	0	0	3	45

Course Objectives

- To provide an overview on power generation through various methods.
- To educate on the important power plant measurements and devices.
- To educate on basic Boiler control techniques.
- To Learn about Piping and Instrumentation diagrams and various instruments in Nuclear Power
- To study about the monitoring and control of turbines.

Course Outcomes

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

CO1 - Understand and analyze about the various Power Generation Methods. **(K2)**
CO2 - Analyze basic measurement in power plants. **(K2)**
CO3 - Recognize various analyzers for monitoring feed water impurity, flue gas etc. **(K2)**
CO4 - Learn about various Instruments used in nuclear power plants. **(K2)**
CO5 - Apply the knowledge to control and monitor the turbines. **(K1)**

UNIT I OVERVIEW OF POWERGENERATION (9 Hrs)

Survey of methods of power generation:– hydro, thermal, nuclear, solar and wind power– Importance of instrumentation in power generation – Thermal power plant – Building blocks - Combined Cycle System – Combined Heat and Power System – sub critical and supercritical boilers.

UNIT II MEASUREMENTS IN POWER PLANTS (9 Hrs)

Measurement of feed water flow, air flow, steam flow and coal flow – Drum level measurement – Steam pressure and temperature measurement – Turbine speed and vibration measurement – Flue gas analyzer – Fuel composition analyzer.

UNIT III BOILER CONTROL (9 Hrs)

Combustion of fuel and excess air – Firing rate demand – Steam temperature control – Control of deaerator – Drum level control – Single, two and three element control – Furnace draft control –implosion - flue gas dew point control – Trimming of combustion air – Soot blowing.

UNIT IV INSTRUMENTATION IN NUCLEAR POWER PLANT (9 Hrs)

Piping and instrumentation diagram of different types of nuclear power plants-radiation detection instruments-process sensors for nuclear power plants-spectrum analyzers-nuclear reactor control systems and allied instrumentation.

UNIT V TURBINE MONITORING AND CONTROL (9 Hrs)

Speed, vibration, shell temperature monitoring and control – Steam pressure control – Lubricant oil temperature control – Cooling system.

Text Books

1. Liptak B.G., Instrumentation in Process Industries, Chilton Book Company,2013.
2. P.K.Nag, Powerplant Engineering, Tata McGraw-Hill Education, 3rd edition,2011.
3. Power-plant Control and Instrumentation, The Control of Boilers and HRSG Systems, By David Lindsley,2000.

Reference Books

1. Sam Dukelow, Control of Boilers, Instrument Society of America,2012.
2. Jain R.K., Mechanical and Industrial Measurements, KhannaPublishers, New Delhi,2012.
3. Power plant instrumentation,by k. Krishnaswamy,m. Ponnibala · 2013

Web References

1. www.ignou.ac.in/upload/Unit-2-58.pdf
2. http://www.powerplantinstrumentationcontrol.yolasite.com/
3. https://electrical-engineering-portal.com/download-center/books-and-guides/power-substations/power-plant-control

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

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

U19ICE63	BUILDING AUTOMATION	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To introduce the basic blocks of Building Management System.
- To impart knowledge on HVAC system
- To explore the access control and security systems
- To enhance the knowledge on types of alarm system.
- To impart knowledge in the design of various sub systems (or modular system) of building automation.

Course Outcomes

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

CO1 - Understand the concept behind building automation. **(K1)**
CO2 - Elucidate the knowledge on HVAC system. **(K2)**
CO3 - Develop a secured access control and security system for automation. **(K1)**
CO4 - Plan for building fire alarm automation with fire control panels. **(K2)**
CO5- Design sub systems for building automation and integrate CCTV, control for appliances. **(K1)**

UNIT I INTRODUCTION **(9 Hrs)**

Concept and application of Building Management System (BMS) and Automation, requirements and design considerations and its effect on functional efficiency of building automation system, architecture and components of BMS.

UNIT II HVAC SYSTEM **(9 Hrs)**

Different components of HVAC system like heating, cooling system, chillers, AHUs, compressors and filter units and their types. Design issues in consideration with respect to efficiency and economics, concept of district cooling and heating.

UNIT III ACCESS CONTROL & SECURITY SYSTEMS **(9 Hrs)**

Concept of automation in access control system for safety, Physical security system with components, Access control components, Computer system access control – DAC, MAC, and RBAC.

UNIT IV FIRE & ALARM SYSTEM **(9 Hrs)**

Different fire sensors, smoke detectors and their types, CO and CO2 sensors, Fire control panels, design considerations for the FA system concept of IP enabled fire & alarm system, design aspects and components of PA system.

UNIT V CCTV SYSTEM & ENERGY MANAGEMENT SYSTEM: **(9 Hrs)**

Components of CCTV system like cameras, types of lenses, typical types of cables, controlling system, concept of energy management system, occupancy sensors, fans & lighting controller. Introduction to structural health monitoring and methods employed.

Text Books:

1. Jim Sinopoli,Smart Buildings, Butterworth-Heinemann imprint of Elsevier,2nd Edition., 2010.
2. Albert Ting Pat So, WaiLok Chan, Intelligent Building Systems, Kluwer Academic publisher, 3rd Edition., 2012.
3. Reinhold A. Carlson, Robert A. Di Giandomenico, Understanding Building Automation Systems,

Published by R.S. Means Company, 1991.
4. Morawski, E, Fire Alarm Guide for Property Managers, Publisher: Kessinger Publishing, 2007.

Reference Books:

1. Albert Ting-Pat So, Wai Lok Chan, Intelligent Building Systems Kluwer Academic publisher, 3rd Edition, 2012.
2. Building Automation: Control Devices and Applications by In Partnership with NJATC, 2008.
3. Building Control Systems, Applications Guide (CIBSE Guide) by the CIBSE, 2000.

Web References:

1. http://www.controlservices.com/learning_automation.htm
2. https://www.johnsoncontrols.com/building-automation-and-controls
3. https://www.se.com/in/en/work/products/building-automation-and-control/

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

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

U19ICE64	WEB BASED INSTRUMENTATION	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To learn Internet and web concepts.
- To learn various application of Internet.
- To learn the language constructs of the programming language.
- To understand the various advanced concepts of java.
- To develop understanding about various applications of java

Course outcomes

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

CO1–Explore the internet and web concepts.**(K2)**
CO2 - Develop internet-based instrumentation and Control applications.**(K1)**
CO3–Acquire the basics of JAVA programming.**(K1)**
CO4 - Develop the advance concepts in java language.**(K1)**
CO5 - Explicate the application of internet measurement and control.**(K1)**

UNIT I BASIC INTERNET CONCEPTS **(9 Hrs)**

Packet Switching - Internet: A Network of Networks-ISPs: Broadband and Wireless Access – Software to Create a Virtual Network -TCP: Software for Reliable Communication - Clients + Servers =Distributed Computing - Names for Computers- NAT: Sharing an Internet Connection.

UNIT II INTERNET APPLICATION **(9 Hrs)**

Electronic Mail- Bulleting Board Service (Newsgroups)-Browsing the World Wide Web- World Wide Web Documents (HTML)-Advanced Web Technologies (Forms, Frames, Plugins, Java, JavaScript, Flash)-Group and Personal Web Pages (Wikis and Blogs)-Automated Web Search (Search Engines)-Text, Audio, and Video Communication (IM, VoIP)-Faxes, File Transfer, and File Sharing (FTP)-Remote Login and Remote Desktops (TELNET)-Facilities for Secure Communication-Secure Access from a Distance (VPNs)-Internet Economics and Electronic Commerce-The Global Digital Library

UNIT III BASICS OF JAVA LANGUAGE **(9 Hrs)**

Java Evolution-Overview of Java Language - Constants, Variables, and Data Types - Operators and Expressions - Classes, Objects and Methods- Arrays and Strings.

UNIT IV ADVANCE CONCEPTS IN JAVA LANGUAGE **(9 Hrs)**

Interfaces: Multiple Inheritance - Packages: Putting Classes Together- Multithreaded Programming Managing Errors and Exceptions- Applet Programming.

UNIT V APPLICATION OF INTERNET MEASUREMENT AND CONTROL **(9 Hrs)**

Measurements through Internet: Web based data acquisition – Monitoring of plant parameters through Internet – Calibration of measuring instruments through Internet.

Internet based Control: Virtual laboratory – Web based Control – Tuning of controllers through Internet.

Case Study: Internet based Measurement and Control case studies using Java, JVM and security –Over view of class library: I/O, AWT and NET – JDBC, Object serialisation – remote method invocation – Java script – Java vs C++.

Text Books

1. Balagurusamy, "Object Oriented Programming Using C++ and JAVA , McGraw Hill Education 2017.
2. Ouglas E. Comer," The Internet Book" 4th Edition, 2009 Princtice Hall.

Reference Books

1. Itel and Deitel, 'Java: How to Program' 9 th Edition Printice Hall 2012
2. Nenbaum, "Computer Networks" 2012 5th Edition, DORLING KINDERSLEY (RS) Publication
3. HTML, JavaScript, and Advanced Internet Technologies BASICS, By Karl Barksdale, E. Shane Turner - 2005

Web References

1. https://link.springer.com/chapter/10.1007/978-3-319-46407-7_1
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	3	2	1	2	2	2	-	-	2	-	3	2	3	2
2	2	3	3	2	3	2	2	-	-	2	-	3	3	3	2
3	2	2	3	2	3	2	2	-	-	2	-	3	3	3	3
4	2	3	2	2	2	2	2	-	-	1	-	2	2	3	3
5	3	2	3	2	2	2	2	-	-	2	-	2	2	3	3

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

U19ICE65	DIGITAL CONTROL SYSTEM	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To understand digital feedback control systems.
- To develop a knowledge of constructing discrete-time mathematical model system
- To develop a knowledge of analysing the system behaviour using discrete-time model and evaluating the system performance.
- To develop knowledge to use controller design techniques.
- To make the system behaviour satisfies specified design objectives.

Course Outcomes

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

CO1 - Learn the digital feedback control systems. **(K1)**
CO2 - Acquire knowledge on discrete-time systems. **(K2)**
CO3 - Gain knowledge of digital control design. **(K1)**
CO4 - Evaluate and test the system performance using digital simulations. **(K2)**
CO5 - Acquire knowledge of State feedback design. **(K1)**

UNIT I INTRODUCTION TO DIGITAL CONTROL **(9 Hrs)**

Introduction-Discrete time system representation -Mathematical modelling of sampling process Data reconstruction - Modelling discrete-time systems by pulse transfer function, Revisiting Z-transform, Mapping of splane to z-plane, Pulse transfer function, Pulse transfer function of closed loop system Sampled signal flow graph Stability analysis of discrete time systems, Jury stability test, Stability analysis using bi-linear transformation.

UNIT II RESPONSE OF DISCRETE TIME SYSTEMS **(9 Hrs)**

Time response of discrete systems, Transient and steady state responses, Time response parameters of a prototype second order system, Deadbeat response design, Design of digital control systems with deadbeat response , Practical issues with deadbeat response design, Sampled data control systems with deadbeat response.

UNIT III DIGITAL CONTROL SYSTEM DESIGN **(9 Hrs)**

Design of sampled data control systems, Root locus method, Controller design using root locus, Root locus based controller design using MATLAB, Nyquist stability criteria, Bode plot, Lead compensator design using Bode plot, Lag compensator design using Bode plot, Lag-lead compensator design in frequency domain.

UNIT IV DISCRETE STATE SPACE MODEL **(9 Hrs)**

Introduction to state variable model Various canonical forms Characteristic equation, state transition matrix Solution to discrete state equation, Controllability, observability and stability of discrete state space models Controllability and observability, Stability : Lyapunov stability theorem

UNIT V STATE FEEDBACK DESIGN **(9 Hrs)**

State feedback design, Pole placement by state feedback, Set point tracking controller, Full order observer, Reduced order observer, Output feedback design, Theory Examples, Introduction to optimal control, Basics of optimal control , Performance indices, Linear Quadratic Regulator (LQR) design.

Text Books

1. B. C. Kuo, Digital Control Systems, Oxford University Press, 2/e, Indian Edition, 2007.
2. M. Gopal, Digital Control and State Variable Methods, Tata McGraw Hill, 2/e, 2003

Reference Books

1. K. Ogata, Discrete Time Control Systems, Prentice Hall, 2/e, 1995.
2. G. F. Franklin, J. D. Powell and M. L. Workman, Digital Control of Dynamic Systems.
3. Addison Wesley, 1998, Pearson Education, Asia, 3/e, 2000. K. J. Astroms and
   B. Witten mark, Computer Controlled Systems - Theory and Design, Prentice Hall, 3/e,1997.

Web References

1. https://nptel.ac.in/courses/108/103/108103008/
2. http://www.ece.mtu.edu/faculty/shiyan/EE4262Spring17/DigitalControlTextBook.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	2	1	2	2	2	-	-	2	-	3	2	3	2
2	2	3	3	2	3	2	2	-	-	2	-	3	3	3	2
3	2	2	3	2	3	2	2	-	-	2	-	3	3	3	3
4	2	3	2	2	2	2	2	-	-	1	-	2	2	3	3
5	3	2	3	2	2	2	2	-	-	2	-	2	2	3	3

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

U19ICE71	COMPUTER CONTROL OF PROCESSES	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To introduce analysis of discrete time systems in state variable form.
- To introduce system identification techniques
- To Design Digital Controllers
- To educate on various process loops and its control.
- To Design Multi-loop and Multivariable Controllers for multivariable system

Course Outcomes

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

CO1 - Analyse the discrete time systems. **(K1)**
CO2 - Analyse transient and steady state behaviours of linear discrete time control systems **(K1, K2)**
CO3 - Design a digital controller. **(K1, K2, K3)**
CO4 - Design multi-loop controller. **(K1, K2, K3)**
CO5 - Design multivariable controller for multivariable system. **(K1, K2, K3)**

UNIT I DISCRETE STATE-VARIABLE TECHNIQUE (9 Hrs)

State equation of discrete data system with sample and hold – State transition equation – Methods of computing the state transition matrix – Decomposition of discrete data transfer functions – State diagrams of discrete data systems – System with zero-order hold – Controllability and observability of linear time invariant discrete data system–Stability tests of discrete-data system – State Observer - State Feedback Control.

UNIT II SYSTEM MODELING AND IDENTIFICATION (9 Hrs)

Mathematical model for processes – first order. Second order processes without and with pure delay higher order systems – process modeling form step test data – pulse testing for process identification – time – domain identification – linear least square algorithm.

UNIT III DIGITAL CONTROLLER DESIGN (9 Hrs)

Review of z-transform – Modified of z-transform – Pulse transfer function – Digital PID controller – Dead-beat control and Dahlin's control – Smith predictor – Digital Feed-forward controller – IMC State Feedback Controller - LQG Control

UNIT IV MULTI-LOOP REGULATORY CONTROL (9 Hrs)

Multi-loop Control - Introduction – Process Interaction – Pairing of Inputs and Outputs -The Relative Gain Array (RGA) – Properties and Application of RGA – Multi – loop PID Controller– Biggest Log Modulus Tuning Method – De coupler

UNIT V MULTIVARIABLE REGULATORY CONTROL (9 Hrs)

Introduction to Multivariable control –Multivariable PID Controller -Multivariable IMC– Multivariable Dynamic Matrix Controller – Multivariable Model Predictive Control – Generalized Predictive Controller – Implementation Issues.

Text Books

1. Gopal,M.,"DigitalControlandStateVariableMethods",TataMcGrawHill,Fourth Edition,2017
2. Bequette,B.W.,"ProcessControlModeling,DesignandSimulation",PrenticeHallof India,2015
3. M. Chidambaram , Computer control of process, Narosa publishing house,2015

Reference Books

1. Stephanopoulos, G., "Chemical Process Control -An Introduction to Theory and Practice", Prentice Hall of India, 2015.
2. John Lavigne, Instrumentation Applications for the Pulp and Paper Industry (A Pulp and paper book), Books,1988
3. E. Ikonen and K.Najim, "Advanced Process Identification and Control", Marcel Dekker, Inc. Newyork, 2002.

Web Resources

1. https://nptel.ac.in/courses/112/105/112105211/
2. https://www.youtube.com/watch?v=lmtSsDLgAal&feature=emb_logo

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

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

U19ICE72	AUTOMOTIVE INSTRUMENTATION SYSTEM	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To impart knowledge on the automobile system, its subsystems and components.
- To expose the students to the concepts of various sensors used in automobile systems.
- To teach the basic and advanced controls in automotive systems.
- To learn the active and passive safety systems.
- To impart knowledge about the electronics and protocol involved in automotive systems.

Course Outcomes

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

CO1 - Identify the automotive system and its components. **(K1)**
CO2 - Attain knowledge of various sensors and conditioning circuits used in automotive systems. **(K1, K2)**
CO3 - Gain knowledge about various control strategies. **(K1, K2)**
CO4 - Acquaint the types of active and passive safety systems. **(K1)**
CO5 - Understand the automotive standards and protocols in the system. **(K1, K2)**

UNIT I INTRODUCTION OF AUTOMOBILE SYSTEM (9 Hrs)

Current trends in automobiles with emphasis on increasing role of electronics and software, overview of generic automotive control ECU functioning, overview of typical automotive subsystems and components, AUTOSAR.

UNIT II ENGINE MANAGEMENT SYSTEMS (9 Hrs)

Basic sensor arrangement, types of sensors such as oxygen sensors, crank angle position sensors, Fuel metering/ vehicle speed sensors, flow sensor, temperature, air mass flow sensors, throttle position sensor, solenoids etc., algorithms for engine control including open loop and closed loop control system, electronic ignition, EGR for exhaust emission control.

UNIT III VEHICLE POWERTRAIN AND MOTION CONTROL (9 Hrs)

Electronic transmission control, adaptive power Steering, adaptive cruise control, safety and comfort systems, anti-lock braking, traction control and electronic stability, active suspension control.

UNIT IV ACTIVE AND PASSIVE SAFETY SYSTEM (9 Hrs)

Body electronics including lighting control, remote keyless entry, immobilizers etc., electronic instrument clusters and dashboard electronics, aspects of hardware design for automotive including electro-magnetic interference suppression, electromagnetic compatibility etc., (ABS) antilock braking system, (ESP) electronic stability program, air bags.

UNIT V AUTOMOTIVE STANDARDS AND PROTOCOLS (9 Hrs)

Automotive standards like CAN protocol, LIN protocol, FLEX RAY, Head-Up Display (HUD), OBD-II, CAN FD, automotive Ethernet etc. Automotive standards like MISRA, functional safety standards (ISO 26262).
System design and energy management: BMS (battery management system), FCM (fuel control module), principles of system design, assembly process of automotives and instrumentation systems.

Text Books:

1. William B. Ribbens, "Understanding Automotive Electronics", Butterworth-Heinemann publications, 7th Edition, 2012.

Reference Books:

1. Young A.P., Griffiths L., "Automotive Electrical Equipment", ELBS and New Press, 2010.
2. Tom Weather Jr., Cland C. Hunter, "Automotive computers and control system", Prentice Hall Inc., New Jersey,2009.
3. Crouse W.H., "Automobile Electrical Equipment", McGraw Hill Co. Inc., New York, 2005.
4. Bechtold, "Understanding Automotive Electronic", SAE, 2010.
5. BOSCH, "Automotive Hand Book", Bentely Publishers, Germany, 9th Edition, 2014.

Web References:

1. https://www.globalspec.com/reference/40076/203279/chapter-9-automotive-instrumentation-and-telematics
2. https://sites.google.com/site/sjredu/subje/instru-auto
3. https://www.gtvinc.com/advances-automotive-instrumentation/
4. https://www.kacsik.com/industries/automotive

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

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

U19ICE73	VIRTUAL INSTRUMENTATION	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To Introduce the evolution, block diagram and architecture of VI.
- To get knowledge on basic Programming by using virtual instrumentation.
- To provide knowledge in programming Structure by VI tools.
- To provide knowledge in Different types of Arrays and Clusters by VI tools.
- To provide knowledge in Hardware Interfacing by VI tools.

Course Outcomes

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

CO1 - Understand the evolution, architecture, applications of visual instrumentation. **(K1)**
CO2 - Study about the basics of Programming by using virtual instrumentation. **(K1, K2)**
CO3 - Acquiring knowledge on VI programming Structure by VI tools. **(K1, K3)**
CO4 - Study about the different types of Arrays and Clusters by VI tools. **(K1)**
CO5 - Understanding the concept of instrument interfacing by VI tools. **(K1, K2)**

UNIT I INTRODUCTION **(9 Hrs)**

Evolutions of VI, advantages, block diagram and architecture of a virtual instrument-Graphical programming, and comparison with conventional programming.

UNIT II VI PROGRAMMING **(9 Hrs)**

Controls and indicators- Labels and Text –Shape, size and color- – Data type, Format, Precision and representation – Data types – Data flow programming-Editing – Debugging and Running a Virtual Instrument –Concept of sub VI.

UNIT III PROGRAMMING STRUCTURE **(9 Hrs)**

FOR Loops, WHILE Loops, CASE Structure, Formula nodes, Sequence structures- Attribute modes Local and Global variables.

UNIT IV ARRAYS AND CLUSTERS **(9 Hrs)**

Arrays and Clusters– Array Operations – Bundle – Bundle/Unbundle by name, graphs and charts – String and file I/O.

UNIT V HARDWARE INTERFACING **(9 Hrs)**

DAQ – Block diagram – Description - basic system components of a signal conditioning system- Interfacing with LabVIEW- Introduction to my RIO

Text Books

1. Gupta , Virtual Instrumentation Using Lab view 2nd Edition, Tata McGraw-Hill Education, 2010
2. Jovitha Jerome, Virtual Instrumentation using LabVIEW, PHI Learning Pvt. Ltd., 2010

Reference Books

1. Gary Jonson, "Labview Graphical Programming", Fourth Edition, McGraw Hill, New York, 2012
2. Gupta.S., Gupta.J.P., "PC interfacing for Data Acquisition and Process Control", Second Edition, Instrument Society of America, 2012.
3. Sokoloff; "Basic concepts of Labview 4", Prentice Hall Inc., New Jersey 2013.

Web References

1. https://www.ni.com/
2. https://www.youtube.com/user/Labview/playlists

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

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

U19ICE74	MODERN ELECTRONIC INSTRUMENTATION	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To introduce the digital methods of measurements.
- To get knowledge on basic current trends in digital instrumentation.
- To provide knowledge in programming Structure by VI tools.
- To provide knowledge in Data Acquisition and VI Chassis Requirements by VI tools.
- To provide knowledge in VI Toolsets, Distributed I/O Modules.

Course Outcomes

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

CO1 - Understand the digital methods of measurements. **(K1)**
CO2 - Study about the basics current trends in digital instrumentation. **(K1)**
CO3 - Acquiring knowledge on programming Structure by VI tools. **(K1,K2)**
CO4 - Study about the Data Acquisition and VI Chassis Requirements by VI tools. **(K1)**
CO5 - Understanding the concept of instrument interfacing by VI tools. **(K1,K3)**

UNIT I DIGITAL METHODS OF MEASUREMENTS (9 Hrs)

Review of A/D, D/A techniques – F/V and V/F conversion techniques – Digital voltmeters and multimeters – Automation and accuracy of digital voltmeters and multimeters – Digital phase meters – Digital tachometers – Digital frequency, period and time measurements – Low frequency measurements – Automatic time and frequency scaling – Sources of error – Noise – Inherent error in digital meters, hidden errors in conventional ac measurements – RMS detector in digital multimeters – Mathematical aspects of RMS - Digital storage Oscilloscope.

UNIT II CURRENT TRENDS IN DIGITAL INSTRUMENTATION (9 Hrs)

Introduction to special function add on cards – Resistance card – Input and output cards –Digital equipment construction with modular designing; interfacing to microprocessor, micro controllers and computers - Computer aided software engineering tools (CASE) – Use of CASE tools in design and development of automated measuring systems – Interfacing IEEE cards – design of GPIB Systems - Intelligent and programmable instruments using computers-Data networks-CAN Bus, SMART/HART protocols

UNIT III VIRTUAL INSTRUMENTATION (9 Hrs)

Historical perspective, advantages, block diagram and architecture of a virtual instrument, data-flow techniques, graphical programming in data flow, comparison with conventional programming. Development of Virtual Instrument using GUI. VI programming techniques: VIS and sub-VIS, loops and charts, arrays, clusters and graphs, case and sequence structures, formula nodes, local and global variables, string and file I/O, Instrument Drivers, Publishing measurement data in the web.

UNIT IV DATA ACQUISITION AND VI CHASSIS REQUIREMENTS (9 Hrs)

Introduction to data acquisition on PC, Sampling fundamentals, Input/Output techniques and buses. ADC, DAC, Digital I/O, counters and timers, DMA, Software and hardware installation, Calibration, Resolution, Data acquisition interface requirements. Common Instrument Interfaces: Current loop, RS 232C/ RS485, GPIB. Bus Interfaces: USB, PCMCIA, VXI, SCSI, PCI, PXI, Firewire. PXI system controllers, Ethernet control of PXI. Networking basics for office and Industrial applications, VISA and IVI.

UNIT V VI TOOLSETS, DISTRIBUTED I/O MODULES (9 Hrs)

Application of Virtual Instrumentation: Instrument Control, Development of process database management system, Simulation of systems using VI, Development of Control system, Industrial Communication, Image acquisition and processing, Motion control.

Textbooks

1. Bouwens, A.J., "Digital Instrumentation", McGraw Hill, 1984.
2. John Lenk, D., "Handbook of Micro computer based Instrumentation and Control", PHI, 1984.
3. Gary Johnson, LabVIEW Graphical Programming, Second edition, McGraw Hill, Newyork, 1997.
4. Lisa K. wells and Jeffrey Travis, LabVIEW for everyone, Prentice Hall, New Jersey, 1997.

References

1. Kevin James, PC Interfacing and Data Acquisition: Techniques for Measurement, Instrumentation and Control, Newnes, 2000.
2. Doebelin, 'Measurement System, Application and Design', IV Ed, McGraw-Hill, 1990.

Web References

1. https://www.ni.com/
2. https://www.youtube.com/user/Labview/playlists

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

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

U19ICE75	FIBER OPTICS AND LASER INSTRUMENTATION	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To study in detail about optical fiber properties.
- To study in detail about optical fiber applications
- To study about lasers fundamentals and its properties.
- To study in detail about industrial applications of laser.
- To study about hologram and medical application of laser

Course Outcomes

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

CO1 - Understand the optical fiber and their properties **(K1)**
CO2 - Acquired knowledge of industrial application of optical fibres.**(K1)**
CO3 - Understand the laser fundamentals. **(K1)**
CO4 - Acquired knowledge of industrial application of lasers. **(K1, K2, K3)**
CO5 - Understand hologram and its medical applications. **(K1, K2, K3)**

UNIT I OPTICAL FIBRES AND THEIR PROPERTIES (9 Hrs)

Principles of light propagation through a fibre - Different types of fibres and their properties, fibre characteristics - Absorption losses - Scattering losses - Dispersion - Connectors and Splices - Optical Sources - Optical detectors.

UNIT II INDUSTRIAL APPLICATIONS OF OPTICAL FIBRES (9 Hrs)

Fibre Optic Sensors - Fibre Optic Instrumentation System – Electro optic, Acousto-optic and Travelling Wave Modulators - Interferometric Method of Measurement of Length – Moire fringes – Measurement of Pressure, Temperature, Current, Voltage, Liquid level and Strain.

UNIT III LASER FUNDAMENTALS (9 Hrs)

Fundamental Characteristics of Lasers – Three level and Four level Lasers - Properties of Lasers - Laser Modes - Resonator Configuration – Q-Switching and Mode locking – Cavity dumping - Types of Lasers – Gas lasers, Solid lasers, Liquid lasers, Semiconductor lasers

UNIT IV INDUSTRIAL APPLICATIONS OF LASERS (9 Hrs)

Laser for measurement of Distance, Length, Velocity, Acceleration, Current, Voltage and Atmospheric Effect -Material Processing - Laser heating, Welding, Melting and Trimming of Material - Removal and Vaporization

UNIT V HOLOGRAM AND MEDICAL APPLICATIONS (9 Hrs)

Holography - Basic Principle - Methods - Holographic interferometry and applications, Holography for non-destructive Testing - Medical Applications of Lasers, Lasers and Tissue interaction - Laser Instrumentations for surgery, Removal of Tumours of Vocal cords, Brain surgery, Plastic surgery.

Text Books

1. G.Keiser, Optical Fibre Communication, McGraw Hill, 2013.
2. Ajoyghatak K. Thyagarajan, Optical Electronics, Cambrige University Press, 2010.

Reference Books

1. J.M.Senior, OFC – Principles and Practice,PH1,2009
2. J.Wilson and J.F.Bhawkes, Introduction to Optical Electronics, PH1, 2001
3. Dr.Manjeet Singh, Lasers – Theory, Principles and Applications, VEI, Vayn Education India, 2011
4. Mr.Gupta, Fibre Optics Communication, PH1, 2004.
5. R.P. Khare, —Fiber Optics and Optoelectronicsll, Oxford University Press, 2008.

Web References

1. https://nptel.ac.in/courses/108101093/
2. http://www.brainkart.com/subject/Fiber-optics-and-Laser-instruments_190
3. https://sites.google.com/site/smartice2015/my-forms/applied-soft-computing

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

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

U19ICE80	INDUSTRIAL SAFETY	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To provide the concept of Industrial Safety and provide knowledge for workplace safety
- To acquire knowledge in identification, evaluation and control of all the hazards
- To prevent harm or damage to people, property, or the environment.
- To conduct safety audits
- To improve safety practices

Course Outcomes

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

CO1 - Identify hazard and potential hazard areas **(K1)**
CO2 - Develop safety programs to prevent or mitigate damage or losses. **(K1, K2)**
CO3 - Assess safety practices and programs. **(K1,K2, K3)**
CO4 - Conduct safety audits. **(K1,K2)**
CO5 - Improve safety practices. **(K1)**

UNIT I INDUSTRIAL SAFETY (9 Hrs)

Accident, causes, types, results and control, mechanical and electrical hazards, types, causes and preventive steps/procedure, describe salient points of factories act 1948 for health and safety, wash rooms, drinking water layouts, light, 103 cleanliness, fire, guarding, pressure vessels, etc, Safety color codes. Fire prevention and firefighting, equipment and methods.

UNIT II FUNDAMENTALS OF MAINTENANCE ENGINEERING (9 Hrs)

Definition and aim of maintenance engineering, Primary and secondary functions and responsibility of maintenance department, Types of maintenance, Types and applications of tools used for maintenance, Maintenance cost and its relation with replacement economy, Service life of equipment.

UNIT III WEAR AND CORROSION AND THEIR PREVENTION (9 Hrs)

Wear- types, causes, effects, wear reduction methods, lubricants-types and applications, Lubrication methods, general sketch, working and applications, i. Screw down grease cup, ii. Pressure grease gun, iii. Splash lubrication, iv. Gravity lubrication, v. Wick feed lubrication vi. Side feed lubrication, vii. Ring lubrication, Definition, principle and factors affecting the corrosion. Types of corrosion, corrosion prevention methods.

UNIT IV FAULT TRACING (9 Hrs)

Fault tracing-concept and importance, decision tree concept, need and applications, sequence of fault finding activities, show as decision tree, draw decision tree for problems in machine tools, hydraulic, pneumatic, automotive, thermal and electrical equipment's like, I. Any one machine tool, ii. Pump iii. Air compressor, iv. Internal combustion engine, v. Boiler, vi. Electrical motors, Types of faults in machine tools and their general causes.

UNIT V PERIODIC AND PREVENTIVE MAINTENANCE (9 Hrs)

Periodic inspection-concept and need, degreasing, cleaning and repairing schemes, overhauling of mechanical components, overhauling of electrical motor, common troubles and remedies of electric motor, repair complexities and its use, definition, need, steps and advantages of preventive maintenance. Steps/procedure for periodic and preventive maintenance of: I. Machine tools, ii. Pumps, iii. Air compressors, iv. Diesel generating (DG) sets, Program and schedule of preventive maintenance of mechanical and electrical equipment, advantages of preventive maintenance. Repair cycle concept and importance

Text Books

1. Higgins and Morrow, Maintenance Engineering Handbook, Da Information Services, 1994.
2. H. P. Garg, Maintenance Engineering, S. Chand and Company Ltd, 2012

Reference Books

1. Frank D Graham, Audels Pumps-Hydraulic Air Compressors, Mcgraw Hill Publication, 1949.
2. Fang, Hsai-Yang,Foundation Engineering Handbook, Chapman & Hall, London

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

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

U19ICE81	SYSTEM IDENTIFICATION AND ADAPTIVE CONTROL	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To introduce Non parametric methods.
- To impart knowledge on parameter estimation methods.
- To impart knowledge on Recursive identification methods.
- To impart knowledge on Adaptive control schemes.
- To introduce stability, Robustness and Applications of adaptive control method.

Course Outcomes

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

CO1 - Apply advanced control theory to practical engineering problems **(K1)**
CO2 - Define basic concepts of parameter estimation methods. **(K1, K2)**
CO3 - Understand the recursive least square method. **(K1, K2)**
CO4 - Acquaint the various adaptive control schemes. **(K1, K2)**
CO5 - Illustrate issues in adaptive control and applications **(K1)**

UNIT I NON-PARAMETRIC METHODS **(9 Hrs)**

Non parametric methods: Transient analysis–frequency analysis–Correlation analysis–Spectral analysis

UNIT II PARAMETER ESTIMATION METHODS **(9 Hrs)**

Least square estimation – best linear unbiased estimation under linear constraints – updating the parameter estimates for linear regression models–prediction error methods: description of prediction methods – optimal prediction – relation between prediction error methods and other identification methods – theoretical analysis - Instrumental variable methods: Description of instrumental variable methods – Input signal design for identification.

UNIT III RECURSIVE IDENTIFICATION METHODS **(9 Hrs)**

The recursive least square method – the recursive instrumental variable methods- the recursive prediction error methods – Maximum likelihood. Identification of systems operating in closed loop: Identification considerations – direct identification – indirect identification

UNIT IV ADAPTIVE CONTROL SCHEMES **(9 Hrs)**

Introduction – Types of adaptive control–Gain scheduling controller–Model reference adaptive control schemes– Self tuning controller–MRAC and STC: Approaches–The Gradient approach – Lyapunov functions – Passivity theory – pole placement method – Minimum variance control – Predictive control.

UNIT V ISSUES IN ADAPTIVE CONTROL AND APPLICATIONS **(9 Hrs)**

State feedback design, Pole placement by state feedback, Set point tracking controller, Full order observer, Reduced order observer, Output feedback design, Theory Examples, Introduction to optimal control, Basics of optimal control, Performance indices, Linear Quadratic Regulator (LQR) design.

Text Books

1.Soder storm T and Peter Stoica, System Identification, Prentice Hall International, 1989.
2.Astrom,K.J. and Wittenmark,B., Adaptive Control, Pearson Education, 2nd Edition, 2001.

3. Sastry,S. and Bodson, M., Adaptive Control– Stability, Convergence and Robustness, Prentice Hall inc., New Jersey, 1989.

Reference Books

1. Ljung L, System Identification: Theory for the user, Prentice Hall, Engle wood Cliffs,1987.
2. Bela.G.Liptak., Process Control and Optimization, Instrument Engineers' Handbook., volume 2, CRC press and ISA, 2005.
3. William S.Levine, Control Systems Advanced Methods, The Control Handbook, CRC Press 2011

Web References

1. https://nptel.ac.in/courses/103/106/103106149/#
2. https://nptel.ac.in/courses/108/102/108102113/

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

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

U19ICE82	ADVANCED INSTRUMENTATION SYSTEM	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To review the instruments used for measurement of basic process parameters like level, flow, pressure and temperature.
- To explore the various types of analyzers used in industrial applications.
- To understand the requirement of safety instrumentation and risk analysis techniques.
- To familiarize with instrumentation standards such as BS1042, ISA 75, ISA 84 and ISA 88.
- To familiarize with instrumentation symbols, process flow and piping diagrams.

Course Outcomes

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

CO1 - Understand the instrumentation behind flow, level a, temperature and pressure measurement **(K1)**
CO2 - Acquire knowledge on various types of analyzers used in typical industries. **(K1, K2)**
CO3 - Understand the role of safety instrumented system in the industry. **(K1)**
CO4 - Explore the standards for applying instrumentation in hazardous locations. **(K1, K2)**
CO5 - Design, develop and interpret the documents used to define instruments and control system. **(K1, K2, K3)**

UNIT I MEASUREMENT OF PROCESS PARAMETERS (9 Hrs)

Review the various measurement techniques of temperature, pressure, flow and level- application- selection of sensors- calibration methods

UNIT II INSTRUMENTS FOR ANALYSIS (9 Hrs)

Ion selective electrodes: Gas and liquid chromatography- Oxygen analyzers for gas and liquid – CO, CO2, NO and SO Analyzers – Hydrocarbon and HS analyzers – Dust Analyzers, smoke analyzers, toxic gas analyzers and radiation monitoring.

UNIT III SAFETY INSTRUMENTATION (9 Hrs)

Introduction to safety instrumented systems – Hazards and Risk- Process Hazards Analysis (PHA) – Safety life cycle – Control and Safety Systems – Safety Instrumented function – Safety Integrity Level (SIL) – Selection, Verification and Validation.

UNIT IV INSTRUMENTATION STANDARDS (9 Hrs)

Instrumentation Standards – Significance of codes and standards – Overview of various types – Introduction of various Instrumentation Standards – review, interpretation and significance of specific standards – examples of usage of standards on specific applications.

UNIT V DOCUMENTATION IN PROCESS INDUSTRIES (9 Hrs)

Block Diagram of a typical Process – Instrumentation Symbols, Abbreviations and Identification for Instruments: - Mechanical Equipment, Electrical Equipment, Instruments and Automation Systems – Process flow diagram (PFD) – Piping and Instrumentation Diagram (P and ID) – Instrument Lists and specification – Logic Diagrams – Instrument Loop Diagrams – Instrument Hookup Diagrams – Location Plans for instruments – Cable Routing Diagrams – Typical Control / Rack Rooms Layout – Vendors Documents and Drawings.

Text Books

1. B. G. Liptak, "Instrumentation Engineers Handbook (Process Measurement and Analysis)", Fourth Edition, Chilton Book Co, CRC Press, 2005.

Reference Books

1. SwapanBasu, "Plant Hazard analysis and Safety Instrumentation Systems" Academic Press, 2016.
2. Al. Sutko, Jerry. D. Faulk, "Industrial Instrumentation", Delmer Publishers, 1996.
3. Paul Gruhn, P.E., CFSE and Harry Cheddie, P.E., "Safety Instrumented Systems: Design, Analysis, and Justification", 2nd Edition, ISA 2006.

Web References

1. https://www.eolss.net/Sample-Chapters/C05/E6-39A-04-08.pdf
2. https://www.nap.edu/read/11520/chapter/4

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

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

U19ICE83	INDUSTRIAL DATA NETWORKS	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To educate on the basic concepts of data networks
- To introduce the basics of inter-networking and serial communications
- To provide details on HART and Field buses
- To educate on MODBUS, PROFIBUS and other communication protocol
- To introduce industrial Ethernet and wireless communication

Course Outcomes

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

CO1 - Understand and analyse Instrumentation systems and their applications to various industries. **(K1)**

CO2 - Define basic concepts of data communication and its importance. **(K1,K2)**

CO3 - Gain knowledge on the various internetworking devices involved in industrial networks. **(K1,K2)**

CO4 - Explore the various serial communication used in process industries. **(K1,K2)**

CO5 - Illustrate and compare the working of HART and Field bus used in process digital communication. **(K1)**

UNIT I DATA NETWORK FUNDAMENTALS (9 Hrs)

Networks hierarchy and switching – Open System Interconnection model of ISO - Data link control protocol - Media access protocol - Command / response - Token passing -CSMA/CD, TCP/IP

UNIT II INTERNET WORKING and RS 232, RS485 (9 Hrs)

Bridges - Routers - Gateways - Standard ETHERNET and ARCNET configuration special requirement for networks used for control - RS 232, RS 485 configuration Actuator Sensor (AS) – interface, Device net.

UNIT III HART AND FIELD BUS (9 Hrs)

Introduction - Evolution of signal standard - HART communication protocol - HART networks HART commands - HART applications - Fieldbus - Introduction - General Fieldbus architecture - Basic requirements of Fieldbus standard - Fieldbus topology - Interoperability Interchangeability - Introduction to OLE for process control (OPC).

UNIT IV MODBUS AND PROFIBUS PA/DP/FMS AND FF (9 Hrs)

MODBUS protocol structure - function codes – troubleshooting Profibus, Introduction, Profibus protocol stack, Profibus communication model - communication objects - system operation troubleshooting - review of foundation fieldbus - Data Highway.

UNIT V INDUSTRIAL ETHERNET AND WIRELESS COMMUNICATION (9 Hrs)

Industrial Ethernet, Introduction, 10 Mbps Ethernet, 100 Mbps Ethernet - Radio and wireless communication, Introduction, components of radio link - radio spectrum and frequency allocation - radio MODEMs-Introduction to wireless HART and ISA100

Text Books

1. Steve Mackay, Edwin Wrijut, Deon Reynders, John Park, Practical Industrial Data
2. Networks Design, Installation and Troubleshooting' Newnes Publication, Elsevier First Edition, 2004
3. Computer Buses – William Buchanan – CRC press.

Reference Books

1. IBM PC and CLONES – B.Govindarajulu – Tata McGraw – Hill Publishing Company, 2004..
2. A. Behrouz Forouzan ,Data Communications & Networking ,3rd Edition, Tata Mc Graw Hill, 2006.

Web References

1. https://nptel.ac.in/courses/106/105/106105082/.
2. https://lecturenotes.in/subject/903/industrial-data-networks-idn.

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

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

U19ICE84	FIELD INSTRUMENTATION AND CABLING	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To analyze, specify, and debug industrial data communication systems,
- To obtain knowledge on Industrial protocol, Industrial networks in the instrumentation, control environment
- To get adequate Knowledge on the model and design of Profibus Networks
- To understand and acquaint fiber optic networks
- To enable the students to understand the use of wireless networks

Course Outcomes

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

CO1 - Impart knowledge on components of digital field bus networks. **(K1)**
CO2 - Describe working of Foundation Fieldbus and HART protocols. **(K1, K2)**
CO3 - Understand and outline profibus networks.**(K1)**
CO4 - Understand and explore fiber optic networks **(K1)**
CO5 - Interpret and to specify use of wireless networks.**(K1,K3)**

UNIT I REVIEW OF IC TECHNOLOGIES (9 Hrs)

Proprietary and open networks- Hardware selection for Field bus systems -Sorting the protocols. Field bus trends-Advantages and Disadvantages- Design- installation-economics and documentation. Hart Networks-Hart protocol, field Devices- calibration- Hart applications, installing Hart Networks, Device Descriptions and Applications. Wireless transmitters and their architecture, Wireless Hart.

UNIT II FOUNDATION FIELDBUS NETWORKS (9 Hrs)

Standards, field bus Architecture and user Layer, H1 and HSE specifications, Segment design.

UNIT III PROFIBUS NETWORKS (9 Hrs)

Basics, Block Model, Applications, Network Design-system configuration and Developments. Profibus PA and DP specifications. Segment design.

UNIT IV FIBER-OPTIC NETWORKS (9 Hrs)

Principles- Types of Cables- Network Design-installation finishing- inspection and Testing, Modulation/Demodulation techniques.

UNIT V NETWORK INSTALLATION AND SECURITY (9 Hrs)

Network components, Configuring routers and switches. Physical security, security policies, Encryption, Identity verification, OS security, Login and password security, protection from viruses, preventive measures, internet access, Digital certificates, Network security with Firewalls.

Text Books

1. Instrument Engineers Handbook 'Process software and Digital Networks': Bela Liptak, CRC process. 2012

Reference Books

1. Understanding Distributed Process system for control samnel Herb 2016.
2. Introduction to Networking Richard McMahon, 2014.

Web Resources

1. https://www.youtube.com/watch?v=lVzANPsrEOs
2. https://www.specialcables.co.in/instrumentation-cables/

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

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

U19ICE85	DESIGN OF PROCESS CONTROL SYSTEM COMPONENTS	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To understand the health and safety implications of working with process control systems
- To know the operation of typical instrumentation systems
- To Identify the various methods of signal transmission
- To make the students to understand about the types of pumps and its characteristics
- To obtain knowledge on Interlocks and alarms and its types

Course Outcomes

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

CO1 - Interpret and formulate design specifications for instrumentation systems that meet accuracy and sampling speed requirements. **(K1)**

CO2 - Design, construct, and verify an instrumentation system to meet desired Specifications. **(K1, K2, K3)**

CO3 - Get familiar with safety issues concerning design of instrumentation, including the effects of electric current through tissue and defibrillation **(K1, K2)**

CO4 - Acquaint with the concept Pumps and its characteristics and types **(K1)**

CO5 - Understand and interpret the concept Interlocks and alarms. **(K1, K3)**

UNIT I INTRODUCTION TO PROCESS CONTROL COMPONENTS (9 Hrs)

Orifice meter - design of orifice for given flow condition - design of rotameter - design of RTD measuring circuit - design of cold junction compensation circuit for thermocouple using RTD - Transmitters – zero and span adjustment in D/P transmitters and temperature transmitters

UNIT II MEASUREMENTS OF PH CONTROLLERS (9 Hrs)

Bourdon gauges - factors affecting sensitivity - design aspect of Bourdon tube -design of Air purge system for level measurement. Electronic P+I+D controllers - design - adjustment of set point, bias and controller settings.

UNIT III CONTROL VALVES (9 Hrs)

Control valves - characteristics of control valves - types of valve bodies - valve characteristics - materials for body and trim - sizing of control valves - cavitations, flashing in control valves- selection of body materials and characteristics of control valves for typical applications

UNIT IV TYPES OF PUMPS (9 Hrs)

Types of pumps - pump performance - Different types of pump systems- characteristics of pump system-pressure, friction and flow - pump operation - maintenance - instruments used in pumping practice - pump noise and vibration - selection of pumps.

UNIT V INTERLOCKS AND ALARMS (9 Hrs)

Interlocks and alarms: Interlock design principles, fail-safe design - alarms and their types. Design of logic circuits for alarm and annunciator circuits, interlocks design

Text Books

1. N.A.Anderson, Instrumentation for Process Measurement and Control, Chilton Company,2012
2. D.M.Considine, Process Instruments and Controls Handbook, McGraw-Hill.reprint 2013

Reference Books

1. R.H.Warring, Pumping Manual, Gulf Publishing Co., 2011.
2. P.Bentley, Principles of Measurment Systems, Longman Inc., 2008.

Web References

1. https://www.youtube.com/watch?v=sF88DdDCrRA
2. https://www.youtube.com/watch?v=1rO9nJriVR0

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

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

U19ICE86	RENEWABLE ENERGY RESOURCES	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To understand the trends in energy consumption
- To know the operation of solar power system
- To know the operation of wind energy system
- To obtain knowledge on fuel cells
- To acquire knowledge on distributed generations

Course Outcomes

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

CO1 - Understand the energy scenario for different energy resources. **(K1)**
CO2 - Acquire knowledge on the operation and types of solar power system. **(K1, K2)**
CO3 - Obtain knowledge on the operation of wind energy systems **(K1, K2)**
CO4 - Acquaint with the concept fuel cells and its types **(K1)**
CO5 - Understand the concept distributed generations. **(K1)**

UNIT I INTRODUCTION **(9 Hrs)**

Trends in energy consumption - Energy sources and their availability – Yield Energy ratio: Classification of Energy sources, Conventional Energy Resources: Coal Oil, Natural Gas, Nuclear Power and Hydro. Sector-wise Energy Consumption, Energy Scenario in India, Growth of Energy Sector and its planning in India - Need for Renewable Energy sources

UNIT II SOLAR POWER SYSTEMS **(9 Hrs)**

Solar Thermal Systems: Principle and operation – Low, Medium and High Temperature Systems. Solar Photovoltaic Systems: Solar cells and their characteristics - Influence of Insolation and Temperature - PV arrays – Maximum Power Point Tracking Algorithms - Grid Connected PV System – Overview of Islanding – Stand-alone PV systems – Concentrated Solar PV systems

UNIT III WIND ENERGY SYSTEMS **(9 Hrs)**

Nature and Power in the wind - Wind Energy Conversion System (WECS) - Components and Classification of a WECS - Yaw and Pitch Control - Betz model - Wind Turbines – Types - Horizontal and Vertical Axis Wind Turbines. Generators for WECS – Types - Selection of Generators – Permanent Magnet Synchronous Generators - Schemes for Fixed and Variable Speed Wind Turbines

UNIT IV FUEL CELLS **(9 Hrs)**

Principle and operation – Types –Efficiency –Effect of Polarization on Efficiency- Construction and Working of H2O2 and Proton Exchange Membrane Fuel Cell.Introduction to Hydrogen Energy Production and Storage.

UNIT V DISTRIBUTED GENERATION **(9 Hrs)**

Distributed Generation – Concept and topologies, Role of Renewable Energy in Distributed Generation, Standards for Interconnecting Distributed Generation to Power Systems – Concept of Virtual Power Plants, Captive Power Generation – Combined Heat and Power Generation.

TEXT BOOKS

1. Khan B H, —Non-Conventional Energy Resourcesll, Tata McGraw-Hill, New Delhi 2010
2. Mukund R Patel, —Wind and Solar Power Systemsll, CRC Press, New York, 2011.

REFERENCES

1. Rai G D, "Non-Conventional Energy Sources", Khanna Publishers, New Delhi, 2004.
2. Bhadra S N, Banerjee S, Kastha D, — Wind Electrical Systems ll, Oxford University Press, New Delhi, 2008
3. Colleen Speigel, —PEM Fuel Cell Modeling and Simulation Using MATLABll, Academic Press, New Delhi, 2008
4. Roger A. Messenger, "Photovoltaic Systems Engineering", CRC Press, New York, 2010

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

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

U19ICE87	INDUSTRY 4.0	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To provide the knowledge of advanced technology and materials
- To learn the technology and tools used for bio engineering
- To learn the advancement in built environment
- To provide the knowledge of smart manufacturing
- To provide the knowledge of smart world

Course Outcomes

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

CO1 - Know the advanced technologies. **(K1)**
CO2 - Transform the technology in bioengineering. **(K1,K2)**
CO3 - Adapt the knowledge in built environment. **(K1,K3)**
CO4 - Acquire knowledge in manufacturing. **(K1,K2)**
CO5 - Design the smart world. **(K1,K3)**

UNIT I ADVANCED TECHNOLOGY AND ADVANCED MATERIALS (9 Hrs)

Advanced electro-optical sensing technology-active, passive multi-spectral and hyper spectral imaging; electronic beam steering; vacuum technology, surface and coating technology, health care technology, Nanotechnology-Nanomechanics, Nano optoelectronics; energy storage technology-next generation Li-based Batteries, Hydrogen storage, solar photovoltaic's, Flexible electronics. Intellectual Property Rights - case studies governing/pertaining to Materials/Technology.

UNIT II TRANSFORMING TECHNOLOGIES IN BIOENGINEERING (9 Hrs)

Establishment of smart biotechnology factory, Artificial intelligence in Bioprocess technology, Omics – Big data analysis through automation, 3D bio printing for tissue engineering. Simulation tools, RSM and Box model. Cyber physical system based telemedicine, diagnosis and therapeutics through real time biosensors. Bionanotechnology. Intellectual Property rights (IPR): Case Studies.

UNIT III ADVANCEMENTS IN SUSTAINABLE BUILT ENVIRONMENT (9 Hrs)

Introduction – Technological developments in Architectural, Engineering and Construction (AEC) - Building Information Modelling (BIM) using Cloud computing technology and Internet of things (IoT) – Unmanned Aerial Vehicles, sensors – Additive manufacturing in construction – Concrete 3D printing - Materials used - Lightweight and functionally graded structures - Net Zero Energy buildings, Bioswales, Biofiltration pond, Ecosan systems- Recent developments in Waste water Management, Air pollution control, waste disposal - Integration of energy, water and environmental systems for a sustainable development- Emerging Technologies: Robot Highway- Vertical farming - Intellectual Property rights: Case studies.

UNIT IV SMART MANUFACTURING (9 Hrs)

Smart factories and interconnection, Smart Manufacturing – automation systems, Additive Manufacturing, Smart grids, Micro Electro Mechanical Systems (MEMS), Stealth technology, Metal Finishing, Self-propelled vehicles, e mobility, Green fuels, drones – unmanned aerial vehicles(UAVs), aerodynamics. Robotic Automation and Collaborative Robots – Augmented reality and haptics, engineering cybernetics and artificial intelligence (AI), Disruptive Technologies – Frugal Innovations –Emerging Technologies- Autonomous Robots, Swam Robot, Modular Robotics, Space craft, Intellectual Property Rights (IPR): Case Studies.

UNIT V SMART WORLD (9 Hrs)

Smart Sensors and IIOT, Smart grid, Hybrid renewable energy systems, Electronics in Smart city, Integration of Sensors in Robots and Artificial Intelligence, 5G Technology, Communication protocols, Human-Machine Interaction, Virtual Reality, Quantum Computing: Changing trends in transistor technology: Processor, Emerging Trends: Deep Space, Swarm Robots, Cyborg, Geofencing, Pervasive Computing, Intellectual Property Rights- Case Studies.

Text Books

1. William D. Callister, "Materials Science and Engineering:An Introduction", John Willey and Sons Inc. Singapore, 2001.
2. V. Raghavan, "Physical Metallurgy: Principle and Practice", Prentice Hall India Pvt Ltd, 2006.
3. Flavio Craveiro, Jose Pinto Duarte, Helena Bartolo and Paulo Jorge Bartolo,"Additive manufacturing as an enabling technology for digital construction: A perspective on Construction 4.0", Automation in Construction, Vol. 103,pp. 251-267, 2019.

Reference Books

1. Klaus Schwab, "Fourth Industrial Revolution", Random House USA Inc, New York, USA, 2017.
2. Oliver Grunow, "SMART FACTORY AND INDUSTRY 4.0. The current state of Application Technologies", Study lab Publications, 2016.
3. Alasdair Gilchrist, "INDUSTRY 4.0: Industrial Internet of Things", Apress, 2016.
4. Sang C. Suh, U. John Tanik, John N Carbone, Abdullah Eroglu, "Applied Cyber-Physical Systems", Springer Publications, New York, 2013.

Web References

1. https://nptel.ac.in/courses/106/105/106105195/

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

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

U19ICE88	CYBER SECURITY IN INDUSTRIAL AUTOMATION	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives
- To get adequate knowledge on the security process for Industrial Control System.
- To learn about the threats in Industrial Control System
- To gain more idea and to apply Industrial Control System vulnerabilities
- To Develop critical thinking for Cyber security in SCADA system
- To make the students to understand and to apply Industrial Sectors Cyber Security

Course Outcomes

Upon completion of the course, students shall have ability to

CO1 - Learn detail about cyber security for Industrial Control System. **(K1)**
CO2 - Describe about threats in Industrial Control System. **(K1,K2)**
CO3 - Gain basic idea and to apply Industrial Control System vulnerabilities. **(K1, K3)**
CO4 - Develop critical thinking for Cyber security in SCADA system. **(K1,K2,K3)**
CO5 - Understand and apply Industrial Sectors Cyber Security. **(K1,K3)**

UNIT I CYBER SECURITY FOR INDUSTRIAL CONTROL SYSTEM (9 Hrs)

Industrial Control System-Industrial control system security different than regular IT security-ICS-ICS compare to safety instrument system-Components of Typical ICS/SCADA systems-SCADA system-Supervisory Control and Data Acquisition-Remote Terminal Unit (RTU)-Distributed Control System (DCS)-Programmable Logic Controller.

UNIT II THREATS TO ICS (9 Hrs)

Threats to ICS: Threat treatment in ICS and IT-Threats to ICS-Threat –to and threat-from-most series treat to ICS-Hi-jacking malware-The reproductive cycle of modern malware- A socks 4/sock 5/HTTP connect proxy-SMTP spam engine-porn dialers

UNIT III ICS VULNERABILITIES (9 Hrs)

ICS Vulnerability versus IT vulnerability-Availability, Integrity and Confidentiality-Purdue Enterprise Reference Architecture-PERA levels-Levels 5- level 4-level 3-level 2-level1-level 0- an ironic comment on PERA

UNIT IV CYBER SECURITY FOR SCADA SYSTEMS (9 Hrs)

SCADA security architecture: Commercial hardware and software vulnerabilities-Operating system-TCP/IP Firewalls-Traditional security feature of SCADA system-Eliminating the vulnerabilities of SCADA system reporting and investigation – measuring safety performance – workman compensation rules.

UNIT V INDUSTRIAL SECTORS CYBER SECURITY (9 Hrs)

ICS Application security: Application security-Application security testing_ ICS application patching-ICS secure SDLC-Case Studies: Water/waste water industry specific cyber security-Piping Industry-specific cyber security issues-Emerging cyber threat to SCADA system

Text Books

1. Pascal Ackerman "Industrial Cyber Security Efficiently secure critical infrastructure systems", Packt Publisher, 2017.
2. William T.Shaw, "Cyber security for SCADA systems", Pennwel publisher, 2006.

Reference Books

1. Culp. A. W, "Principles of Energy Conservation", McGraw Hill Book Co., 2012
2. R.A.Kisner, W.W.Manges, "Cyber security through Real-time Distributed Control Systems", UT-Battelle.

Web Resources

1. https://www.assetguardian.com/cyber-security-management-of-industrial-automation-and-control-systems-iacs/
2. https://www.youtube.com/watch?v=SCzdtXDus7A

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

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

U19ICE89	PIPING AND INSTRUMENTATION DIAGRAM	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives:

- To introduce various flow sheet design using process flow diagram.
- To impart knowledge on P and I D symbols for pumps, compressors and process vessels.
- To learn about the control systems and interlocks
- To explore the line diagram symbols, logic gates of instruments.
- To learn the applications of P and I.

Course Outcomes:

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

CO1 - Learn the basic knowledge of flow sheet design. **(K1)**
CO2 - Understand of P and I diagrams standards involved and its preparation. **(K1,K2)**
CO3 - Select different control systems and interlocks for instruments installation used for the preparation of P and IDs. **(K1,K2, K3)**
CO4 - Utilize software for preparation of P and IDs. **(K1, K2)**
CO5 - Learn the applications of P and ID. **(K1,K3)**

UNIT I FLOW SHEET DESIGN (9 Hrs)

Types of flow sheets, flow sheet presentation, flow sheet symbols, line symbols and designation, process flow diagram, synthesis of steady state flowsheet, flowsheeting software.

UNIT II PIPING AND INSTRUMENTATION DIAGRAM EVALUATION AND PREPARATION (9 Hrs)

P and I D Symbols, line numbering, line schedule, P and I D development, various stages of P and I D, P and I D for pumps, compressors process vessels, absorber, evaporator.

UNIT III CONTROL SYSTEMS AND INTERLOCKS FOR PROCESS OPERATION (9 Hrs)

Introduction and description, need of interlock, types of interlocks, interlock for pumps, compressor, heater-control system for heater, distillation column, expander

UNIT IV INSTRUMENT LINE DIAGRAM (9 Hrs)

Line diagram symbols, logic gates, representation of line diagram.

UNIT V APPLICATION OF P AND ID'S (9 Hrs)

Applications of P and ID in design state, construction stage, commissioning state, operating stage, revamping state, applications of P and ID in HAZAMPS and risk analysis

Text Books

1. Ernest E.Ludwig, Applied Process Design for Chemical and Petrochemical Plants Vol-1, Gulf Publishing Company, Hoston,1989.
2. Max. S. Peters and K.D.Timmerhaus, Plant Design and Economics for Chemical Engineers, McGraw Hill Inc., New York, 1991.

Reference Books

1. Anil Kumar, Chemical Process Synthesis and Engineering Design, Tata McGraw Hill, New Delhi, 1981.
2. A.N.Westerberg et al., Process Flowsheeting, Cambridge University Press, New Delhi,1979.

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

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

Open Electives

R-2019

U19EEO41	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 – Perfomance 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.

Web References

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

U19EEO42	ELECTRICAL SAFETY (Common to ECE, ICE, MECH, CIVIL, Mechatronics, BME, IT, CSE)	L	T	P	C	Hrs
		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.

Web References

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 & lastem 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

Web References
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

U19ECO42	CONSUMER ELECTRONICS (Common to EEE, ICE, CSE, MECH, IT, CIVIL, BME, Mechatronics)	L	T	P	C	Hours
		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 TD7021T, 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

Web References

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

U19CSO41	WEB DEVELOPMENT (Common to EEE, ECE, ICE, MECH, CIVIL, BME, Mechatronics)	L	T	P	C	Hrs
		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.

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. 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.

Web References

1. https://www.w3schools.com
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

U19CSO42	ANALYSIS OF ALGORITHMS (Common to EEE, ECE, ICE, MECH, CIVIL, BME, Mechatronics)	L	T	P	C	Hrs
		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, 3rd Edition, 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.

Web References

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

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

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	-	-	-

U19IT041 **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 SystemsI, 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

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	L	T	P	C	Hrs
	(Common to EEE, ECE, ICE, CIVIL, BME)	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.

Web References

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=WXmldbVDJqE
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

U19BMO41	MEDICAL ELECTRONICS (Common to EEE, ECE, CSE, IT, ICE, MECH, Mechatronics)	L	T	P	C	Hrs
		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.

Web References

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

U19CCO41	BASIC DBMS (Common to EEE, ECE, MECH, CIVIL, ICE, Mechatronics, BME Branches)	L	T	P	C	Hrs
		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.

Web References

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
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

U19CCO42	INTRODUCTION TO COMMUNICATION SYSTEMS (Common to EEE, CSE, IT, MECH, CIVIL, ICE, Mechatronics)	L	T	P	C	Hrs
		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
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

U19ADO41	KNOWLEDGE REPRESENTATION AND REASONING	L	T	P	C	Hrs
	(Common to EEE, ECE, CSE, IT, ICE, MECH, CIVIL, CCE, BME, Mechatronics)	3	0	0	3	45

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 processes based on its context techniques.
- To understand process, knowledge acquisition and sharing of ontology.

Course Outcomes

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

CO1 -Analyze 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 the process according to the context. **(K3)**
CO5 - Learn the process, knowledge acquisition and sharing of ontology. **(K2)**

UNIT I EVOLUTION OF KNOWLEDGE REPRESENTATION (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 ONTOLOGY AND ITS CLASSIFICATION (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 KNOWLEDGE REPRESENTATION (9 Hrs)

Knowledge Representations: Knowledge Engineering, Representing structure in frames, Rules and data, Object-oriented systems, Natural language Semantics, Levels of representation.

UNIT IV PROCESSES, CONTEXTS AND AGENTS (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 KNOWLEDGE SOUP, ACQUISITION AND SHARING (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; 1st edition, 1991.

Reference Books

1. Trevor Bench-Capon, "Knowledge representation: an approach to artificial intelligence", Academic Press, 2014.
2. Yulia Kahl, 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. Sanida Omerović, Grega Jakus, V. Milutinovic, Sašo Tomažič "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	2	-	-	-	-	-	-	-	1	-	-
2	2	2	2	2	2	-	-	-	-	-	-	-	1	-	-
3	1	2	1	2	2	-	-	-	-	-	-	-	-	-	-
4	1	2	1	2	1	-	-	-	-	-	-	-	-	-	-
5	2	1	2	1	2	-	-	2	-	-	-	-	-	-	-

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

U19ADO42	INTRODUCTION TO DATA SCIENCE (Common to EEE, ECE, CSE, IT, ICE, MECH, CIVIL, CCE, BME, Mechatronics)	L	T	P	C	Hrs
		3	0	0	3	45

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 **(9 Hrs)**

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 **(9 Hrs)**

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.

UNIT III DATA SCIENCE TOOLS **(9 Hrs)**

Introduction to Data Science Tool – Data Cleaning Tools – Data Munging and Modelling Tools – Data Visualization Tools – Tools for Data Science.

UNIT IV INDUSTRIALIZATION, OPPORTUNITIES AND APPLICATIONS **(9 Hrs)**

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 **(9 Hrs)**

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. Mc Owan, "The Power of Computational Thinking", World Scientific Publishing, 2017.
3. Steven S. Skiena, "Data Science Design Manual", Spring International Publication, 2017.
4. Rajendra Akerkar, Priti Srinivas Sajja, "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	2	2	2	-	-	-	-	-	-	-	-	-	-
2	2	2	2	1	1	-	-	-	-	-	-	-	-	-	-
3	2	1	2	2	1	-	-	-	-	-	-	-	-	1	-
4	1	2	2	1	1	-	-	-	-	-	-	-	-	-	-
5	2	1	1	2	1	-	-	1	-	-	-	-	-	1	-

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

U19HSO51	PRODUCT DEVELOPMENT AND DESIGN	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To provide the basic concepts of product design, product features and its architecture.
- To have a basic knowledge in the common features a product has and how to incorporate them suitably in product.
- To enhance team working skills.
- To design some products for the given set of applications.
- To compete with a set of tools and methods for product design and development.

Course Outcomes

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

CO1 - Apply the concept for new product development. **(K3)**
CO2 - Validate knowledge on the concepts of product specification. **(K5)**
CO3 - Describe the principles of industrial design and prototyping. **(K2)**
CO4 - Apply knowledge on product architecture. **(K3)**
CO5 - Review the concept of product development and customer needs. **(K5)**

UNIT I: INTRODUCTION TO PRODUCT DEVELOPMENT (9 Hrs)

Product development versus design, product development process, product cost analysis, cost models, reverse engineering and redesign product development process, new product development, tear down method.

UNIT II: PRODUCT SPECIFICATIONS (9 Hrs)

Establishing the product specifications– Target specifications – Refining specifications, concept generation-Clarify the problem – Search Internally – Search externally – Explore systematically - Reflect on the Results and the Process.

UNIT III: PRODUCT CONCEPTS (9 Hrs)

A: Concept generation, product configuration, concept evaluation and selection, product embodiments.
B: Quality function deployment, product design specification, physical prototypes-types and technique, dimensional analysis, design of experiments.

UNIT IV: PRODUCT ARCHITECTURE (9 Hrs)

Concept selection- Screening – scoring, Product architecture – Implication of architecture - Establishing the architecture – Related system level design issues.

UNIT V: PROTOTYPING (9 Hrs)

Reliability, failure identification techniques, Poka-Yoke, Design for the environment, design for maintainability, product safety, liability and design, design for packaging.

Text Books

1. Karl T.Ulrich and Steven D.Eppinger,"Product Design and Development", McGraw-Hill International Edns.
2. Stephen Rosenthal, "Effective Product Design and Development", Business One Orwin, Homewood,
3. Otto, K. N. Product design: techniques in reverse engineering and new product development.

Reference Books

1. Ashby, M. F., & Johnson, K... Materials and design: the art and science of material selection in product design. Butterworth-Heinemann.

2. Kevin Otto and Kristin Wood, "Techniques in Reverse Engineering and New Product Development", Pearson Education, Chennai, Edition III.
3. Chitale A.V. and Gupta R.C., "Product Design and Manufacturing", 6th Edition, PHI.
4. Taurt Pugh,"Tool Design – Integrated Methods for Successful Product Engineering", Addison Wesley Publishing, New york, NY
5. Kumar, A., Jain, P. K., & Pathak, P. M. Reverse engineering in product manufacturing: an overview. DAAAM international scientific book,

Web References

1. http://www.worldcat.org/title/product-design-and-development/oclc/904505863
2. https://www.pdfdrive.com/product-design-and-development-e38289913.html
3. https://www.smashingmagazine.com/2018/01/comprehensive-guide-product-design/
4. https://www.smashingmagazine.com/2018/01/comprehensive-guide-product-design/
5. https://ocw.mit.edu/courses/sloan-school-of-management/15-783j-product-design-and-development-spring-2006/lecture-notes/clas1_int_crse_6.pdf
6. https://swayam.gov.in/nd1_noc20_de05/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	-	-	-
2	1	-	2	-	3	-	-	-	-	-	-	3	-	-	-
3	1	-	3	-	2	-	-	-	-	-	-	2	-	-	-
4	3	-	1	-	3	-	-	-	-	-	-	1	-	-	-
5	1	-	3	-	3	-	-	-	-	-	-	2	-	-	-

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

U19HSO52	INTELLECTUAL PROPERTY RIGHTS	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To introduce fundamental aspects of Intellectual Property Rights to students who are going to play a major role in development and management of innovative projects in industries.
- To disseminate knowledge on patents, patent regime in India and abroad and registration aspects
- To disseminate knowledge on copyrights and its related rights and registration aspects
- To disseminate knowledge on trademarks and registration aspects
- Awareness about current trends in IPR and Government steps in fostering IPR

Course Outcomes

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

CO1: Complete their academic projects, shall get an adequate knowledge on patent and copyright for their innovative research works **(K2)**
CO2: Presenting useful insight on novelty of their idea from state-of-the art search during their project work period. **(K3)**
CO3: Posting Intellectual Property as a career option like R&D IP Counsel, Government Jobs – Patent Examiner, Private Jobs, Patent agent and/or Trademark agent and Entrepreneur **(K5)**
CO4: To disseminate knowledge on Design, Geographical Indication, Plant Variety and Layout Design Protection and their registration aspects **(K1)**
CO5: Organizing their idea or innovations and analyse ethical and professional issues which arise in the intellectual property law context. **(K4)**

UNIT I OVERVIEW OF INTELLECTUAL PROPERTY (9 Hrs)

Introduction and the need for intellectual property right (IPR) - Kinds of Intellectual Property Rights: Patent, Copyright, Trade Mark, Design, Geographical Indication, Plant Varieties and Layout Design – Genetic Resources and Traditional Knowledge – Trade Secret - IPR in India : Genesis and development – IPR in abroad - Major International Instruments concerning Intellectual Property Rights: Paris Convention, 1883, the Berne Convention, 1886, the Universal Copyright Convention, 1952, the WIPO Convention, 1967,the Patent Co-operation Treaty, 1970, the TRIPS Agreement, 1994

UNIT II PATENTS (9 Hrs)

Patents - Elements of Patentability: Novelty, Non Obviousness (Inventive Steps), Industrial Application - Non - Patentable Subject Matter - Registration Procedure, Rights and Duties of Patentee, Assignment and licence, Restoration of lapsed Patents, Surrender and Revocation of Patents, Infringement, Remedies & Penalties - Patent office and Appellate Board

UNIT III COPYRIGHTS (9 Hrs)

Nature of Copyright - Subject matter of copyright: original literary, dramatic, musical, artistic works; cinematograph films and sound recordings - Registration Procedure, Term of protection, Ownership of copyright, Assignment and licence of copyright - Infringement, Remedies & Penalties – Related Rights - Distinction between related rights and copyrights

UNIT IV TRADEMARKS **(9 Hrs)**

Concept of Trademarks - Different kinds of marks (brand names, logos, signatures, symbols, well known marks, certification marks and service marks) - Non Registrable Trademarks - Registration of Trademarks - Rights of holder and assignment and licensing of marks - Infringement, Remedies & Penalties - Trademarks registry and appellate board

UNIT V OTHER FORMS OF IP **(9 Hrs)**

Design: meaning and concept of novel and original - Procedure for registration, effect of registration and term of protection Geographical Indication (GI) Geographical indication: meaning, and difference between GI and trademarks - Procedure for registration, effect of registration and term of protection.

Text Books

1. Nithyananda, K V. Intellectual Property Rights: Protection and Management. India, IN: Cengage Learning India Private Limited, 2019
2. Neeraj, P., & Khusdeep, D. Intellectual Property Rights. India, IN: PHI learning Private Limited. 2014

Reference Books

1. Ahuja, V K. Law relating to Intellectual Property Rights. India, IN: Lexis Nexis, 2017.
2. Deborah E. Bouchoux, Intellectual Property: The Law of Trademarks, Copyrights, Patents and Trade Secrets, Cengage Learning, Third Edition, 2012.
3. Edited by Derek Bosworth and Elizabeth Webster, The Management of Intellectual Property, Edward Elgar Publishing Ltd., 2013.
4. Prabuddha Ganguli, Intellectual Property Rights: Unleashing the Knowledge Economy, McGraw Hill Education, 2011.
5. S.V. Satakar, Intellectual Property Rights and Copy Rights, Ess Ess Publications, New Delhi, 2002.
6. V. Scople Vinod, Managing Intellectual Property, Prentice Hall of India pvt Ltd, 2012.

Web References

1. Subramanian, N., & Sundararaman, M. (2018). Intellectual Property Rights – An Overview. Retrieved from http://www.bdu.ac.in/cells/ipr/docs/ipr-eng-ebook.pdf
2. World Intellectual Property Organisation. (2004). WIPO Intellectual property Handbook. Retrieved from https://www.wipo.int/edocs/pubdocs/en/intproperty/489/wipo_pub _489.pdf
3. Cell for IPR Promotion and Management (http://cipam.gov.in/)
4. World Intellectual Property Organisation (https://www.wipo.int/about-ip/en/)
5. Office of the Controller General of Patents, Designs & Trademarks (http://www.ipindia.nic.in/)
6. Journal of Intellectual Property Rights (JIPR): NISCAIR

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

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

U19HSO53	MARKETING MANAGEMENT AND RESEARCH	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To facilitate understanding of the conceptual framework of marketing in engineering.
- To understand the concepts of product and market segmentation for engineering services and technological products.
- Analyzing the various pricing concepts and promotional strategies for engineering and technology markets.
- Learn to focus on a research problem using scientific methods in engineering and technological enterprises.
- To be able to design and execute a basic survey research reports in in engineering and technological enterprises

Course Outcomes

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

CO1 - Analyze the fundamental principles involved in managing engineering and technological markets **(K3)**

CO2 - Understand and develop product, and Market Segmentation for engineering services and technological Products **(K4)**

CO3 - Develop pricing and promotional strategies for engineering and technology markets **(K6)**

CO4 - Analyze market problems and be capable of applying relevant models to generate appropriate solutions to meet challenges in engineering and technological enterprises **(K3)**

CO5 - Identify the interrelationships between market trends, innovation, sustainability and communication in engineering and technological enterprises **(K5)**

UNIT I MARKETING – AN OVERVIEW **(9 Hrs)**

Definition, Marketing Process, Dynamics, Needs, Wants and Demands, Marketing Concepts, Environment, Mix, Types, Philosophies, Selling vs Marketing, Consumer Goods, Industrial Goods.

UNIT II PRODUCT AND MARKET SEGMENTATION **(9 Hrs)**

Product, Classifications of product, Product Life Cycle, New product development, Branding, Segmentation factors, Demographic, Psycho graphic and Geographic Segmentation, Process, Patterns, Services marketing and Industrial marketing.

UNIT III PRICING AND PROMOTIONAL STRATEGIES **(9 Hrs)**

Price: Objectives, Pricing Decisions and Pricing Methods, Pricing Management. Advertising-Characteristics, Impact, Goals, Types, Sales Promotion – Point of purchase, Unique Selling Propositions, Characteristics, Wholesaling, Retailing, Channel Design, Logistics.

UNIT IV RESEARCH AND ITS FUNDAMENTALS **(9 Hrs)**

Research: Meaning, Objectives of Research, Types of Research, Significance of Research - Methods Vs Methodology - Research Process – Components of Research Problem, Literature Survey – Primary Data and Secondary Data, Questionnaire design, Measurement and Scaling Techniques.

UNIT V BASIC STATISTICAL ANALYSIS AND REPORT WRITING **(9 Hrs)**

Fundamentals of Statistical Analysis and Inference- Measures of Central Tendency -Measures of Dispersion - Measures of Asymmetry - Report Writing: Types of research reports, Techniques of Interpretation, Precautions in Interpretation, Significance of Report Writing, Different Steps in Report Writing, Layout of Research Report, Mechanics of Writing Research Report, Ethics in Research

Text Books

1. Philip Kolter & Keller, "Marketing Management", Prentice Hall of India, 14th edition, 2012.
2. Lilien, Gary I., and Arvind Rangaswamy. "Marketing managers make ongoing decisions about product features, prices, distribution options", The Handbook of Marketing Research: Uses, Misuses, and Future Advances (2006).

Reference Books

1. Chandrasekar. K.S., "Marketing Management Text and Cases", 1st Edition, Tata McGraw Hill - Vijaynicole, 2010.
2. Kothari, C. "Research Methodology Methods and Techniques", New Age International (P) Ltd., 2017
3. RajanSexena. Marketing Management: Text cases in Indian Context.(3rd edition) New Delhi, Tata McGraw hill, 2006
4. Moisander J, Valtonen A, "Qualitative marketing research: A cultural approach", Sage Publisher, 2006.
5. Malhotra NK, Satyabhushan Dash, "Marketing Research: An Applied Orientation", 7th ed, Pearson Education, 2019

Web References

1. https://swayam.gov.in/nd1_noc20_mg26/preview
2. https://swayam.gov.in/nd1_noc20_mg26/preview
3. https://www.entrepreneur.com/encyclopedia/market-research

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

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

U19HSO54	PROJECT MANAGEMENT FOR ENGINEERS	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To understand the various concepts and steps in project management.
- To familiarize the students with the project feasibility studies and project life cycle
- To enable the students to prepare a project schedule
- To understand the risk management and project Control process.
- To learn about the closure of a project and strategies to be an effective project manager.

Course Outcomes

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

CO1 - Interpret the different concepts and the various steps in defining a project. **(K2)**
CO2 - Examining the feasibility of a project. **(K3)**
CO3 - Build a schedule for a Project. **(K6)**
CO4 - Predict the risk associated with a project and demonstrate the project audit. **(K2)**
CO5 - Analyse the project team and outline the Project closure. **(K4)**

UNIT I PROJECT MANAGEMENT CONCEPTS (9 Hrs)

Project: Meaning, Attributes of a project, Project Life cycle, Project Stakeholders, Classification, Importance of project management, Project Portfolio Management System, Different Project Management Structure, Steps in Defining the Project, Project Rollup – Process breakdown structure – Responsibility Matrices – External causes of delay and internal constraints

UNIT II PROJECT FEASIBILITY ANALYSIS (9 Hrs)

Opportunity Studies, Pre-Feasibility studies, and Feasibility Study: Market Feasibility, Technical Feasibility, Financial Feasibility and Economic Feasibility. Financial and Economic Appraisal of a project, Social Cost Benefit Analysis in India and Project Life Cycle.

UNIT III PROJECT SCHEDULING & NETWORK TECHNIQUES (9 Hrs)

Scheduling Resources and reducing Project duration: Types of project constraints, classification of scheduling problem, Resources allocation methods, Splitting, Multitasking, Benefits of scheduling resources, Rationale for reducing project duration, Options for accelerating Project completion
Developing and Constructing the Project Network (Problems), PERT, CPM; Crashing of Project Network,

UNIT IV PROJECT RISK MANAGEMENT AND PROJECT CONTROL (9 Hrs)

Project Risk management; Risk concept, Risk identification, Risk assessment, Risk response development, Contingency planning, Contingency funding and time buffers, Risk response control, and Change control management
Budgeting and Project Control Process, Control issues, Tendering and Contract Administration. Steps in Project Appraisal Process and Project Audits

UNIT V PROJECT CLOSURE AND MANAGING PROJECT (9 Hrs)

Project Closure: Team, Team Member and Project Manager Evaluations. Managing versus Leading a Project: Qualities of an Effective Project Manager, Managing Project Stakeholders, Managing Project Teams: Five Stage Team Development Model, Situational factors affecting team development and project team pitfalls.

Text Books

1. Erik Larson and Clifford Gray. "Project Management: The Managerial Process". 6th Edn. McGraw Hill Education; 2017.
2. Harold Kerzner. "Project Management: A systems approach to Planning, Scheduling and Controlling. 12th Edn. John Wiley & Sons; 2017

Reference Books

1. Meredith, J.R. & Mantel, S. J. "Project Management- A Managerial Approach". John Wiley.:2017
2. Prasanna Chandra. "Projects: Planning, Analysis, Selection, Financing, Implementation, and Review". 9th Edn. McGraw Hill Education; 2019.
3. B C Punmia by K K Khandelwal. "Project Planning and Control with PERT and CPM". 4th Edn. Laxmi Publications Private Limited; 2016.
4. Hira N Ahuja, S.P.Dozzi, S.M.Abourizk. "Project Management". 2nd Edn. Wiley India Pvt Ltd; 2013.
5. "A guide to Project Management Body of Knowledge". 6th Edn. Project Management Institute; 2017

Web Resources

1. www.pmi.org
2. www.projectmanagement.com
3. https://www.sciencedirect.com/journal/international-journal-of-project-management
4. https://nptel.ac.in/courses/110/107/110107081/
5. https://nptel.ac.in/courses/110/104/110104073/

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

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

	L	T	P	C
U19HSO55 FINANCE FOR ENGINEERS	3	0	0	3

Course Objectives

- To develop a deeper understanding of the fundamentals of Accounting and Finance
- To learn how to apply mathematical principles in Finance and the concepts of Risk and Return
- To understand the need and procedure for conducting Financial Analysis for better decision-making
- To be familiar with the modes of generating funds for business and their implications
- To understand the scientific ways to determine deployment of funds in business

Course Outcomes

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

CO1: Understand basic concepts in accounting and finance and their importance for engineers **(K2)**

CO2: Demonstrate knowledge and understanding of the applications of mathematics in finance **(K3)**

CO3: Conduct Financial Analysis and use the outcome in making informed decisions in investing **(K4)**

CO4: Identify and Appreciate various sources of procurement of funds in business and their critical evaluation **(K2)**

CO5: Know how to scientifically determine the investing in long-term and short-term assets in business **(K3)**

UNIT I UNDERSTANDING THE FUNDAMENTALS **(9 Hrs)**

Assets – Need and Functions of Assets – Types of Assets – Factors determining Investments in Assets. Liabilities – Meaning and Functions of Liabilities – Types of Liabilities – Capital as a Liability: Why and How — Concept and Meaning of Finance – Distinction between Accounting and Finance – Significance of Accounting and Finance for Engineers.

UNIT II MATHEMATICS OF FINANCE **(9 hrs)**

Time Value of Money – Computation of Present Value and Future Value – Implications of TVM in Financial Decisions – Concept of Risk and Return – Measuring Risk and Return – Concept of Required Rate of Return and its significance in Investment Decisions.

UNIT III FINANCIAL ANALYSIS **(9 hrs)**

Meaning and Objectives of Financial Analysis – Annual Report As an Input for Analysis – Basic Understanding of Annual Reports - Tools of Financial Analysis – Horizontal Analysis – Vertical Analysis – Trend Analysis – Accounting Ratios – Significance of Ratio Analysis in Decision-making – Snap-shot of the Past to predict the Future – Computation of Key Ratios – Liquidity Ratios – Profitability Ratios – Performance Ratios – Ratios that are helpful for Potential Investors.

UNIT IV FUNDS PROCUREMENT **(9 hrs)**

Meaning of Funds – Sources of Funds – Long-Term Sources – Short-Term Sources – Financing Decisions in Business – Capital Structure – Need and Importance of Capital Structure – Determining Optimum Capital Structure – Concept and Computation of Earnings Before Interest and Tax (EBIT), Earnings Before Tax (EBT), and Earnings After Tax (EAT)(Simple Problems) - Leverage in Finance – Types and Computation of Leverages – Operating Leverage, Financial Leverage, and Combined Leverage.

UNIT V FUNDS DEPLOYMENT (9 hrs)

Investment Decisions – Types of Investment Decisions: Long-Term Investment Decisions. Significance – Methods: Pay-Back Period Method, Net Present Value Method and Benefit-Cost Ratio Method. Short-Term Investment Decisions – Concept of Working Capital – Need and Importance of Working Capital in Business – Determinants of Working Capital in a Business. Components of Working Capital. Dividends: Concept and Meaning – Implications of Dividend Decisions on Liquidity Management.

Text Books

1. R. Narayanaswamy, Financial Accounting – A managerial perspective, PHI Learning, New Delhi. (2015 or later edition)
2. C. Paramasivan and T. Subramanian. Financial Management. New Age International, New Delhi. (2015 or later edition)

Reference Books

1. S.N. Maheswari, Sharad K. Maheswari & Suneel K. Maheswari. Accounting For Management. Vikas Publishing (2017 or later edition)
2. Varun Dawar & Narendar L. Ahuja. Financial Accounting and Analysis. Taxmann Publications. (2018 or later edition)
3. Athma. P. Financial Accounting and Analysis. Himalaya Publishing House. (2017 or later edtion)
4. Prasanna Chandra. Financial Management. Tata-McGraw Hill Publishers, New Delhi. (2019 or later edition)
5. S.C. Kuchhal. Financial Management. Chaitanya Publishing House, Allahabad. (2014 or later edition)

Web Resources

1. http://www.annualreports.com/
2. http://www.mmachennai.org/
3. https://finance.yahoo.com/
4. https://icmai.in/icmai/
5. https://nptel.ac.in/courses/110/107/110107144/
6. https://web.utk.edu/~jwachowi/wacho_world.html
7. https://www.icai.org/indexbkp.html
8. https://www.icsi.edu/home/
9. https://www.investopedia.com/
10. https://www.moneycontrol.com/
11. https://www.rbi.org.in/

COs/POs/PSOs Mapping

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

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

U19EEO63	CONVENTIONAL AND NON-CONVENTIONAL ENERGY SOURCES (Common to ECE, ICE, MECH, CIVIL, BME, Mechatronics)	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To get knowledge on the status of conventional and non-conventional energy resources in world.
- To have a clear idea about the operation of conventional power plant and its associated equipment's.
- To learn about the concept of energy harvesting of solar through thermal and PV module
- To understand the technological basis for harnessing wind energy.
- To get a clear knowledge on power generation using Ocean, Tidal Energy and Bio-Energy

Course Outcomes

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

CO1 – Identify the world and Indian energy scenario and the necessity of renewable energy sources **(K1)**
CO2 – Gain knowledge for the generation of electrical power from various power plants **(K1)**
CO3 – Analyze and compare the various solar harvesting techniques **(K3)**
CO4 – Describe the aerodynamics of wind turbines and calculate their power, energy production**(K1)**
CO5 – Describe the construction and working principle of various equipment's used in Ocean, Tidal Energy and Bio-Energy power plants**(K2)**

UNIT I ENERGY RESOURCES **(9 Hrs)**
Perspective of energy resources – Forms of Energy – Conventional and non-conventional sources of energy– World's energy status - Energy reserves in India. Limitations of Conventional sources of energy efficiency – Renewable Energy Sources – Energy parameters – Energy Intensity - Gross Domestic product.

UNIT II POWER PLANTS **(9 Hrs)**
Thermal power plant – layout, working principle. Gas turbine power plant – layout, working principle. Nuclear power plants: fuels, nuclear fuel cycle, reactors and nuclear waste management. Hydro Electric plants – Types, energy conversion schemes, environmental aspects.

UNIT III SOLAR ENERGY SYSTEMS **(9 Hrs)**
Solar radiation - Principles of solar energy collection –Types of collector – working principles - Characteristics - efficiency - Solar Energy applications – water heaters, air heaters, solar cooling; solar drying and power generation – solar tower concept – solar pump. Photovoltaic (PV) technology – photovoltaic effect – modelling - Characteristics – efficiency of solar cells.

UNIT IV WIND ENERGY SYSTEMS **(9 Hrs)**
General theory of wind mills – Types of wind mills – performance of wind machines–wind power – efficiency. Merits and Limitations of Wind energy system – Modes of wind power generation.

UNIT V ALTERNATE ENERGY SYSTEMS **(9 Hrs)**
Ocean and Tidal energy conversion - working principle of OTEC – Anderson closed cycle OTEC System. Tidal power – tides - tidal range - types of tidal power plants, single basin and double basins schemes. Bio-mass Energy – Biogas plants.

Text Books

1. S. Rao and Dr. B. B. Parulekar, "Energy Technology", Khanna Publication, 3rd Edition, 1999.
2. B. H. Khan, "Non-Conventional Energy Resources", Tata McGraw Hill Education, 2nd Edition, 2009.
3. D. P. Kothari, K. C. Singal, Rakesh Ranjan, "Renewable Energy Sources and Emerging Technologies", PHI, 2011

Reference Books

1. G. D. Rai, "Non-conventional energy sources", Khanna Publication. 4th Edition, 2002.
2. Pulfrey, David. L, "Photo voltaic Power Generation", Van Nostrand reinhold Company, 1983.
3. Abbasik, "Renewable Energy Sources and their Environment", PHI, 2008.
4. Steve Doty, Wayne C. Turner, "Energy Management Handbook", Fairmont Press, 8th Edition, 2012.
5. S.A.Abbasi and N. Abbasi, "Renewable Energy Sources and Their Environmental Impact", PHI, 2001.

Web References

1. https://www.tutorialspoint.com/renewable_energy/index.htm
2. https://nptel.ac.in/courses/112/107/112107291/
3. https://byjus.com/physics/conventional-and-nonconventional-sources-of-energy/
4. https://www.jagranjosh.com/general-knowledge/nonconventional-sources-of-energy-1448698715-1
5. https://wb.gov.in/departments-power-and-non-conventional-energy-sources.aspx

COs / POs and 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	2	-	1	2	-	-	-	-	1	-	1	1
2	3	1	1	2	-	1	2	-	-	-	-	1	-	1	1
3	3	1	1	2	-	1	2	-	-	-	-	1	-	1	1
4	3	1	1	2	-	1	2	-	-	-	-	1	-	1	1
5	3	1	1	2	-	1	2	-	-	-	-	1	-	1	1

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

U19EEO64	INDUSTRIAL DRIVES AND CONTROL (Common to ECE, ICE, MECH, Mechatronics)	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To introduce the concept of selection and Utilization of Electric drives.
- To understand power flow diagram for industrial process and drives.
- To introduce effect of heating and cooling characteristics of drives.
- To introduce the various speed control techniques for DC drives.
- To introduce the various speed control techniques for AC drives

Course Outcomes

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

CO1 – Select the appropriate motors to meet the load requirements.**(K3)**
CO2 – Explain the industrial process and selection of drives for various applications .**(K2)**
CO3 – Describe the thermal characteristics of electric motors.**(K1)**
CO4 – Analyze the speed torque characteristics of converter and chopper fed DC drives. **(K3)**
CO5 – Apply the various speed control methods for induction and synchronous motor.**(K3)**

UNIT I INTRODUCTION TO ELECTRIC DRIVES (9 Hrs)

Need for Drive – Concept of electric drives – Motors used in drives – Types of loads – Choices – Classification – Multi quadrant operation – Fundamental torque equation – Nature and classification of load torques.

UNIT II INDUSTRIAL PROCESS AND DRIVES (9 Hrs)

Process flow diagram of paper mill – Cement mill – Sugar mill – Steel mill –Textile mills – Hoists and cranes – Centrifugal pumps and compressors – Solar powered pump drives –Selection of drives.

UNIT III THERMAL CHARACTERISTICS OF ELECTRIC MOTORS (9 Hrs)

Effect of heating – Heating and cooling characteristics – Loading condition and classes of duty – Determination of rating of motors – Effect of load inertia – Load equalization – Environmental factors.

UNIT IV SPEED CONTROL OF DC DRIVES (9 Hrs)

Controlled rectifier fed separately excited DC drives – Single phase drives – Three phase drives – Four quadrant operation fully controlled rectifier – Rectifier control of DC series motor – Chopper control of separately excited and series DC motor.

UNIT V SPEED CONTROL OF AC DRIVES (9 Hrs)

VSI and CSI driven induction motor – Closed loop speed control - static rotor resistance control – Slip power recovery schemes – performance comparison of CSI and VSI fed drives – Variable frequency control of multiple synchronous motors.

Text Books

1. B. N. Sarkar, "Fundamentals of industrial drives", PHI Learning Pvt Ltd Education, 2011.
2. Gobal K. Dubey, "Fundamentals of Electrical Drives", Alpha Science Int. Ltd., Pangbourne, 2nd Edition, 2002.
3. R. Krishnan, "Electric Motor Drives–Modeling, Analysis and Control", Pearson Education, 1st Edition, 2002.

Reference Books

1. S. B. Dewan, G. R. Slemon & A. Stranghan, "Power Semiconductor controlled Drives", John willey Publication
2. KokKiong Tan & Andi Sudjana Putra, "Drives and Control for Industrial Automation Advances in Industrial Control", Springer Science & Business Media, 2010.
3. Juha Pyrhonen, Valeria Hrabovcova, R. Scott Semken, "Electrical Machine Drives Control: An Introduction", John Wiley & Sons, 2016

Web References

1. www.siemens.com/paperwww.siemens.com/cernet
2. www.siemens.com/metal
3. www.siemens.comn/sugar
4. www.abb.com/industries
5. www.krupp polysius.com
6. www.voith.paper.com
7. www.abb.com/drives

COs / POs and 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	1
2	3	2	2	-	-	-	-	-	-	-	-	-	-	1	1
3	3	3	3	1	-	-	-	-	-	-	-	-	-	1	1
4	3	3	3	1	-	-	-	-	-	-	-	-	-	1	1
5	3	3	3	1	-	-	-	-	-	-	-	-	-	1	1

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

U19ECO63	ELECTRONIC PRODUCT DESIGN AND PACKAGING	L	T	P	C	Hrs
		3	0	0	3	45

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

Course Objectives

- To provide basic knowledge about Electronic Product and Packaging
- To introduce and discuss various issues related to the system packaging
- To get clear idea about design of packages which can withstand higher temperature, vibrations and shock
- To Design of PCBs which minimize the EMI and operate at higher frequency
- To acquire depth knowledge about the concepts of Testing and testing methods

Course Outcomes

After completion of the course, students are able to

CO1 - Explain the basics of Electronic Product and Packaging. (K2)
CO2 - Infer various issues related to the system packaging. (K2)
CO3 - Summarize the clear idea about design of packages which can withstand higher temperature, vibrations and shock (K2)

CO4 - Describe the design of PCBs which minimize the EMI and operate at higher frequency (K2)
CO5 - Explain the various testing methods (K2)

UNIT I : OVERVIEW OF ELECT RONIC SYSTEMS PACKAGING (9 Hrs)
Definition of a system and history of semiconductors, Products and levels of packaging, Packaging aspects of handheld products, Definition of PWB, Basics of Semiconductor and Process flowchart, Wafer fabrication, inspection and testing, Wafer packaging; Packaging evolution; Chip connection choices, Wire bonding, TAB and flip chip.

UNIT II : SEMICONDUCTOR PACKAGES (9 Hrs)
Single chip packages or modules (SCM), Commonly used packages and advanced packages; Materials in packages; Thermal mismatch in packages; Multichip modules (MCM)-types; System-in-package (SIP); Packaging roadmaps; Hybrid circuits;

UNIT III ELECTRICAL ISSUES IN PACKAGING (9 Hrs)
Electrical Issues of Systems Packaging, Signal Distribution, Power Distribution, Electromagnetic Interference, Transmission Lines, Clock Distribution, Noise Sources, Digital and RF Issues. Design Process Electrical Design: Interconnect Capacitance, Resistance and Inductance fundamentals; Packaging roadmaps – Hybrid circuits – Resistive, Capacitive and Inductive parasitic

UNIT IV CHIP PACKAGES (9 Hrs)
IC Assembly – Purpose, Requirements, Technologies, Wire bonding, Tape Automated Bonding, Flip Chip, Wafer Level Packaging, reliability, wafer level burn – in and test. Single chip packaging: functions, types, materials processes, properties, characteristics, trends. Multi chip packaging: types, design, comparison, trends. System – in – package (SIP); Passives: discrete, integrated, and embedded

UNIT IV TESTING (9 Hrs)
Testing Reliability, Basic concepts, Environmental interactions. Thermal mismatch and fatigue – failures - thermo mechanically induced -electrically induced – chemically induced. Electrical Testing: System level electrical testing, Interconnection tests, Active Circuit Testing, Design for Testability

Text Books:

1. Tummala, Rao R., Fundamentals of Microsystems Packaging, McGraw Hill, 2001
2. R.G. Kaduskar and V.B.Baru, Electronic Product design, Wiley India, 2011
3. Tummala, Rao R, Microelectronics packaging handbook, McGraw Hill, 2008.

References

1. Blackwell (Ed), "The electronic packaging handbook", CRC Press, 2000.
2. R.S.Khandpur, "Printed Circuit Board", Tata McGraw Hill, 2005
3. R. K. Ulrich, "Recent literature in Electronic Packaging", 2005
4. Michael L. Bushnell and Vishwani D. Agrawal, "Essentials of Electronic Testing for Digital, Memory and Mixed signal VLSI Circuits", Kluwer Academic Publishers.2000.
5. M. Abramovici, M. A. Breuer, and A.D. Friedman, "Digital System Testing and Testable Design", Computer Science Press,

Web Reference

1. http://www.logopeople.in/blog/awesome-packaging-design-of-electronic-products-for-inspiration/
2. https://www.pinterest.com/PackagingTPI/electronic-packaging/
3. https://www.einfochips.com/blog/semiconductor-and-electronic-design-networks-and-profiles-to-follow-in-2018/
4. https://en.wikipedia.org/wiki/Electronic_packaging
5. https://nptel.ac.in/courses/108/108/108108031/

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

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

U19ECO64 **AUTOMOTIVE ELECTRONICS**

L	T	P	C	Hrs
3	0	0	3	45

(common to EE, ECE, ICE, Mech)

Course Objectives

- To provide basic knowledge about Autotronics
- To introduce and discuss the fundamentals of Automotive Electronics
- To get clear idea about various Sensors and Actuators for automobiles.
- To acquire depth knowledge about the Microcontrollers/Microprocessors in Automotive Domain.
- To study the Current Trends in Automotive Electronics.5

Course Outcomes

After completion of the course, students are able to

CO1 - Explain the basics of Autotronics. **(K2)**

CO2 - Infer the fundamentals of Automotive Electronics. **(K2)**
CO3 - Summarize the clear idea about Sensors and Actuators **(K2)**

CO4 - Demonstrate the role of Microcontrollers/Microprocessors in Automotive Domain **(K3)**
CO5 - Use Current Trends in Automotive Electronic Engine Management System **(K3)**

UNIT-I INTRODUCTION TO AUTOTRONICS **(9 Hrs)**

Autotronics- Definition- need, Field effect transistor-construction and working-applications, Silicon controlled rectifiers-construction and working-applications, logic gates-concept-AND-OR-NOT gates-working with truth tables, Flip flops-concept-applications, registers-concept, Integrated circuits-concept-types, Binary number system- need- conversion process, analog and digital signals-signal conditioning-need-steps, analog to digital conversion-steps

UNIT - II FUNDAMENTALS OF AUTOMOTIVE ELECTRONICS **(9 Hrs)**

Microprocessor architecture, open and closed loop control strategies, PID control, Look up tables, introduction to modem control strategies like Fuzzy logic and adaptive control. Parameters to be controlled in SI and CI engines and in the other parts of the automobile

UNIT - III SENSORS AND ACTUATORS **(9 Hrs)**

Types of Sensors: Sensor for Speed- Throttle Position- Exhaust Oxygen Level- Manifold Pressure-Crankshaft Position- Coolant Temperature- Exhaust Temperature- Air Mass Flow for Engine Application. Solenoids- Stepper Motors- Relay.

UNIT - IV MICROCONTROLLERS/MICROPROCESSORS IN AUTOMOTIVE DOMAIN **(9 Hrs)**

Critical review and overview of development within the automotive context of microprocessors, microcontrollers and digital signal processors (architecture of 8/16 bit microcontrollers with emphasis on

Ports, Timer/Counters, Interrupts, Watchdog timers and PWM). Criteria to choose the right microcontroller/processor for various automotive applications. Understanding various architectural attributes relevant to automotive applications. Automotive grade processors viz. Renesas, Quorivva, Infineon.

UNIT - V ELECTRONICS SYSTEMS **(9 Hrs)**

Current Trends in Automotive Electronic Engine Management System- Types of EMS Electromagnetic Interference Suppression- Electromagnetic Compatibility- Electronic Dashboard Instruments- Onboard Diagnostic System- Security - Warning System infotainment and Telematics

Text Books

1. William Ribben Butterworth-Heinemann, "Understanding Automotive Electronics" 5th edition, Elsevier, 1998
2. Jack Erjavec, "A Systems Approach to Automotive Technology", Cengage Learning, 5th edition, 2009
3. Steve.V.Hatch, "Electronic Engine Controls", Cengage Learning, 2012

References

1. G. Meyer, J. Valldorf and W. Gessner: "Advanced Microsystems for Automotive Applications", Springer, 2009.
2. Mehrdad Ebsani, Ali Emadi & Yimin Gao: "Modern Electronic Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design", 2 nd Edition, CRC Press, 2009.
3. Ronald K Jurgen: "Automotive Electronics Handbook", 2nd Edition, McGraw-Hill
4. Bennett , "Truck engines Fuel & computerized management systems Sean", Cengage Learning, 2016

Web Reference

1. http://www.diffen.com/difference/Analog vs Digital
2. https://www.youtube.com/watch?v=AiQpYO5E-go
3. https://en.wikipedia.org/wiki/Signal_conditioning
4. https://en.wikibooks.org/wiki/Electronics/Digital to Analog %26
5. http://www.allaboutcircuits.com/textbook/digital/chpt-13/delta-sigma-adc/

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

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

U19CSO64	PLATFORM TECHNOLOGY (Common to EEE, ECE, ICE, CIVIL & BME)	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To understand the fundamentals of developing modular application by using object oriented concepts.
- To utilize the C# and .NET framework to build distributed enterprise applications.
- To develop Console Application, Windows Application and Web Applications.
- To connect to multiple data sources and managing them effectively.
- To develop the Enterprise kind of applications

Course Outcomes

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

CO1-Understand the concept of .NET Framework.**(K2)**
CO2 -Develop, implement and creating Applications with C#.**(K4)**
CO3 -Evaluate various graphics and window forms.**(K5)**
CO4 - Integrating front end applications with Database connectivity.**(K3)**
CO5- Classifying various Enterprise applications into real world problems.**(K3)**

UNIT I INTRODUCTION TO .NET FRAMEWORK (9Hrs)

.NET Framework - Common language Runtime (CLR) – Common Type System (CTS) – Common language Specification (CLS) – Compilation process – Assemblies – Namespaces – Command line compiler.

UNIT II C# FUNDAMENTALS (9Hrs)

C# class - object - string formatting - Types - scope - Constants - C# iteration - Control flow - Operators - Array - String - Enumerations - Structures - Custom namespaces. Programming constructs – value types and reference types – object oriented concepts – Encapsulation – Inheritance – polymorphism – Interfaces – collections – Multithreading.

UNIT III GRAPHICS AND WINDOWS FORMS (9Hrs)

Tool box controls – Container control – Menu – Tool bar – Tool tip Controls during design time – Run time – Graphics programming GDI+.

UNIT IV DATABASE PROGRAMMING (9Hrs)

Data Access with ADO.NET – Architecture – Data reader – Data Adapter – Command – Connection – Data set – Data binding – Data Grid Control – XML based Data sets.

UNIT V J2EE (9Hrs)

Enterprise Edition Overview – Multi-Tier Architecture – Best Practices – Comparison between J2EE and .NET.

Text Books

1. David Chappell, "Understanding .NET – A Tutorial and Analysis", Addison Wesley, 2002.

2. Herbert Schildt, "C# 3.0 The Complete Reference", McGraw-Hill Professional, Third Edition, 2008.
3. Keogh, "J2EE The Complete Reference", Tata McGraw-Hill, 2008.

Reference Books

1. Andrew Troelsen, "Pro C# 5.0 and the .NET 4.5 Framework", Sixth edition, A Press, 2012.
2. Joh Skeet, "C# in depth, Manning publications", Third Edition, 2014.
3. AdrewStellman and Jennifer Greene, "Head First C#", Third Edition, O'Reilly, 2013.
4. Rod Johnson, "J2EE Design and Development", Wrox, 2002
5. Michael Schmalz, "C# Database Basics", O'Reilly Media, January 2012.

Web Resources

1. https://www.nptel.ac.in/
2. https://www.c-sharpcorner.com/csharp-tutorials
3. https://www.guru99.com/c-sharp-tutorial.html

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

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

U19CSO65	GRAPHICS DESIGNING (Common to EEE, ECE, ICE, CIVIL & BME)	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To develop basic skills using graphics and theory used in design process.
- Create computer-based projects using Adobe Photoshop.
- Understand, develop and employ visual hierarchy using images and text
- Use a computer to create and manipulate images and layers for use in various print and digital mediums.
- To acquire the knowledge of Animation

Course Outcomes

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

CO1 – Develop the basic design elements of graphics. **(K3)**
CO2 – Apply the various photoshop tools. **(K3)**
CO3 – Modify the image size, selection and grids using tools. **(k3)**
CO4 – Create and Work with colored layers. **(K4)**
CO5 – Apply different methods for Animation & Panoramic Picture creation. **(K5)**

UNIT I BASIC CONCEPTS **(9 Hrs)**

Basic Concepts of Designing - Design Principles – Basics of design elements – Typography – Color theory - Introduction to Graphics - Introduction to Photoshop - Bitmap and Vector Images - Understanding Image Size and Resolution

UNIT II INTRODUCTION TO PHOTOSHOP **(9 Hrs)**

Introduction to Tools - Environment - layout of Photoshop - Design layout setup - color - resolution setting - using basic marquee - selection tools Usage of lasso tools - Using brushes - using and filling colors - layers Using text tool - free transform tool - Exercise: Designing Greeting card / Advertisement

UNIT III IMAGE SIZE, SELECTION, GRID AND GUIDES **(9 Hrs)**

Modifying Image Size - Resolution, Marquee - Lasso - Magic Wand - Selection Tools – Selecting – Saving - Crop tool - Coping Selection And Image - Grid and Guide Options – Masks – Channel - Painting and editing - Working with quick masks - Painting (Brush, and its effects) - Blending Modes, Color palettes – Editing - Background - Color - Touchup - Cleanup - Gradient tools - layer blending modes - all types of text tools - shape tools Exercise : Designing Magazine cover - Poster - Brochure

UNIT IV LAYERS **(9 Hrs)**

The layer Palette - Changing and controlling layer order - Editing layers - Adjustment layers - Layer Effects Filters - Actions - Automation - Extract - Filter Gallery - Liquefy , Pattern making - Vanishing point - Built in Bitmap Filters - 3rd party Plug-ins - Using predefined Actions - Creating and Recording Actions - Using built in automation - Learning Filter effects - managing the files with layers and layer effects - plugins Manipulation tools - Image control options – HUE - Levels - brightness control Using image – modifying - changing color Exercise : Converting black and white photo to color - designing a photo album

UNIT V ANIMATION & PANORAMIC PICTURE CREATION (9Hrs)

Creating product Packaging designs - CD cover - Book and magazine front cover - Envelope - Visiting card - Color correction and color channel management - Design automation theory and Practical's Samples and demos - guidelines for freelance work - website links - resource sharing - Preparing Image For Print and Web -
Calculating Image size and Resolution, Changing Image Dimensions - Layout Preview - Color Separation - Optimizing Images for Web - File Formats - Creating Webpages - web photo galleries

Text Books

1. Adobe Creative Team, "Adobe Photoshop – Classroom in a Book", Adobe system incorporation, Adobe Press, 2010.
2. Katherine A.Hughes, "Graphic Design", Learn It,Do It,CRC Press 2019.
3. Ken Pender, "Digital color in Graphics Design", CRC Press 2012.

Reference Books

1. Mike Wooldridge , "Teach Yourself Visually Adobe Photoshop CS 5", Wiley Publishing , 2010
2. Lesa Snider, "Photoshop the missing Manual", O'Reilly Media, Inc, 2010.
3. Poppy Evans, Aaris Sherin, Irina Lee, "The Graphic Design", Rockport, 2013.
4. Peter Bauer, "Photoshop CC for Dummies", Wiley, 2013.
5. Scott Onstott, "Enhancing CAD Drawings with Photoshop", Wiley,2006

Web Resources

1. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-831-user-interface-design-and-implementation-spring-2011/lecture-notes/MIT6_831S11_lec18.pdfhttp://www.moshplant.com/direct-or/bezier/
2. https://www.cs.montana.edu/courses/spring2004/352/lectures/CS351-GUIDesign.pdf
3. https://www.university.youth4work.com/study-material/graphic-design-lecture
4. https://kmayeunhla.wordpress.com/lecture-notes/
5. https://nptel.ac.in/courses/106/106/106106090/

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

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

U19IT063	ESSENTIALS OF DATA SCIENCE	L	T	P	C	Hrs
		3	0	0	3	45

(common to EEE, ECE, ICE, MECH, CIVIL, BME)

Course Objectives

- To gain knowledge about the concepts involved in data analytics.
- To discover insights in data using R programming.
- To summarize the operations involved in Hadoop Map Reduce.
- To make use of algorithms related to regression and classification.
- To examine data using time series analysis and text analysis

Course Outcomes

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

CO1 - Experiment with data analytics using R language. **(K3)**
CO2 - Demonstrate clustering algorithms and association rules. **(K3)**
CO3 - Use algorithms related to regression and classification. **(K3)**
CO4 - Explore data using time series analysis and text analysis. **(K2)**
CO5 - Summarize Hadoop platform to solve map reduce problems. **(K2)**

UNIT I DATA ANALYTICS USING R (9 Hrs)

Big Data Overview-Examples of Big Data Analytics-Data Analytics Lifecycle overview-Phases in the lifecycle-GINA Case Study-Introduction to R programming-Exploratory Data Analysis-Statistical Methods for Evaluation.

UNIT II CLUSTERING AND ASSOCIATION RULES (9 Hrs)

Overview of clustering-Scope of Clustering Techniques- K Means clustering- Additional Algorithms-Clustering in practise: Fake news identification-Overview of Association rules-Apriori Algorithm-Evaluation of Candidate Rules-Applications of Association Rules-An Example: Transactions in a grocery store-Validation and Testing-Diagnosis

UNIT III REGRESSION AND CLASSIFICATION (9 Hrs)

Scope of Regression Techniques-Linear Regression-Logistic Regression-Additional Regression models-Scope of Classification Techniques-Decision Trees-Naïve Bayes-Diagnostics of Classifiers-Additional Classification Methods-Applications: Prediction of crop yield

UNIT IV TIME SERIES ANALYSIS AND TEXT ANALYSIS (9 Hrs)

Overview of Time Series Analysis-ARIMA Model-Additional Methods-Text Analysis Steps-A Text Analysis Example-Collecting Raw Text-Representing Texts-TFIDF-Categorizing documents by topics-Determining Sentiments-Gaining Insights.

UNIT V HADOOP MAP REDUCE AND DATA ANALYTICS (9 Hrs)

Installing and Understanding Hadoop-HDFS and Map Reduce Architecture-Hadoop Map Reduce Example-Hadoop Map Reduce in R-Data Analytics Problems: Exploring web pages categorization - Computing the frequency of stock market change-Real Time Recommender model using Apache Spark.

Text Books

1. David Dietrich, Barry Heller and Beibei Yang, "Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data", EMC Education Services, Reprint 2015, Wiley, ISBN: 9788126556533.

2. VigneshPrajapathi, "Big Data Analytics with R and Hadoop", Packt Publishing, 2013, Birmingham, Mumbai.
3. Bill Franks, "Taming the Big Data Tidal Wave: Finding opportunities in Huge DataStreams with Advanced Analytics", John Wiley & sons, 2012.

Reference Books

1. Roger D. Peng, "R Programming for Data Science", LeanPub, 2015.
2. Bart Baesens , "Analytics in a Big Data World: The Essential Guide to Data Science and its Applications", Wiley Publishers, 2014.

Web References

1. www.ibm.com/Data Analytics/
2. https://www.ijser.org/researchpaper/Importance-of-Clustering-in-Data-Mining.pdf
3. https://datafloq.com/read/7-innovative-uses-of-clustering-algorithms/6224
4. https://publications.waset.org/10011058/improving-fake-news-detection-using-k-means-and-support-vector-machine-approaches
5. https://statisticsbyjim.com/regression/when-use-regression-analysis/

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

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

U19ITO64	MOBILE APP DEVELOPMENT	L	T	P	C	Hrs
		3	0	0	3	45

(common to EEE, ECE, ICE, MECH, CIVIL, BME, Mechatronics)

Course Objectives

- To understand the basic concepts of mobile computing
- To be familiar with the network protocol stack
- To learn the basics of mobile telecommunication system
- To be exposed to Ad-Hoc networks
- To gain knowledge about different mobile platforms and application development

Course Outcomes

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

CO1 - Explain the basics of mobile telecommunication system **(K2)**
CO2 - Articulate the required functionality at each layer for given application **(K2)**
CO3 - Identify solution for all functionality at each layer. **(K2)**
CO4 - Use simulator tools and design Ad hoc networks **(K3)**
CO5 - Develop a mobile application **(K3)**

UNIT I INTRODUCTION (9 Hrs)

Mobile Computing – Mobile Computing Vs wireless Networking – Mobile Computing Applications – Characteristics of Mobile computing – Structure of Mobile Computing Application. MAC Protocols – Wireless MAC Issues – Fixed Assignment Schemes – Random Assignment Schemes – Reservation Based Schemes.

UNIT II MOBILE INTERNET PROTOCOL AND TRANSPORT LAYER (9 Hrs)

Overview of Mobile IP – Features of Mobile IP – Key Mechanism in Mobile IP – route Optimization. Overview of TCP/IP – Architecture of TCP/IP- Adaptation of TCP Window – Improvement in TCP Performance.

UNIT III MOBILE TELECOMMUNICATION SYSTEM (9 Hrs)

Global System for Mobile Communication (GSM) – General Packet Radio Service (GPRS) – Universal Mobile Telecommunication System (UMTS).

UNIT III MOBILE AD-HOC NETWORKS (9 Hrs)

Ad-Hoc Basic Concepts – Characteristics – Applications – Design Issues – Routing – Essential of Traditional Routing Protocols –Popular Routing Protocols – Vehicular Ad Hoc networks (VANET) – MANET Vs VANET – Security.

UNIT V MOBILE PLATFORMS AND APPLICATIONS (9 Hrs)

Mobile Device Operating Systems – Special Constrains & Requirements – Commercial Mobile Operating Systems – Software Development Kit: iOS, Android, BlackBerry, Windows Phone – M- Commerce – Structure – Pros & Cons – Mobile Payment System – Security Issues.

Text Books

1. Prasant Kumar Pattnaik, Rajib Mall, "Fundamentals of Mobile Computing", PHI Learning Pvt. Ltd, New Delhi – 2012.
2. Jochen H. Schller, "Mobile Communications", Second Edition, Pearson Education, New Delhi, 2007

3. C.K.Toh, "AdHoc Mobile Wireless Networks", First Edition, Pearson Education, 2002.

Reference Books

1. Dharma Prakash Agarval, Qing and An Zeng, "Introduction to Wireless and Mobile systems", Thomson Asia Pvt Ltd, 2005.
2. William.C.Y.Lee,"Mobile Cellular Telecommunications-Analog and Digital Systems", Second Edition,TataMcGraw Hill Edition ,2006.
3. UweHansmann, LotharMerk, Martin S. Nicklons and Thomas Stober, "Principles of Mobile Computing", Springer, 2003.

Web References

1. Developers : http://developer.android.com/index.html
2. Apple Developer : https://developer.apple.com/
3. http://developer.windowsphone.com
4. BlackBerry Developer : http://developer.blackberry.com/

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

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

U19MEO64	HEATING VENTILATION AND AIR CONDITIONING SYSTEM (HVAC) (common to EEE, ECE, ICE, CIVIL)	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To understand the principles of heating ventilation and air conditioning, refrigerant properties, selection
- To learn about the heating and cooling load estimation
- To understand about air distribution systems, industrial ventilation
- To impart knowledge of the psychrometric properties, processes and air-conditioning systems
- To provide knowledge on different components and parameters involved in design of air conditioning systems using cooling load calculations

Course Outcomes

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

CO1 - Describe the principles of heating ventilation and refrigerant properties. **(K1)**
CO2 - Analyse the factors affecting the load estimate. **(K4)**
CO3 - Explainthe air distribution classification, types of air flow and types of cross section. **(K1)**
CO4 - Appraise the psychrometric processes and air conditioning system performance. **(K5)**
CO5 - Design the Air-conditioning systems with available resources as cost effective. **(K5)**

UNIT I INTRODUCTION TO HVAC (9 Hrs)

Definition – Principles of HVAC –Scope of HVAC Industry with overview of consulting & construction Industry-market size – Growth – Penetration – opportunities- challenges – Energy usage and saving of HVAC - Terminologies – Heat and its types – Psychometric chart – Properties of Air – Codes & Standards used in HVAC-Refrigerants - Desirable properties – classification – refrigerants used – nomenclature – Selection of refrigerants - ozone depletion – global warming–ASHRAE – Recent substitute for refrigerants.

UNIT II VENTILATION, HEATING AND COOLING LOAD (9 Hrs)

Basics of Heat transfer in a building envelop – Understanding of Outdoor & Indoor condition – Factors affecting the loads estimate Sources of Heat gain – External: Sun gain through Glass/Window/Roof/Wall – Partition gain – Internal: People/Lights/Electrical Equipments/motors/Kitchen Appliances – Heat gain through Infiltration air – Ventilation, air quantity and loads –Need, threshold limits of contaminants, estimation of ventilation rate, decay equation, air flow around buildings – Methods of Ventilation – Infiltration load calculation – Heating and cooling load estimation – Calculating ESHF, GTH, ADP, Dehumidified CFM – Cold storage design

UNIT III DESIGN OF AIR DISTRIBUTION SYSTEM (9 Hrs)

Air Distribution – Classification – Types of Air flow – Types of Cross section – Types of Velocity & pressure duct – Types of material – Types of Insulations – Duct Accessories – SMACNA standard – Duct designing methods: Velocity reduction method, Equal friction method, Static regain method - Duct designing Software – Duct sheet metal calculation: GI sheet, Gauge of duct & thickness of Gauge, Hanger spacing,Hanger Rod Diameter and Angle support Size –Air terminal selection – Industrial ventilation: Steel plants, car parks, plant rooms and mines

UNIT IV INTRODUCTION TO PSYCHROMETRIC AND HUMAN COMFORT (9 Hrs)

Principle and psychrometric properties of air – Psychrometric Chart – Psychrometric relations; Dalton's law of partial pressures –Wet bulb temperature and measurement – Adiabatic saturation temperature –

Psychrometric processes – mixing of air stream - sensible heat factor – HVAC systems: Unitary, Semi-central, Central, Air-cooled systems, Water cooled systems–Human Comfort – Heat transfer from body, convection, radiation, conduction, evaporation, clothing resistance, activity level - Concept of human comfort – Thermal response – comfort factors– Environmental indices - Indoor air quality(IQA) - Effective temperature and comfort chart – Heat production and regulation of human body.

UNIT V DESIGN OF AIR CONDITIONING SYSTEMS COMPONENTS (9 Hrs)

Air conditioning loads - Sources of heat load – Sensible load – Latent load - Conduction load – Sun load – Load from occupants – Equipment load – Infiltration air load- Load from moisture gain – Fresh air load-ASHARE standards - concepts of RSHF, GSHF- problems, concept of ESHF and ADP temperature - Requirements of industrial air conditioning – Calculation of load on air-conditioning system – Design of space cooling load - Air-conditioning devices and components:Air filters, types, efficiency – Humidifiers and Dehumidifiers – selection of humidifier and design – Fans, types &selection - Coil, Characteristics, types & Coil Accessories - condensate control-blowers – Cooling towers and spray ponds – Air distribution system – precision air conditioning - Automotive air conditioning - Heat pump – heat sources – different heat pump circuits – Commissioning and Maintenance.

Text books

1. Arora, C.P.," Refrigeration and Air conditioning", TataMcGraw-Hill, New Delhi, Third edition, 2017.
2. McQuiston, F.C., Parker, J.D and Spilter, J.D.," Heating Ventilating and Air Conditioning", John Wiley & Sons Inc., 2001.
3. Stocker W.F and Jones J.W, "Refrigeration and Air Conditioning ", McGraw-Hill, 1995.

Reference books

1. Manohar Prasad, "Refrigeration and Air Conditioning", New Age International Publisher, New Delhi, 2015.
2. Arora.S.C and Domkundwar.S, "A course in refrigeration and Air conditioning", DhanpatRai(P) Ltd, New Delhi, 2016.
3. Legg, R.C., "Air Conditioning System - Design, Commissioning and maintenance", Batsford Ltd, London 1991.
4. Haines, W.R, and Wilso, C.L," HVAC systems Design Handbook", Mcgraw Hill, 2nd Edition, New Delhi, 1994
5. Sapali S.N, "Refrigeration and air Conditioning", PHI, second edition, 2014.

Web References

1. http://nptel.ac.in/courses/112105128/
2. Httpp://ocw.mit.edu/courses/mechanical engineering/
3. http://www.nptelvideos.in/2012/12/refrigeration-and-airconditioning.html
4. https://www.youtube.com/watch?v=ScVBPAitibQ
5. https://www.youtube.com/watch?v=z8ZStRCacdM

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

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

U19MEO65	CREATIVITY INNOVATION AND NEW PRODUCT DEVELOPMENT	L	T	P	C	Hrs
		3	0	0	3	45

(common to EEE, ECE, ICE, CIVIL, BME, Mechatronics)

Course Objectives

- To understand the need for creativity and innovation
- To learn about the project selection and evaluation
- To learn about the Patent and IPR
- To understand the quality standards and new product planning
- To learn model preparation and evaluation

Course Outcomes

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

CO1 - Describe the creativity and problem solving. **(K1)**
CO2 - Analyse the methods for project selection and evaluation. **(K4)**
CO3 - Analyse the patent laws and IPR. **(K4)**
CO4 - Describe the new product planning. **(K1)**
CO5 - Acquire knowledge about the patent applications. **(K1)**

UNIT I INTRODUCTION (9 Hrs)

The process of technological innovation - factors contributing to successful technological innovation - the need for creativity and innovation - creativity and problem solving -brainstorming - different techniques

UNIT II PROJECT SELECTION AND EVALUATION (9 Hrs)

Collection of ideas and purpose of project - Selection criteria - screening ideas for new products evaluation techniques

UNIT III NEW PRODUCT DEVELOPMENT (9 Hrs)

Research and new product development - Patents - Patent search - Patent laws-International code for patents - Intellectual property rights (IPR)

UNIT IV NEW PRODUCT PLANNING (9 Hrs)

Design of proto type - testing - quality standards - marketing research introducing new Products

UNIT V MODEL PREPARATION & EVALUATION (9 Hrs)

Creative design - Model Preparation - Testing - Cost evaluation – Patent application

Text Books

1. Twiss, Brian. "Managing Technological Innovation", Pitman Publishing Ltd., 1992.
2. Watton, Harry B. "New Product Planning", Prentice Hall Inc., 1992.
3. Lawrence Sanders G, Saylor foundation Publishing Ltd., 2012.

Reference Books

1. Nystrom, Harry "Creativity and Innovation", John Wiley & Sons, 1979.
2. Dr Paul Trott, Innovation Management and New Product Development, 6th Edition, Pearson Publication, 2017
3. Khandwalla, N – "Fourth Eye (Excellence through Creativity) - Wheeler Publishing", 1992.
4. Bulletins I.P.R, TIFAC, New Delhi, 1997.
5. Jacob Goldenberg, Creativity in Product Innovation, Cambridge University Press, 2002.

Web References

1. https://nptel.ac.in/courses/107/103/107103082/
2. https://nptel.ac.in/courses/107/101/107101086/
3. https://nptel.ac.in/courses/110/107/110107094/
4. https://www.youtube.com/watch?v=H6OlyjLJf6k
5. https://www.youtube.com/watch?v=CnKeVs-_9zs

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

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

U19CEO63

DISASTER MANAGEMENT

L	T	P	C	Hours
3	0	0	3	45

Course Objectives:

- To provide basic conceptual understanding of disasters
- To understand approaches of Disaster Management
- To build skills to respond to disaster
- To understand the safety precaution
- To know the basic planning and policy act of the disaster

Course Outcomes:

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

CO1 – Infer Disasters, man-made Hazards and Vulnerabilities **(K2)**

CO2 – Summarize the disaster management studies **(K2)**

CO3 – Identify disaster mitigation and management mechanism **(K1)**

CO4 - Estimate the disaster safety precaution **(K2)**

CO5 – Determine the disaster plan and act **(K3)**

UNIT - I – DEFINITION AND TYPES (9 Hrs)

Hazards and Disasters, Risk and Vulnerability in Disasters, Natural and Man-made disasters, earthquakes, floods drought, landside, land subsidence, cyclones, volcanoes, tsunami, avalanches, global climate extremes. Man-made disasters: Terrorism, gas and radiations leaks, toxic waste disposal, oil spills, forest fires.

UNIT – II STUDY OF IMPORTANT DISASTERS (9 Hrs)

Earthquakes and its types, magnitude and intensity, seismic zones of India, major fault systems of Indian plate, flood types and its management, drought types and its management, landslide and its managements case studies of disasters in Sikkim (e.g) Earthquakes, Landslide). Social Economics and Environmental impact of disasters.

UNIT - III MITIGATION AND MANAGEMENT (9 Hrs)

Concepts of risk management and crisis management - Disaster management cycle - Response and Recovery - Development, Prevention, Mitigation and Preparedness- Planning for relief.

UNIT – IV SAFETY PROCESS (9 Hrs)

Coping with Disaster: Coping Strategies; alternative adjustment processes - Changing Concepts of disaster management - Industrial Safety Plan; Safety norms and survival kits - Mass media and disaster management

UNIT - V PLANNING AND ACT **(9 Hrs)**

Planning for disaster management: Strategies for disaster management planning - Steps for formulating a disaster risk reduction plan - Disaster management Act and Policy in India - Organizational structure for disaster management in India - Preparation of state and district disaster management plans

Text books

1. Dr. Mrinalini Pandey, Disaster Management, Wiley India Pvt. Ltd, 2014
2. Tushar Bhattacharya, Disaster Science and Management, McGraw Hill Education (India) Pvt. Ltd, 2017
3. Jagbir Singh, Disaster Management : Future Challenges and Opportunities, K W Publishers Pvt. Ltd, 2013
4. J. P. Singhal, Disaster Management, Laxmi Publications, 2019
5. C. K. Rajan, NavalePandharinath, Earth and Atmospheric Disaster Management : Nature and Manmade, B S Publication, 2009

Reference Books

1. M.M. Sulphey, Disaster Management, PHI Learning Private Limited, 2016.
2. Disaster Science and Management by T. Bhattacharya, McGraw Hill Education (India) Pvt Ltd Wiley 2015
3. Earth and Atmospheric Disasters Management, N. Pandharinath, CK Rajan, BS Publications 2009.
4. National Disaster Management Plan, Ministry of Home affairs, Government of India
5. Manual on Disaster Management, National Disaster Management, Agency Govt of India.

Web sources

1. http://www.ndma.gov.in/images/policyplan/dmplan/draftndmp.pdf
2. http://nidm.gov.in/pdf/guidelines/new/sdmp.pdf
3. http://sdmassam.nic.in/pdf/publication/undp/disaster_management_in_india.pdf

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	3	2	3	3	2	-	2	2	2	3	1	3	3
CO2	3	2	3	2	3	3	2	-	2	2	2	3	1	3	3
CO3	3	2	3	2	3	3	2	-	2	2	2	3	1	3	3
CO4	3	2	3	2	3	3	2	-	2	2	2	3	1	3	3
CO5	3	2	3	2	3	3	2	-	2	2	2	3	1	3	3

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

U19CEO64 **AIR POLLUTION AND SOLID WASTE MANAGEMENT**

L	T	P	C	Hours
3	0	0	3	45

Course Objectives

This course should enable the students to

- Provide general understanding of air pollution, air pollutants, their sources and their effects.
- Provide knowledge about Meteorological parameters, air sampling and measurement of pollutants,
- Provide knowledge of air pollution controlling technologies, air pollution due to automobiles and general Idea of noise pollution.
- Study the importance of solid waste management by processing, treatment, disposal and reuse of solid waste.
- Study about the equipment used for waste collection and transportation of solids waste.

Course Outcomes

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

CO1 - Understand the type, sources & effect of air pollutants **(K2)**

CO2 - Know the meteorological aspects and various methods of measurement and estimation of pollutants (K4)

CO3 - Gain knowledge about air pollution control equipment's and basics of Noise pollution **(K3)**

CO4 - Understand about the concept of solid waste management **(K2)**

CO5 - Gain knowledge about the Equipments used to collection and transportation methods **(K3)**

UNIT I INTRODUCTION TO AIR POLLUTION (8 Hrs)

Introduction to air pollution: Air pollution episodes, Atmosphere and its zones, classification and sources of air pollutants, effects of air pollutants on man, plants animal & materials

UNIT II METEOROLOGICAL ASPECTS (8Hrs)

Meteorological Aspects: Atmospheric stability, plume behavior, Ambient air sampling and stack sampling, collection of particulates and gaseous pollutants, methods of estimation.

UNIT III AIR POLLUTION CONTROL METHODS (9 Hrs)

Air pollution control methods and equipment: Principle of control methods for particulates and gaseous pollutants, gravity settlers, electrostatic precipitators, bag filters cyclones, wet scrubbers, automobile exhaust: Pollution due to diesel and petrol engines, exhaust treatment and abatement, noise Pollution: Sources, ill effects, control measures.

UNIT IV SOLID WASTE MANAGEMENT (8Hrs)

Introduction to solid waste management, sources, quantification and characterization, classification and components, sampling and analysis, Method of collection

UNIT V EQUIPMENT (12 Hrs)

Equipment used for collection and transportation, transfer stations, solid waste processing and management. Treatment and disposal methods: composting, sanitary landfills, Incineration – concept, components and applications, leachate management.

Text Books

1. M.N. Rao & H.V.N. Rao, 1986, Air Pollution, Tata McGraw Hill Publishing Co. Ltd.
2. C.S. RAO, 2007, Environmental Pollution Control Engineering, New Age International, Wiley Estern Ltd. New Delhi.
3. Stern A. C., 1973, Air pollution, Academic Press.
4. A.D. Bhide & Sunderesan B.B., 1983, Solid Waste Management in Developing countries, INSDOC, New Delhi.
5. Tohobanoglous, 1993, Intgrated Solid Waste Management Engineering Principle and Management Issues, McGraw-Hill publication Ltd.

Reference books

1. P. Aarne Vesilind, William Worrell & Debra Reinhart, 2002, Solid Waste Engineering, Cengage Learning India pvt. Ltd.
2. Dr. Y Anjaneyulu, 2002, Air Pollution and Control Technologies, Allied Publisher pvt. Ltd.
3. Waste Management: A Reference Handbook. Contributors: Jacqueline Vaughn - Author, Publisher. ABC-Clio
4. K. V. S. G. Murlikrishna, 1995, Air Pollution, Kaushal& Company.

Web References

1. https://nptel.ac.in/courses/120108005/
2. http://cpheeo.gov.in/upload/uploadfiles/files/Part1
3. https://nptel.ac.in/content/storage2/courses/104103022

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	2	3	2	3	2	3	3	3	3	3	2	3	3	2	3
CO2	3	3	2	3	3	3	3	2	3	2	2	3	3	3	3
CO3	3	3	3	2	2	2	3	3	3	3	2	3	3	3	2
CO4	2	3	2	3	2	3	2	3	3	2	2	3	3	3	3
CO5	3	3	3	2	3	3	3	3	3	2	3	3	3	3	3

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

U19BMO63	BIOMETRIC SYSTEMS (Common to EEE, ECE, ICE)	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives:

- To understand the basics of Biometric systems
- To gain knowledge in different fingerprint technologies
- To understand the classification of face recognition methods.
- To understand multimodal Biometrics and its performance evaluation.
- To know personal privacy and security implications of biometrics systems.

Course Outcomes:

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

CO1 - Explain the fundamentals of biometric systems**(K2)**
CO2 - Describethe various fingerprint technologies**(K3)**
CO3 - Distinguish different face recognition and hand geometry pattern**(K3)**
CO4 - Analyse the multimodal biometrics and performance evaluation of biometrics **(K4)**
CO5–Recognize various Biometric authentication methods **(K3)**

UNIT I INTRODUCTION TO BIOMETRICS **(9 Hrs)**

Introduction– biometric technologies – passive biometrics – active biometrics - Biometric systems – Enrolment – templates – algorithm – verification – Authentication technologies –Need for strong authentication - Protecting privacy and biometrics policy – Biometric applications – biometric characteristics.

UNIT IIFINGERPRINT TECHNOLOGY **(9 Hrs)**

History of fingerprint pattern recognition - General description of fingerprints - Finger print feature processing techniques - fingerprint sensors using RF imaging techniques – fingerprint quality assessment – computer enhancement and modelling of fingerprint images – fingerprint enhancement – Feature extraction – fingerprint classification – fingerprint matching

UNIT III FACE RECOGNITION AND HAND GEOMETRY **(9 Hrs)**

Introduction to face recognition - face recognition from correspondence maps - Hand geometry- scanning - feature extraction - Adaptive Classifiers - Visual Based feature extraction and Pattern Classification - types of algorithm - Biometric fusion.

UNIT IV MULTIMODAL BIOMETRICS AND PERFORMANCE EVALUATION **(9 Hrs)**

Voice scan - Physiological biometrics –Behavioural biometrics - Introduction to multimodal biometric system- Integration strategies - Architecture -level of fusion - combination strategy – training and adaptability - examples of multimodal biometric systems - Performance evaluation - Statistical Measures of Biometrics- FAR - FRR - FTE - EER -Memory requirement and allocation.

UNIT V BIOMETRIC AUTHENTICATION **(9 Hrs)**

Introduction - Biometric Authentication Methods - Biometric authentication by fingerprint - Biometric Authentication by Face Recognition. Expectation-Maximization theory - Support Vector Machines-Biometric authentication by hand geometry- Securing and trusting a biometric transaction – matching location – local host - authentication server – match on card (MOC) – Multibiometrics and Two-Factor Authentication.

Text Books

1.Anil K. Jain, Arun Ross, and KarthikNandakumar" Introduction to Biometrics", Springer,2011
2. Richard O. Duda, David G.Stork,Peter E. Hart, "Pattern Classification", Wiley 2007
3. S.Y.Kung, S.H. Lin, M.W.Mak, "Biometric Authentication: A Machine Learning Approach", Prentice Hall,2005

Reference Books

1.Anil K. Jain, Patrick Flynn, and Arun A. Ross, "Handbook of Biometrics", Springer, 2008
2.John Chirillo, Scott Blaul, "Implementing Biometric Security", John Wiley, 2003.
3.John R. Vacca, "Biometric Technologies and Verification Systems", Elsevier Inc, 2007
4.James Wayman, Anil Jain, DavideMaltoni, Dario Maio, "Biometric Systems, Technology Design and Performance Evaluation",Springer,2005
5.Nikolaos V. Boulgouris,Konstantinos N. Plataniotis ,EvangeliaMicheli-Tzanakou,"Biometrics: Theory, Methods, and Applications" , Wiley 2009

Web Resources:

1.http://www.findbiometrics.com/Pages/glossary.html
2. http://www.biometrics.gov/Documents/privacy.pdf
3. http://zing.ncsl.nist.gov/biousa/docs/Usability_and_Biometrics_final2.pdf
4. User Interface, System Design
5. http://www.cesg.gov.uk/site/ast/biometrics/media/BEM_10.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
2	3	2	2	1	1	2	-	-	-	-	-	1	-	-	1
3	3	2	2	1	2	2	-	-	-	-	-	1	-	-	1
4	3	1	1	1	1	1	-	-	-	-	-	1	-	-	1
5	3	1	2	1	2	2	-	-	-	-	-	1	-	-	1

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

U19BMO64	MEDICAL ROBOTICS (Common to EEE, ECE, ICE,CIVIL)	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives:

- To understand the basics of Robotics
- To gain knowledge in Kinematics
- To know about the robot vision
- To describe various motion planning solutions
- To explain various applications of Robots in Medicine

Course Outcomes:

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

CO1 - Understand the basics of robotic systems.**(K2)**
CO2- Explore workspace and related motion of the Robots**(K3)**
CO3- Analyse and extract information from the image using Robots **(K3)**
CO4 - Design of task planning and simulating the task. **(K4)**
CO5–Construct Robots for Medical applications **(K4)**.

UNIT I INTRODUCTION **(9 Hrs)**

Introduction- Automation and Robots – Classification - Applications- Specifications – Direct Kinematics Dot and cross products – Coordinate frames – Rotations – Homogeneous coordinates Link coordination arm equation – Four-axis robot -Five-axis robot - Six-axis robot.

UNIT II KINEMATICS **(9 Hrs)**

Inverse Kinematics – General properties of solutions tool configuration – Workspace analysis and trajectory planning work envelope - examples- workspace fixtures – Pick and place operations – Continuous path motion – Interpolated motion – Straight-line motion.

UNIT III ROBOT VISION **(9 Hrs)**

Robot Vision- Image representation – Template matching – Polyhedral objects – Shane analysis – Segmentation – Thresholding – region labelling – Shrink operators – Swell operators – Euler numbers – Perspective transformation – Structured illumination – Camera calibration.

UNIT IV PLANNING **(9 Hrs)**

Task Planning – Task level programming – Uncertainty – Configuration – Space, Gross motion – Planning – Grasp Planning – Fine-motion planning – Simulation of planar motion – Source and Goal scenes – Task Planner simulation.

UNIT V MEDICAL APPLICATIONS **(9 Hrs)**

Applications in Biomedical Engineering – Biologically Inspired Robots – Application in Rehabilitation – Interactive Therapy – Bionic Arm – Clinical and Surgical – Gynaecology – Orthopaedics – Neurosurgery.

Text Books

1. Robert Schilling, "Fundamentals of Robotics-Analysis and control", Prentice Hall, 2003.
2. Paula Gomes,"Biomedical Instrument and Robotic Surgery System: Design and Development for Biomedical Applications", Woodhead Publishing, 2012
3. Klafter, Chmielewski and Negin, "Robotic Engineering - An Integrated approach",, PHI, *first edition*, 2009

Reference Books

1.J.J.Craig, "Introduction to Robotics", Pearson Education, 2005.
2. Fu, Lee and Gonzalez., "Robotics, control vision and intelligence", McGraw Hill International, 2nd edition, 2007
3 John J. Craig, "Introduction to Robotics", Addison Wesley Publishing, 3rd edition, 2010.
4. Saeed B. Niku, "Introduction to Robotics: Analysis, Systems, Applications", Prentice Hall, 2001.
5. K. S. Fu, R. C. Gonzalez and C. S. G. Lee, "Robotics", McGraw Hill, 2008.

Web Refrences

1. https://nptel.ac.in/courses/112/105/112105249/
2. https://www.intechopen.com/books/medical_robotics/motion_tracking_for_minimally_invasive_robotic surgery
3.https://www.intechopen.com/books/medical_robotics/robotic_applications_in_neurosurgery
4. https://www.intechopen.com/books/medical_robotics/medical_robotics_in_cardiac_surgery
5. https://www.worldscientific.com/worldscinet/jmrr

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

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

U19CCO63	NETWORK ESSENTIALS (Common to EEE, MECH, CIVIL, ICE MECHATRONICS, BME)	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To understand the fundamental concepts of computer communication and data networks
- To gain the necessary knowledge and skills to work effectively with network engineering and administrators
- To learn how to research ,communicated network and IT issuing by reading relevant industry information
- To understanding the basic technologies and step required for setting up managing small LAN
- To understand the various technologies of security to protect the information in network

Course Outcomes

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

CO1- Understand the basic knowledge and skills to implement defined network architecture
CO2- Explain the performances of data link control and their access medium
CO3- Describe about internet Protocol and their working processes in IPV.
CO4- Explain the basic concepts of Transport Protocols and working of TCP layer
CO5-Design and study the operations of Security and their different algorithm

UNIT I NETWORK MODELS (9 Hrs)

Data communications- Networks-PAN,LAN, MAN and WAN- Internet, Intranet and Extranets- Protocols and standards- OSI/ISO reference model- TCP/IP protocol suite- Broadband ISDN-ATM protocol reference model-- SONET/SDH architecture-Bluetooth and UWB –WIFI-WiMax Cognitive Radios-Adhoc and Sensor Networks-Green communications.

UNIT II DATA LINK CONTROL AND MEDIUM ACCESS (9 Hrs)

Types of errors- Error detection and correction- Checksum- Framing-Flow control-Stop and wait protocol-Go-back N- Selective repeat protocols HDLC-Random access protocols-Controlled access-Wired LANs-IEEE standards, IEEE 802.3, 802.4, 802.5 and 802.6-- Fast Ethernet-Gigabit Ethernet –Wireless LANs-IEEE 802.11.

UNIT III NETWORK ROUTING (9 Hrs)

Logical addressing- IPv4 addresses- IPv6- Internet protocol- Transition from IPv4 to IPv6-Mapping logical to physical address – Mapping physical to logical address- ICMP-Direct Vsin direct delivery- Forwarding-Unicast and Multicast routing protocols-Different Routing Algorithms-Internetworking-Routers and gateways.

UNIT IV TRANSPORTANDCONGESTION (9 Hrs)

Elements of Transport Protocols: addressing, Connection Establishment, Connection Release, Error Control and Flow Control – Congestion control: Desirable Bandwidth Allocation, Regulating the Sending Rate, Wireless Issues- UDP, RPC -TCP Protocol, TCP connection management, TCP sliding window and congestion control.

UNIT V SECURITY **(9 Hrs)**

Introduction to Cryptography, Cipher text, symmetric key cryptography – AES and DES, RSA public key and private keys- Digital signature. Security in the Internet: IPSec, PGP, VPN and Firewalls. Authentication Protocols: Shared Secret Key, The Diffie-Hellman Key Exchange, Authentication Using Kerberos. Wireless Security- issues and challenge

Text Books

1. William Stallings, "Data and computer communications", Ninth Edition, Pearson Education, New Delhi, 2014.
2. Behrouz. A. Forouzan, "Data Communication and Networking", Fifth Edition, McGraw Hill, New Delhi, 2013.
3. Pallapa Venkatram and Sathish Babu .B, "Wireless &Mobile Network security",Tata McGraw Hill, New Delhi, 2010

Reference Books

1. DouglasE.Comer,"InternetworkingwithTCP/IP(VolumeI)Principles,ProtocolsandArchitecture",6^{th} Edition, Pearson Education,2013.
2. NaderF.Mir,"ComputerandCommunicationNetworks",2^{nd} Edition, Prentice Hall, 2014.
3. Ying-DarLin,Ren-HungHwangandFredBaker,"ComputerNetworks:AnOpenSourceApproach",McGrawHillPublisher, 2011
4. BehrouzA.ForouzanandFirouzMosharraf,"ComputerNetworksaTopDownApproach",TataMcGraw-Hill, 2017.
5. Rich Seifert,JamesEdwards,"TheAllNewSwitchBook:TheCompleteGuidetoLANSwitchingTechnology",2^{nd} Edition ,Wiley Publishing Inc,2011

Web References

1. https://tinyurl.com/ycy6x454
2. https://tinyurl.com/yapn9ac7
3. https://tinyurl.com/ydf33ye6
4. https://nptel.ac.in/courses/106/105/106105081/
5. https://nptel.ac.in/courses/106/105/106105183/

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

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

U19CCO64	WEB PROGRAMMING (Common to EEE,ECE, MECH, CIVIL, ICE MECHATRONICS, BME)	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

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

Course Outcomes

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

CO1 - Comprehend basic web applications using HTML **(K2)**
CO2 - Use CSS to design web applications **(K3)**
CO3-Use java scripts functions for the web page creation **(K3)**
CO4 - Explain XML structure **(K2)**
CO5 - Demonstrate the web 2.0 application to advance scripts **(K2)**

UNIT - I INTRODUCTION TO WWW & HTML **(9 Hrs)**

Protocols,secure connections, application and developmenttools, the web browser, Whatis server, dynamic IP, Web Design: Web site designprinciples, planning the site and navigation. **HTML:** The development process, Html tags and simple HTML forms.

UNIT – II STYLE SHEETS **(9 Hrs)**

CSS: Need for CSS, Introduction to CSS, basic syntax and structure, usingCSS, 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, JavaScript, develop JavaScript, simple JavaScript, variables, functions, conditions, loops and repetition.

UNIT –IV XML **(9 Hrs)**

XML: Introduction to XML, uses of XML, simple XML, XML key components, DTD and Schemas, Well formed, using XML with application XML, XSL and XSLT. Introduction to XSL, XML transformed simple example, XSL elements, transforming with XSLT.

UNIT –V ADVANCE SCRIPT **(9 Hrs)**

JavaScript and objects, JavaScript own objects, the DOM and web browser environments, forms and validations **DHTML:** Combining HTML, CSS and JavaScript, events and buttons, controlling your browser, **AJAX:** Introduction, advantages & disadvantages, AJAX based web application, alternatives of AJAX.

Text Books

1. Ralph Moseley, M.T. Savaliya, "Developing Web Applications", BPB Publications, 2017.
2. HirdeshBhardwaj,, "Web Designing", Pothi.com, 2016

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

Reference Books

1. Ralph Moseley, "Developing Web Applications", Wiley India Pvt. Ltd, 2013
2. Joel Sklar, " Principles of Web Design", 6th edition, Cengage Learning, Inc, 2014
3. B. M. Harwani," Developing Web Applications in PHP and AJAX", Tata McGraw-Hill Education, 2010
4. UttamK.Roy, Web Technologies, Oxford University Press, 2010.
5. Rajkamal, Web Technology, Tata McGraw-Hill, 2009.

Web References

1. https://nptel.ac.in/courses/106/106/106106156/
2. https://www.coursera.org/learn/html-css-javascript-for-web-developers
3. https://code.tutsplus.com/courses/how-to-become-a-web-developer
4. https://webdesignerwall.com/
5. https://www.smashingmagazine.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	2	1	1	1	2	1	-	-	-	-	-	1	-	-	-
2	2	1	2	1	2	1	-	-	-	-	-	1	-	-	-
3	2	1	2	1	2	1	-	-	-	-	-	1	-	-	-
4	2	1	1	1	2	1	-	-	-	-	-	1	-	-	-
5	2	1	1	1	2	1	-	-	-	-	-	1	-	-	-

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

U19ADO63	PRINCIPLE OF ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING (Common to EEE, ECE, CSE, IT, ICE, MECH, CIVIL, CCE)	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To understand basic principles of Artificial Intelligence
- To learn and design Knowledge representation
- To understand the concept of reasoning
- To master the fundamentals of machine learning, mathematical framework and learning algorithms
- To understand the reinforcement and statistical learning.

Course Outcomes

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

CO1 - Understand foundational principles of artificial intelligence. **(K2)**
CO2 - Understand formal methods of knowledge representation. **(K2)**
CO3 - Understand the fundamental issues and challenges of Reasoning. **(K2)**
CO4 - Analyze the underlying mathematical relationships with Machine Learning algorithms. **(K3)**
CO5 - Apply various models for Artificial Intelligence programming techniques. **(K4)**

UNIT I INTRODUCTION (9 Hrs)

Introduction to Artificial Intelligence - Artificial Intelligence Problems -Timelines of Artificial Intelligence - Production Systems - State Space Representation - Branches of Artificial Intelligence - Application of Artificial Intelligence.

UNIT II KNOWLEDGE REPRESENTATION (9 Hrs)

Knowledge Management - Types of Knowledge - Knowledge representation - Approaches to Knowledge representation - Issues in Knowledge representation - Knowledge base. First order Logic – Frames — Conceptual Dependency.

UNIT III REASONING (9 Hrs)

Types of reasoning - reasoning with Fuzzy Logic - Rule based Reasoning - Diagnosis Reasoning.

UNIT IV LEARNING (9 Hrs)

Types of Learning - Machine Learning - Intelligent agents - Association Learning: Apriori Algorithm - Case Study: Customer Sequence and SCADA Application – k-Means Clustering - Fuzzy Clustering - Cluster Similarity

UNIT V REINFORCEMENT AND STATISTICAL LEARNING
(9 Hrs)

Markov Decision Problem - Hidden Markov Model - Linear Classifier - decision Trees: Random forest - Bayesian Network – ANN - ANN Learning process - Types of Network – Perceptron - RBF Network -

Case studies: Character recognition.

Text Books

1. Anand Hareendran S., Anand Hareendran, And Vinod Chandra S.S. "Artificial Intelligence and Machine Learning" PHI Publication, 2014.
2. Tom M. Mitchell, "Machine Learning", McGraw-Hill Science, 1997.
3. Peter Harrington, "Machine Learning in action", Manning Publication, 2012.

Reference Books

1. Charu C. Aggarwal "Data Classification Algorithms and Applications", Chapman & Hall/CRC Data Mining and Knowledge Discovery Series.
2. Andreas C. Mueller and Sarah Guido, "Introduction to Machine Learning with Python", O'Reilly Media, Inc. First Edition, 2016.
3. Eremy Watt, Reza Borhani, and Aggelos K. Katsaggelos "Machine Learning Refined Foundations, Algorithms, and Applications", Cambridge University Press, 2016.
4. Shai Shalev-Shwartz and Shai Ben-David, "Understanding Machine Learning: From Theory to Algorithms", Cambridge University Press, 2014.

Web Resources

1. https://www.coursera.org/learn/machine-learning
2. https://ml-cheatsheet.readthedocs.io/en/latest/regression_algos.html
3. https://machinelearningmastery.com/a-tour-of-machine-learning-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	2	2	2	–	1	-	-	-	-	-	-	-	2	2	2
2	1	2	2	–	–	-	-	-	-	-	-	-	1	1	-
3	2	2	1	2	–	-	-	-	-	-	-	-	-	1	1
4	3	2	2	2	1	-	-	-	-	-	-	-	1	-	1
5	2	2	2	2	1	-	-	-	-	-	-	-	1	1	2

U19ADO64	DATA SCIENCE APPLICATION OF VISION (Common to EEE, ECE, CSE, IT, ICE, MECH, CIVIL, CCE, BME, Mechatronics)	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To understand the capability of a machine to get and analyze visual information and make decisions
- To learn methods and algorithms for Vision
- To learn how to use deep learning for Vision tasks
- To understand the neural network concepts
- To study the real world applications using computer vision

Course Outcomes

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

CO1 - Understand the methods and algorithms for image processing. **(K2)**
CO2 - Apply object detection and segmentation concepts for image processing. **(K4)**
CO3 - Apply scalable algorithms for large datasets in vision. **(K4)**
CO4 - Analyze deep learning and neural network architectures for image and video processing. **(K3)**
CO5 - Apply vision-based solutions for specific real-world applications. **(K4)**

UNIT I IMAGE FUNDAMENTALS **(9 Hrs)**

Pixels - The Building Blocks of Images - The Image Coordinate System - RGB and BGR Ordering - Scaling and Aspect Ratios. Image filters - Gaussian blur - Median filter - Dilation and erosion - Custom filters - Image thresholding - Edge detection - Sobel edge detector - Canny edge detector.

UNIT II OBJECT DETECTION AND SEGMENTATION **(9 Hrs)**

Image Features - Harris corner detection - Local Binary Patterns - Image stitching - Segmentation: Contour detection - The Watershed algorithm - Super pixels - Normalized graph cut.

UNIT III MACHINE LEARNING WITH COMPUTER VISION **(9 Hrs)**

Data pre-processing - Image translation through random cropping - Image rotation and scaling - Applications of machine learning for computer vision - Logistic regression - Support vector machines - K-means clustering.

UNIT IV IMAGE CLASSIFICATION USING NEURAL NETWORKS **(9 Hrs)**

Image Classification Basics Types of Learning - The Deep Learning Classification Pipeline - Introduction to Neural Networks - The Perceptron Algorithm - Backpropagation and Multi-layer Networks - The Four Ingredients in a Neural Network Recipe - Weight Initialization - Constant Initialization - Uniform and Normal Distributions - LeCun Uniform and Normal - Understanding Convolutions - CNN Building Blocks - Common Architectures and Training Patterns.

UNIT V COMPUTER VISION AS A SERVICE **(9 Hrs)**

Computer vision as a service – architecture - Developing a server-client model - Computer vision engine.

Text Books

1. Rafael C. Gonzalez, Richard E. Woods, "Digital Image Processing", Third Edition, Pearson Education, 2009.
2. Milan Sonka, Vaclav Hlavac, Roger Boyle, "Image Processing, Analysis and Machine Vision", Third Edition, Cengage Learning, 2007.
3. Gary Bradski, "Learning OpenCV", First Edition, 2008.

Reference Books

1. Alok Kumar Singh Kushwaha, Rajeev Srivastava, "Recognition of Humans and Their Activities for Video Surveillance", IGI Global, 2014.
2. Ying-li Tian, Arun Hampapur, Lisa Brown, Rogerio Feris, Max Lu, Andrew Senior, "Event Detection, Query, and Retrieval for Video Surveillance", IGI Global, 2009.
3. Matthew Turk, Gang Hua, "Vision-based Interaction", First Edition, Morgan Claypool, 2013.
4. Ian Goodfellow, Yoshuo Bengio, Aaron Courville, "Deep Learning (Adaptive Computation and Machine Learning series)", MIT Press, 2017.
5. Fan Jiang, "Anomalous Event Detection from Surveillance Video", ProQuest, 2012.

Web Resources

1. https://www.kaggle.com/learn/computer-vision
2. https://machinelearningmastery.com/what-is-computer-vision/
3. https://www.udemy.com/course/pythoncv/
4. https://www.analyticsvidhya.com/blog/2019/03/opencv-functions-computer-vision-python/
5. https://www.youtube.com/watch?v=N81PCpADwKQ&ab_channel=ProgrammingKnowledge

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

U19EEO76	ELECTRICAL ENERGY CONSERVATION AND AUDITING (Common to ECE, ICE, MECH, CIVIL, BME, Mechatronics)	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To know the necessity of conservation of energy.
- To understand the energy management schemes in motors.
- To understand the energy management methods in lighting schemes.
- To illustrate the metering schemes for energy management.
- To learn economic analysis and management techniques.

Course Outcomes

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

CO1 - Outline about the energy audit process and instruments. **(K2)**
CO2 - Apply the energy efficient methods for improving efficiency of electric motors. **(K2)**
CO3 - Develop good illumination systems and analyze the power factor. **(K3)**
CO4 - Acquire knowledge on various meters used for energy management. **(K2)**
CO5 - Analyze and evaluate cost effective model in electrical equipments. **(K5)**

UNIT I INTRODUCTION (9 Hrs)

Basics of energy – need for energy management – energy accounting – energy monitoring – targeting and reporting – energy audit – definitions – types of energy audit – audit instruments – audit of process industry – Case studies.

UNIT II ENERGY MANAGEMENT FOR MOTORS AND COGENERATION (9 Hrs)

Energy management for electric motors: energy efficient controls and starting efficiency – motor efficiency and load analysis – selection of motors – energy efficient motors. Energy management by cogeneration: forms of cogeneration – electrical interconnection.

UNIT III LIGHTING SYSTEMS (9 Hrs)

Energy management in lighting systems: task and the working space – light sources – ballasts – lighting controls – optimizing lighting energy – reactive power management – capacitor sizing – degree of compensation – capacitor losses –effect of harmonics – lighting and energy standards.

UNIT IV METERING FOR ENERGY MANAGEMENT (9 Hrs)

Metering for energy management: units of measure – utility meters – demand meters – paralleling of current transformers – instrument transformer burdens – multi tasking solid state meters – metering location vs requirements – power analyzer – metering techniques and practical examples.

UNIT V ECONOMIC ANALYSIS AND MODELS (9 Hrs)

Power system tariffs – Economic analysis: cash flow model – Time value of money – pay-back method – utility rate structures – cost of electricity – loss evaluation – load management – demand control techniques – utility monitoring and control system – economic analysis of HVAC systems.

Text Books

1. Barney L. Capehart, Wayne C. Turner, and William J. Kennedy, "Guide to Energy Management", The Fairmont Press, Inc., 5th Edition, 2006.
2. Frank Kreith, D. Yogi Goswami, "Energy Management and Conservation Handbook", CRC Press, 2nd Edition, 2016.
3. Wayne C. Turner, "Energy Management Handbook", The Fairmont Press, 4th Edition, 2001.

References Books

1. P. Venkataseshaiah K.V. Sharma, "Energy Management and Conservation", Dreamtech Press, 1st Edition, 2020.
2. Amit K. Tyagi, "Handbook on Energy Audits and Management", TERI, 1st Edition, 2003.
3. ICAI, "Electricity in buildings good practice guide", McGraw-Hill Education, 1st Edition, 2017.

Web References

1. https://nptel.ac.in/courses/108/106/108106022/
2. https://www.youtube.com/watch?v=onlhwmbL8CA
3. https://www.youtube.com/watch?v=CTt4y8bokWs
4. https://ieeexplore.ieee.org/document/7977655
5. https://ieeexplore.ieee.org/document/993185
6. https://ieeexplore.ieee.org/document/6450335

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

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

U19ECO75	IOT AND ITS APPLICATIONS	L	T	P	C	Hrs
	(Common to EEE, ICE, CSE MECH, IT, CIVIL)	3	0	0	3	45

Course Objectives

- To impart necessary and practical knowledge of components of Internet of Things.
- To attain the knowledge about different types of architecture and their elements of IoT.
- To understand the concepts of integration of devices and data's.
- To acquire the knowledge about remotely monitor data and control devices.
- To develop skills required to build real-time IoT based projects.

Course Outcomes

After completion of the course, students will be able to

CO1 - Understand internet of Things and its hardware and software components. (K2)
CO2 - Demonstrate the Interfacing of I/O devices, sensors & communication modules. (K3)
CO3 - Understand the concepts of remotely monitor data and control devices. (K2)
CO4 - Build and deploy an various architecture with their elements. (K3)
CO5 - Can develop real time IoT based projects. (K3)

UNIT I INTRODUCTION TO INTERNET OF THINGS **(9 Hrs)**

The technology of the internet of things, making the internet of things, Elements of an IoT ecosystem, design principles for connected devices, Web thinking for connected devices.

UNIT II ARCHITECTURE OF IoT **(9 Hrs)**

Architectural Overview, Design principles and needed capabilities, IoT Applications, Sensing, Actuation, Basics of Networking, M2M and IoT Technology Fundamentals- Devices and gateways, Data management, Business processes in IoT, Everything as a Service(XaaS), Role of Cloud in IoT, Security aspects in IoT.

UNIT III ELEMENTS OF IoT **(9 Hrs)**

Hardware Components- Computing (Arduino, Raspberry Pi), Communication, Sensing, Actuation, I/O interfaces.
Software Components- Programming API's (using Python/Node.js/Arduino) for Communication Protocols-MQTT, ZigBee, Bluetooth, CoAP, UDP, TCP.

UNIT IV IoT APPLICATION DEVELOPMENT **(9 Hrs)**

Solution framework for IoT applications- Implementation of Device integration, Data acquisition and integration, Device data storage- Unstructured data storage on cloud/local server, Authentication, authorization of devices

UNIT V IoT APPLICATIONS **(9 Hrs)**

IoT applications for industry: Future Factory Concepts, Brownfield IoT, Smart Objects, Smart Applications, Four Aspects in Business to Master IoT, IoT for Retailing Industry, IoT For Oil and Gas Industry, Opinions on IoT Application and Value for Industry, Home Management, eHealth.

Text Books

1. Vijay Madisetti, ArshdeepBahga, "Internet of Things, A Hands on Approach", University Press ,3rd/e ,Aug 2018.

2. Raj Kamal, "Internet of Things: Architecture and Design", McGraw Hill ISBN: 9789352605224, 9789352605224,2nd edition, May 2017
3. Dr. SRN Reddy, RachitThukral and Manasi Mishra, "Introduction to Internet of Things: A practical Approach", ETI Labs 2014.

Reference Books

1. Jeeva Jose, "Internet of Things", Khanna Publishing House, Delhi, 2012
2. Adrian McEwen, "Designing the Internet of Things", Wiley, 2007
3. Francis da Costa, "Rethinking the Internet of Things: A Scalable Approach to Connecting Everything", 1 st Edition, Apress Publications, 2013
4. CunoPfister, "Getting Started with the Internet of Things", O Reilly Media, 2015
5. Pethuru Raj and Anupama C. Raman, "The Internet of Things: Enabling Technologies, Platforms, and Use Cases", CRC Press

Web Resources

1. https://www.i-scoop.eu/internet-of-things-guide/
2. https://www.theinternetofthings.eu/
3. https://www.udemy.com/course/complete-guide-to-build-iot-things-from-scratch-to-market/
4. https://www.coursera.org/learn/iot
5. https://onlinecourses.nptel.ac.in/noc21_ee85/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	2	2	3	2	-	-	-	-	-	-	-	-	2	2	3
2	3	-	3	2	-	-	-	-	-	-	-	-	2	2	3
3	2	3	2	-	-	-	-	-	-	-	-	-	2	2	3
4	2	2	2	-	-	-	-	-	-	-	3	-	2	2	3
5	2	3	2	-	3	-	-	-	-	-	3	-	2	2	3

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

U19ECO76 SENSORS FOR INDUSTRIAL APPLICATIONS

L	T	P	C	Hrs
3	0	0	3	45

(Common to EEE, CSE, IT, ICE, MECH, Mechatronics and Civil)

Course Objectives

- To study principles of sensor and calibration
- To understand different types of motion sensors
- To demonstrate force, magnetic and heading sensors with its application to the learners
- To enhance students to understand the concept of optical, pressure and temperature sensor
- To select suitable sensor for industrial application

Course Outcomes

After completion of the course, students will be able to

CO1 - Explain principles of sensor and illustrate the calibration (K2)
CO2 - Demonstrate different types of range and sensors (K3)
CO3 - Determine the principles of Force, magnetic and heading sensors (K3)
CO4 - Describe different optical and thermal sensors (K2)
CO5 - Select suitable sensor for real time applications (K3)

UNIT I INTRODUCTION **(9 Hrs)**

Principles of Physical and Chemical Sensors: Sensor classification, Sensing mechanism of Mechanical, Electrical, Thermal, Magnetic, Optical, Chemical and Biological Sensors.
Sensor Characterization and Calibration: Study of Static and Dynamic Characteristics, Sensor reliability, aging test, failure mechanisms and their evaluation and stability study.

UNIT II MOTION, PROXIMITY AND RANGING SENSORS **(9 Hrs)**

Motion Sensors – Potentiometers, Resolver, Encoders – Optical, Magnetic, Inductive, Capacitive, LVDT – RVDT – Synchro – Microsyn, Accelerometer– GPS, Bluetooth, Range Sensors – RF beacons, Ultrasonic Ranging, Reflective beacons, Laser Range Sensor (LIDAR).

UNIT III FORCE, MAGNETIC AND HEADING SENSORS **(9 Hrs)**

Strain Gage, Load Cell and Magnetic Sensors –types, principle, requirement and advantages: Magneto resistive –Hall Effect – Current sensor Heading Sensors – Compass, Gyroscope, Inclinometers.

UNIT IV OPTICAL, PRESSURE AND TEMPERATURE SENSORS **(9 Hrs)**

Photo conductive cell, photo voltaic, Photo resistive, LDR – Fiber optic sensors – Pressure – Diaphragm, Bellows, Piezoelectric – Tactile sensors, Temperature – IC, Thermistor, RTD, Thermocouple. Acoustic Sensors – flow and level measurement. Radiation Sensors - Smart Sensors - Film sensor, MEMS & Nano Sensors, LASER sensors.

UNITV APPLICATIONS OF SENSORS **(9 Hrs)**

Applications of Sensors for Industry Automation - Design of smart Industry using Temperature, Humidity and Pressure sensors - Applications of Flow sensors in Industries-Applications of Gyro sensor. Applications of Position sensors.

Text Books

1. Patranabis D.," Sensor and Actuators", Prentice Hall of India (Pvt) Ltd., second edition 2005(revised).
2. Renganathan S.," Transducer Engineering", Allied Publishers (P) Ltd., 2005(revised).
3. Ernest O. Doebelin, "Measurement systems Application and Design", International Student Edition, VIEdition, Tata McGraw-Hill Book Company, 2012.

Reference Books

1. Kr.Iniewski, "Smart Sensors for Industrial Applications" ,CRC Press ,2017
2. Bolton W, "Mechatronics", Thomson Press, third edition, 2004.
3. Ian R Sinclair, —Sensors and Transducersl, Third Edition, Newnes publishers, 2001.
4. Robert B. Northrop, "Introduction to Instrumentation and Measurement", 3rd Edition", CRC – Press, Taylor and Francis Group, 2005
5. Curtis D. Johnson, "Process Control Instrumentation Technology", Prentice Hall International Edition, 2015.

Web References

1. https://www.first-sensor.com/en/applications/industrial/
2. https://www.finoit.com/blog/top-15-sensor-types-used-iot/
3. https://www.iaasiaonline.com/smart-sensors-for-industrial-applications-2/
4. https://www.plantautomation-technology.com/articles/types-of-sensors-used-in-industrial-automation
5. https://www.thomasnet.com/articles/instruments-controls/sensors/

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

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

U19CSO76 **ARTIFICIAL INTELLIGENCE**
(Common to EEE, ICE, CIVIL, MECH,CCE, FT)

L	T	P	C	Hrs
3	0	0	3	45

Course Objectives

- To cover fundamentals of Artificial Intelligence,
- To understand various knowledge representation techniques.
- To provide knowledge of AI systems and its variants
- To understand the planning and different learning.
- To understand the communication process of language translator.

Course Outcomes

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

CO1 - Understand the basics of Artificial Intelligence. **(K1)**
CO2 - Apply AI problem solving techniques, knowledge representation, and reasoning methods in Knowledge based systems **(K3)**
CO3 - Develop simple intelligent / expert system using available tools and techniques of AI to analyze and interpret domain knowledge. **(K3)**
CO4 - Become familiar with planning and different learning methods. **(K3)**
CO5 - Understanding the human language to Machine language and Robotics. **(K1)**

UNIT I INTRODUCTION **(9 Hrs)**
Introduction - Foundations of AI – History of AI –Structure of AI agents, Problem solving - Informed and uninformed search techniques.

UNIT II KNOWLEDGE REPRESENTATION AND REASONING **(9 Hrs)**
Logical Agents –Propositional logic - First-Order Logic - Forward and backward chaining - Knowledge Representation

UNIT III UNCERTAIN KNOWLEDGE AND REASONING **(9 Hrs)**
Basic probability notations - Bayes rule – Wumpus world revisited - Bayesian network.

UNIT IV PLANNING AND LEARNING **(9 Hrs)**
Introduction to planning, Planning in situational calculus - Representation for planning – Partial order planning algorithm- Learning from examples- Knowledge in Learning - Statistical Learning Methods - Reinforcement Learning.

UNIT V COMMUNICATING, PERCEIVING AND ACTING **(9 Hrs)**
Natural Language Processing – Natural Language for communication – Perception - Robotics.

Text Books

1. Kevin Night, Elaine Rich, Nair B., "Artificial Intelligence (SIE)", McGraw Hill2008.
2. Stuart Russel, Peter Norvig "AI – A Modern Approach", 2nd Edition, Pearson Education 2007.
3. Patrick Henry Winston," Artificial Intelligence", Addison Wesley, Books Third edition, 2000.

Reference Books

1. George F Luger, Artificial Intelligence, Pearson Education, 6th edition, 2009.
2. Peter Jackson, "Introduction to Expert Systems", 3rd Edition, Pearson Education, 2007.
3. EngeneCharniak and Drew Mc Dermott," Introduction to Artificial intelligence, Addison Wesley 2000.
4. Patrick Henry Winston, "Artificial Intelligence", Addison Wesley, Books Third edition, 2000.
5. Nils J. Nilsson, "Principles of Artificial Intelligence", Narosa Publishing House, 2000.

Web Resources

1. https://www.tutorialspoint.com/artificial_intelligence/index.htm
2. https://www.javatpoint.com/artificial-intelligence-tutorial
3. https://www.w3schools.com/ai/
4. https://www.mygreatlearning.com/blog/artificial-intelligence-tutorial/
5. https://nptel.ac.in/courses/112/103/112103280/

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

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

U19CSO77 CLOUD TECHNOLOGY AND ITS APPLICATIONS

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

L	T	P	C	Hrs
3	0	0	3	45

Course Objectives

- To define the fundamental ideas behind Cloud Computing.
- To classify the basic ideas and principles in cloud information system.
- To relate cloud storage technologies and relevant distributed file systems.
- To explain the Cloud Applications.
- To define the Future of Cloud.

Course Outcomes

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

CO1 - Explain the core concepts of the cloud computing paradigm: how and why this paradigm shift came about, the characteristics, advantages and challenges brought about by the various models services in cloud computing. **(K1)**

CO2 - Apply fundamental concepts in cloud infrastructures to understand the tradeoffs in power, efficiency and cost, and then study how to leverage and manage single and multiple datacentres to build and deploy cloud applications that are resilient, elastic and cost-efficient. **(K3)**

CO3 - Illustrate the fundamental concepts of Cloud Applications. **(K4)**

CO4 - Explain the Applications of cloud. **(K3)**

CO5 - Advancing towards a Cloud. **(K3)**

UNIT I INTRODUCTION (9 Hrs)

Introduction to Cloud Computing- The Evolution of Cloud Computing – Hardware Evolution – Internet Software Evolution – Server Virtualization - Web Services Deliver from the Cloud – Communication-as-a-Service – Infrastructure-as-a-Service – Monitoring-as-a-Service – Platform-as-a-Service – Software-as-a-Service – Building Cloud Network.

UNIT II CLOUD INFORMATION SYSTEMS (9 Hrs)

Federation in the Cloud - Presence in the Cloud - Privacy and its Relation to Cloud-Based Information Systems – Security in the Cloud - Common Standards in the Cloud – End-User Access to the Cloud Computing.

UNIT III CLOUD INFRASTRUCTURE (9 Hrs)

Introduction– Evolving IT infrastructure – Evolving Software Applications –Service Oriented Architecture – Interoperability Standards for Data Center Management - Virtualization – Hyper Threading – Blade Servers - Automated Provisioning - Policy Based Automation – Application Management – Evaluating Utility Management Technology - Virtual Test and development Environment.

UNIT IV CLOUD APPLICATIONS (9 Hrs)

Software Utility Application Architecture - Characteristics of a SaaS - Software Utility Applications - Cost Versus Value - Software Application Services Framework - Common Enablers – Conceptual view to Reality – Business Profits - Implementing Database Systems for Multitenant Architecture - Service creation environments to develop cloud based applications. Development environments for service development; Amazon, Azure, Google App.

UNIT V FUTURE OF CLOUD (9 Hrs)

Other Design Considerations - Design of a Web Services Metering Interface - Application Monitoring Implementation - A Design for an Update and Notification Policy - Transforming to Software as a Service - Application Transformation Program - Business Model Scenarios - Virtual Services for Organizations - The Future.

Text Books

1. Sandeep Bhowmik ,& quot; Cloud Computing & quot;,Cambridge University Press; First editiouun,2017.
2. Erl ,'Cloud Computing: Concepts, Technology & Architecture', Pearson Education India, 1st edition, 1 January 2014.
3. Kai Hwang, Geoffrey C. Fox, Jack G. Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers, 2012.

Reference Books

1. Sanjiva Shankar Dubey ,' Cloud Computing and Beyond', Dreamtech Press 2edition,2019.
2. John W. Rittinghouse and james F. Ransome, "Cloud Computing Implementation, Management and Security", CRC Press, Taylor & Francis Group, Boca Raton London New York, 2010.
3. George Reese, "Cloud Application Architectures", O'reilly Publications, 2009.
4. Alfredo Mendoza, "Utility Computing Technologies, Standards, and Strategies", Artech House INC, 2007.
5. Bunker and Darren Thomson, "Delivering Utility Computing", John Wiley & Sons Ltd.2006.

Web Resources

1. www.coltdatacentres.net/Cloud Technology.
2. www.zdnet.com.
3. https://www.cloudbakers.com/blog/what-is-a-cloud-application
4. https://www.cloudbakers.com/blog/what-is-a-cloud-application
5. https://blog.servermania.com/what-is-a-cloud-application/

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

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

U19ITO76	AUTOMATION TECHNIQUES & TOOLS - DEVOPS (common to EEE, ECE, ICE, CSE, MECH, CIVIL, BME, Mechatronics)	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- The Background and mindset of Devops
- To enable students appreciate the agile led development environment.
- To give the students a perspective to grasp the need for Minimum viable product led development using Sprints.
- To enable students acquire fundamental knowledge of CI/CD and CAMS.
- To enable learners realize various aspects of DevOps Ecosystem.

Course Outcomes

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

CO1 - Explain traditional software development methodologies like waterfall. **(K2)**
CO2 - Apply the Agile Methodology and comparing various other software development models with agile. **(K3)**
CO3 - Explain implementing Continuous Integration and Continuous Delivery. **(K2)**
CO4 - Explain CAMS for DevOps (Culture, Automation, Measurement and Sharing). **(K2)**
CO5 - Create quick MVP prototypes for modules and functionalities. **(K3)**

UNIT I TRADITIONAL SOFTWARE DEVELOPMENT (9 Hrs)

The Advent of Software Engineering - Software Process, Perspective and Specialized Process Models – Software Project Management: Estimation - Developers vs IT Operations conflict.

UNIT II RISE OF AGILE METHODOLOGIES (9 Hrs)

Agile movement in 2000 - Agile Vs Waterfall Method - Iterative Agile Software Development - Individual and team interactions over processes and tools - Working software over comprehensive documentation - Customer collaboration over contract negotiation - Responding to change over following a plan

UNIT III INTRODUCTION DEVOPS (9 Hrs)

Introduction to DevOps - Version control - Automated testing - Continuous integration - Continuous delivery - Deployment pipeline - Infrastructure management – Databases

UNIT IV PURPOSE OF DEVOPS (9 Hrs)

Minimum Viable Product- Application Deployment- Continuous Integration- Continuous Delivery

UNIT V CAMS (CULTURE, AUTOMATION, MEASUREMENT AND SHARING) (9 Hrs)

CAMS – Culture, CAMS – Automation, CAMS – Measurement, CAMS – Sharing, Test-Driven Development, Configuration Management-Infrastructure Automation- Root Cause Analysis- Blamelessness- Organizational Learning

Text Books

1. Dev Ops – Volume 1 , Pearson and Xebia Press
2. Grig Gheorghiu, Alfredo Deza, Kennedy Behrman, Noah Gift, Python for DevOps,2019

Reference Books

1. The DevOps Handbook - Book by Gene Kim, Jez Humble, Patrick Debois, and Willis Willis
2. What is DevOps? - by Mike Loukides
3. Joakim Verona, Practical DevOps ,2016.

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

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

U19IT077	AUGMENTED AND VIRTUAL REALITY	L	T	P	C	Hrs
	(common to EEE, ICE, MECH, CICIL, BME)	3	0	0	3	45

Course Objectives

- To learn basics of VR and AR systems
- To know about basic Augment reality functions
- To know about basic Virtual reality functions
- To know about Virtual reality environment and steps to work on it
- To learn various application on AR and VR

Course Outcomes

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

CO1 - Understand the concepts of VR **(K2)**
CO2 - Summarize different VR modelling Process **(K2)**
CO3 - Identify applications of virtual reality environment **(K2)**
CO4 - Explore and work on Augmented Reality environment **(K2)**
CO5 - Illustrate applications related to VR and AR **(K3)**

UNIT I VIRTUAL REALITY AND 3D COMPUTER GRAPHICS **(9 Hrs)**

Introduction - Benefits of virtual reality - The Virtual world space – Positioning the virtual observer – Stereo perspective projection – 3D clipping – Color Theory – Simple 3D modeling – Illumination models – Reflection models – Shading algorithms

UNIT II VR MODELLING PROCESS **(9 Hrs)**

Geometric modeling – kinematics modeling- physical modeling – behaviour modeling – model Management.

UNIT III CONTENT CREATION CONSIDERATIONS FOR VR **(9 Hrs)**

Methodology and terminology - user performance studies - VR health and safety issues – Usability of virtual reality system - cyber sickness -side effects of exposures to virtual reality environment

UNIT IV AUGMENTED REALITY (AR) **(9 Hrs)**

Introduction – Benefits of AR – Key players of AR technology - Understanding Augmented reality - Working with AR and System structure

UNIT -V APPLICATIONS ON VR **(9 Hrs)**

Medical applications- robotics applications- Advanced Real time Tracking-other applications- games, movies, simulations

Text Books

1. Kelly S. Hale , Kay M. Stanney, "Handbook of Virtual Environments: Design, Implementation, and Applications", Human Factors and Ergonomics ,Second Edition , 2014.
2. C. Burdea and Philippe Coiffet, "Virtual Reality Technology", Gregory, John Wiley and Sons, Inc., Second Edition, 2008.
3. Jason Jerald, "The VR Book: Human-Centred Design for Virtual Reality". Association for Computing Machinery and Morgan and Claypool, New York, 2015.

Reference Books

1. Dieter Schmalstieg and Tobias Hollerer , "Augmented Reality: Principles and Practice (Usability)", Pearson Education (US), Addison-Wesley Educational Publishers Inc, New Jersey, United States, 2016.
2. Steve Aukstakalnis, "Practical Augmented Reality: A Guide to the Technologies, Applications, and Human Factors for AR and VR (Usability)", Addison-Wesley Professional; 1 edition, 2016.
3. Tony Parisi , "Learning Virtual Reality: Developing Immersive Experiences and Applications for Desktop, Web, and Mobile", OReilly Media, 1st edition, 2015.
4. Tony Parisi , "Programming 3D Applications with HTML5 and WebGL: 3D Animation and Visualization for Web Pages", OReilly Media, 1st edition, 2014.

Web References

1. https://www.coursera.org/courses?query=augmented%20reality
2. https://nptel.ac.in/courses/106/106/106106138/
3. http://www.vrmedia.it/en/xvr.html
4. http://www.hitl.washington.edu/artoolkit/

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

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

U19MEO76	PRINCIPLES OF HYDRAULIC AND PNEUMATIC SYSTEM	L	T	P	C	Hrs
		3	0	0	3	45

(Common to EEE, ECE, ICE, CIVIL)

Course Objectives

- To provide student with knowledge on the application of fluid power in process, construction and manufacturing Industries.
- To provide students with an understanding of Hydraulic system design and industrial applications.
- To provide fundamental knowledge of components forming pneumatic systems.
- To design pneumatic circuits.
- To understand the PLC programming and its applications in Hydro mechanical servo systems.

Course Outcomes

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

CO1 - Identify the components of a typical hydraulic systems. **(K2)**
CO2 - Design and predict simple pressure and direction flow circuits. **(K3)**
CO3 - Understand the pneumatic components (Cylinders, valves, etc.), their use, symbols, and their constructional details. **(K2)**
CO4 - Design Industrial Pneumatics automatic control circuits. **(K3)**
CO5 - Develop circuits for controlling hydraulic and pneumatic system using PLC. **(K3)**

UNIT I ELEMENTS OF HYDRAULIC SYSTEMS (9 Hrs)

Introduction to fluid power, Power unit and accessories, Types of power units –elements. Design properties - Hydraulic fluids, Selection of hydraulic fluid, comparison of hydraulics and pneumatics. Types of cylinders, cylinder cushioning, Pipes- material, pipe fittings. Seals and packing. Filter arrangement, maintenance of hydraulic systems. Selection criteria for cylinders, pipes, Heat generation in hydraulic system.

UNIT II HYDRAULIC SYSTEM DESIGN AND INDUSTRIAL APPLICATIONS (9 Hrs)

Pressure, flow and direction control valves – types & constructional details, circuit symbols. Flow, Pressure and direction control circuits. Regenerative circuits, differential circuits, feed circuits, sequencing circuits, synchronizing circuits, fail-safe circuits. Design of hydraulic circuits.

UNIT III ELEMENTS OF PNEUMATIC SYSTEMS (9 Hrs)

Compressors- types, selection. Symbols of pneumatic elements. Cylinders - types, typical construction details. Valves – Types, typical construction details.

UNIT IV PNEUMATIC SYSTEMS DESIGN AND INDUSTRIAL APPLICATIONS (9 Hrs)

General approach, travel step diagram. Types - sequence control, cascade, step counter method. K..Mapping for minimization of logic equation. Metal working, handling, clamping, application with counters. Design of pneumatic circuits.

UNIT V ADVANCES IN HYDRAULICS AND PNEUMATICS **(9 Hrs)**

Electro pneumatics, ladder diagram. Servo and Proportional valves - types, operation, application. Hydro-Mechanical servo systems. PLC-construction, types, operation, programming.

Text Books

1. Anthony Esposito, "Fluid Power with Applications", Pearson Education 2005.
2. Srinivasan R. "Hydraulic and Pneumatic Controls', Vijay Nicole Imprints Private Ltd, 2005.
3. Yeaple F.D ,"Hydraulic and Pneumatic Power and Control: Design', McGraw-Hill, USA, 2007.
4. S.Sameer, "Hydraulic And Pneumatic",R.K.Publications, 2010.
5. Turner I C, "Engineering Applications Of Pneumatics And Hydraulics", Taylor & Francis, 2020.

Reference Books

1. Majumdar, S.R, "Oil Hydraulic Systems: Principles and Maintenance', Tata McGraw- Hill, New Delhi, 2003.
2. Sundaram K.Shanmuga, "Hydraulic and Pneumatic Controls", S. Chand,2006.
3. Pippenger J.J Tyler G Hicks, "Industrial Hydraulics", McGraw-Hill, USA, 2007.
4. Jaroslaw Stryczek, "Advances in Hydraulic and Pneumatic Drives and Controls", Springer, 2020.
5. Joji Parambath, "Hydraulics Accumulators and Circuits" 2020.

Web References

1. https://nptel.ac.in/courses/112/106/112106300/
2. https://nptel.ac.in/courses/112/105/112105046/
3. https://nptel.ac.in/courses/112/102/112102011/
4. https://nptel.ac.in/courses/112/106/112106175/
5. https://www.hydraulicspneumatics.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	1	-	2	1	-	1	-	1	-	2	1	2	1
2	3	2	2	1	2	1	-	1	-	1	-	2	2	1	2
3	3	1	2	-	1	-	-	1	-	1	-	1	2	2	1
4	3	2	2	2	1	1	-	1	-	1	-	3	2	1	2
5	3	1	2	1	2	1	-	1	1	1	-	3	2	2	2

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

U19CEO76	GLOBAL WARMING AND CLIMATE CHANGE	L	T	P	C	Hrs
	(common to EEE, ECE, CSE, IT, ICE, MECH, BME)	3	0	0	3	45

Course Objectives

This course should enable the students to

- Understand the basics and importance of global warming.
- Gain adequate knowledge about the characteristic of atmosphere components.
- Gain knowledge about impart of climate change.
- Gain knowledge about the Changes in Climate and Environment
- Impart knowledge about the mitigation measures

Course Outcomes

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

CO1 - Understand the concept and effects of global warming**(K2)**

CO2 - Understand Climate system, earth's atmosphere and its components.**(K2)**

CO3 - Analyze the Impacts of Climate Change on various sectors**(K4)**

CO4 - Assess the concept about carbon credit and clean development mechanism.**(K3)**

CO5 - Understand climate changes, its impact and mitigation activities.**(K2)**

KNOWLEDGE LEVEL: K1 – Remember, **K2** – Understand, **K3** – Apply, **K4** – Analyze and **K5** – Evaluate

UNIT I EARTH'S CLIMATE SYSTEM (9 Hrs)

Ozone layer-Role of ozone in environment-ozone depleting -Green House gases- Effects of Greenhouse Gases- Global Warming -Hydrological Cycle – Radiative Effects and Carbon Cycle.

UNIT II ATMOSPHERE AND ITS COMPONENTS (9 Hrs)

Importance of Atmosphere-Physical Chemical Characteristics of Atmosphere- Vertical structure of the atmosphere-Composition of the atmosphere-Atmospheric stability-Temperature profile of the atmosphere-Lapse rates-Temperature inversion-effects of inversion on pollution dispersion.

UNIT III IMPACTS OF CLIMATE CHANGE (9 Hrs)

Causes of Climate change : Change of Temperature in the environment-Melting of ice Pole-sea level rise-Impacts of Climate Change on various sectors – Agriculture, Forestry and Ecosystem – Water Resources – Human Health – Industry, Settlement and Society – Methods and Scenarios – Projected Impacts for Different Regions– Uncertainties in the Projected Impacts of Climate Change – Risk of Irreversible Changes.

UNIT IV OBSERVED CHANGES AND ITS CAUSES (9 Hrs)

Climate change and Carbon credits- Initiatives in India-Kyoto Protocol-Intergovernmental Panel on Climate change- Climate Sensitivity and Feedbacks –The Montreal Protocol – UNFCCC – IPCC – Evidences of Changes in Climate and Environment – on a Global Scale and in India .

UNIT V CLIMATE CHANGE AND MITIGATION MEASURES (9 Hrs)

Clean Development Mechanism –Carbon Trading- examples of future Clean Technology – Biodiesel – Natural Compost – Eco- Friendly Plastic – Alternate Energy – Hydrogen – Bio-fuels – Mitigation Efforts in India and Adaptation funding. Key Mitigation Technologies and Practices– Carbon sequestration – Carbon capture and storage (CCS) – International and Regional cooperation-Remedial measures.

Text Books

1. Joan Fitzgerald "Greenovation: Urban Leadership on Climate Change,Oxford University Press 2020.
2. J. David Neelin" Climate change and climate modelling" Cambridge University press (2011).
3. Robin Moilveen "Fundamentals of weather and climate" Oxford University Press (2nd Edition) (2010),
4. Andrew Dessler and Edward A. Parson "The Science and Politics of Global Climate Change"2009
5. Dash Sushil Kumar, "Climate Change – An Indian Perspective", Cambridge University Press India Pvt. Ltd, 2007.

Reference Books

1. Bill Mc Kibben (2012), The Global Warming Reader: A Century of Writing About Climate Change, Penguin.
2. Jason Smerdon (2009) Climate Change: The Science of Global Warming and Our Energy Future, Columbia University
3. Adaptation (2006) and mitigation of climate change-Scientific Technical Analysis. Cambridge University Press, Cambridge.
4. J.M. Wallace and P.V. Hobbs (2006) Atmospheric Science, Elsevier / Academic Press.
5. Jan C. van Dam, (2003) Impacts of "Climate Change and Climate Variability on Hydrological Regimes", Cambridge University Press.

Web References

1. https://nptel.ac.in/courses/105102089/
2. https://www.warmheartworldwide
3. https://nptel.ac.in/content/storage

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	2	2	3	3	3	3	3	3	3	3	3	3	-	-	-
CO2	3	3	2	3	3	3	3	3	3	2	3	3	-	-	-
CO3	3	3	3	3	3	3	3	3	3	3	3	3	-	-	-
CO4	2	3	3	2	3	3	3	3	3	3	3	3	-	-	1
CO5	3	3	3	3	3	3	3	3	3	3	3	3	-	-	1

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

U19BMO75	INTERNET OF THINGS FOR HEALTH CARE	L	T	P	C	Hrs
	(common to EEE, ECE, ICE)	3	0	0	3	45

Course Objectives

- To understand the architecture of IoT and its associated protocols
- To gain knowledge on interfacing IoT and cloud
- To analyse the designand development of IoT.
- To get trained with m-IoT components and equipments
- To understand wearable technologies and applications of m-IoT

Course Outcomes

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

CO1 - Understand the architecture of IoT and its associated protocols **(K2)**
CO2 - Gain knowledge on interfacing IoT and cloud. **(K2)**
CO3 - Analyse the design and development of IoT. **(K3)**
CO4 - Understand m-IOT components andequipments **(K2)**
CO5 - Gain knowledge in wearable technologies and applications of m-IoT **(K2)**

UNIT I INTRODUCTION TO IoT **(9 Hrs)**

Brief History of IoT, Architectural Layers of IoT, Bluetooth, ZigBee, Wi-Fi, IP-Based Protocols, UPnP, CoAP, MQTT, XMPP. SCADA, Authentication protocols, IEEE 802.15.4.

UNIT II IOT IN THE CLOUD **(9 Hrs)**

Network layer, Cloud, Network Technologies, Types of Networks, BAN, Cloud and Virtualization, Cloud terminologies, Types of Cloud, Service Models, Fog and edge customization

UNIT III DESIGN & DEVELOPMENT **(9 Hrs)**

Design Methodology – Embedded computing logic – Microcontroller, System on Chips – IoT system building blocks – Arduino board details – IDE programming – Raspberry Pi – Introduction and Interfacing

UNIT IV M-IoT **(9 Hrs)**

Perception Layer, RFIDs, cameras, Sensors, Introduction to ASICs, pulse oximeters, instrumentation amplifiers, surgical equipment and dependencies, Surgery and its types, role of IoT in surgery.

UNIT V APPLICATION OF IoT in HEALTH CARE **(9 Hrs)**

Ventilators, Wearable Technologies, smart watches, Computer Assisted Anthropology, Smart Health Organizations

Text Books

1. Aboul Ella Hassanien, Nilanjan, Dey, Surekha Borra, "Medical Big Data and Internet of Medical Things", CRC Press, 1st edition, 2018.
2. Pankajavalli, P. B., Karthick, G. S. "Incorporating the Internet of Things in Healthcare Applications and Wearable Devices,"IGI Global, 1st edition, 2019.
3. Peter Waher, "Learning Internet of Things", Packt Publishing, 2015

Reference Books

1. Valentia E.Balas, Le Hoang Son, Sudan Jha, Manju Khari, Raghvendra Kumar "Internet of Things in Biomedical Engineering", , Academic Press, 2019
2. Dr. Guillaume Girardin, Antoine Bonnabel, Dr. Eric Mounier, 'Technologies Sensors for the Internet of Things Businesses & Market Trends, Yole Development Copyrights ,2014
3. Vijender Kumar Solanki, Raghvendra Kumar, Md. Atiqur Rahman Ahad "A Handbook of Internet of Things in Biomedical and Cyber Physical System" Springer International Publishing,2019
4. Amit Banerjee, Lalit Garg, Joel J. P. C. Rodrigues "Internet of Medical Things for Smart Healthcare" Springer Singapore,2019
5. Subhas Chandra Mukhopadhyay "Intelligent IoT Systems in Personalized Health Care" Elsevier SciencePublishing,2020

Web References

1. https://nptel.ac.in/noc/courses/noc19/SEM1/noc19-cs31/
2. https://www.digimat.in/nptel/courses/video/108105091/L01.html
3. https://youtu.be/ZIBBZnGjFCg
4. https://youtu.be/UrwbeOllc68
5. https://youtu.be/gGNz-SduPnM

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

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

U19BMO76	TELEHEALTH TECHNOLOGY	L	T	P	C	Hrs
	(common to EEE, ECE, ICE)	3	0	0	3	45

Course Objectives

- To Learn the key principles for telehealth technologies
- To understand communication networks and services.
- To know telemedicine system deployment
- To know the technology for alternative medicine
- To get an adequate knowledge of telemedicine applications.

Course Outcomes

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

CO1 - Understand fundamentals of telemedicine **(K2)**
CO2 - Gain knowledge in Communication networks and services **(K2)**
CO3 - Explain telemedicine system deployment and apply safeguard technologies in telemedicine **(K3)**
CO4 - Gain knowledge in technology for alternative medicine **(K2)**
CO5 - Explain telemedicine applications. **(K2)**

UNIT I FUNDAMENTALS OF TELEMEDICINE (9 Hrs)

Information Technology and Healthcare Professionals- Providing Healthcare to Patients- Technical Perspective - Healthcare Providers - Healthcare Informatics Developments - Different Definitions of Telemedicine - The Growth of the Internet: Information Flooding in E-Health.

UNIT II COMMUNICATION NETWORKSAND SERVICES (9 Hrs)

Wireless Communications Basics - Types of Wireless Networks - Wireless Technology in Patient Monitoring - Body Area Networks - Remote Recovery, General Health Assessments, Technologies in Medical Information Processing - Collecting Data from Patients - Bio-signal Transmission and Processing - Patient Records and Data Mining - Knowledge Management for Clinical Applications - Electronic Drug Store.

UNIT III TELEMEDICINE SYSTEM DEPLOYMENT AND SECURITY (9 Hrs)

Planning and Deployment Considerations - OSI Model - Scalability to Support Future Growth - Integration with Existing IT Infrastructure – Database - Evaluating IT Service and Solution Provider - Technologies for Safeguarding Medical Data and Privacy - Information Security Overview – Safeguarding Patient Medical History.

UNIT IV TECHNOLOGY FOR ALTERNATIVE MEDICINE (9 Hrs)

Technology for Natural Healing and Preventive Care - Consumer Electronics in Healthcare-Telehealth in General Healthcare and Fitness - Telemedicine in Physiotherapy -Healthcare Technology and the Environment.

UNIT V APPLICATIONS OF TELEMEDICINE (9 Hrs)

Teleradiology- Telepathology -Telecardiology- Tele oncology- Tele dermatology- Telesurgery-e-Health and Cyber Medicine - Future Trends in Healthcare Technology.

Text Books

1. Norris A C, Essentials of Telemedicine and Telecare, John Wiley, New York, 2002.
2. Bernard Fong, A. C. M. Fong, C. K. Li, "Telemedicine Technologies: Information Technologies in Medicine and Telehealth", John Wiley & Sons, Ltd, 2010.
3. Khandpur R S, "Telemedicine Technology and Applications", PHI Learning Pvt Ltd, 2017.

Reference Books

1. Olga Ferrer Roca, Marcelo Sosa Iudicissa, Handbook of Telemedicine, IOS Press, Netherland, 2002.
2. Wootton, R., Craig, J., Patterson, V. (Eds.), "Introduction to Telemedicine" Taylor & Francis 2017
3. Carroll, P.W. Yasnoff, W.A., Ward, E., Ripp, L.H., Martin, E.L. (Eds), "Public Health Informatics and Information Systems", Springer, 2003.
4. Ferrer-Roca, O., Sosa - Iudicissa, M. (Eds.), "Handbook of Telemedicine,Studies in Health Technology and Informatics", IOS Press, 2002
5. R. Latifi," Current Principles and Practices of Telemedicine and e-Health, IOS Press; 2008

Web References

1. https://youtu.be/B9oC8vUjqk8
2. https://youtu.be/AMyTpsG86Pk
3. https://youtu.be/ZfDheAo4nCo
4. https://youtu.be/d87Iyj4rCNg
5. https://youtu.be/QfAoYUsTvtk

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

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

U19CCO75	DATA SCIENCE USING PYTHON (Common to EEE, ECE, MECH, CIVIL, ICE, Mechatronics, BME)	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To understand the concepts of Real world data science and Python.
- To learn the OOPs concepts with data science.
- To understand the NumPy operations with data science.
- To learn the data manipulation with Pandas.
- To clean, prepare and visualize with real data science.

Course outcomes

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

CO1 - Infer the Real world data science and and solve basic problems using Python. **(K2)**

CO2 - Design an application with user-defined modules and packages using OOP concept **(K2)**

CO3 - Employ efficient storage and data operations using NumPy arrays. **(K2)**

CO4 - Apply powerful data manipulations using Pandas. **(K3)**

CO5 - Do data preprocessing using Pandas. **(K2)**

UNIT I INTRODUCTION TO DATA SCIENCE AND PYTHON (9 Hrs)

Introduction to Data Science - Why Python? - Essential Python libraries - Python Introduction- Features, Identifiers, Reserved words, Indentation, Comments, Built-in Data types and their Methods: Strings, List, Tuples, Dictionary, Set - Type Conversion- Operators.

Decision Making- Looping- Loop Control statement- Math and Random number functions. User defined functions - function arguments & its types.

UNIT II FILE, EXCEPTION HANDLING AND OOP (9 Hrs)

User defined Modules and Packages in Python- Files: File manipulations, File and Directory related methods- Python Exception Handling. OOPs Concepts - Class and Objects, Constructors – Data hiding- Data Abstraction- Inheritance.

UNIT III INTRODUCTION TO NUMPY (9 Hrs)

NumPy Basics: Arrays and Vectorized Computation- The NumPy ndarray- Creating ndarrays- Data Types for ndarrays- Arithmetic with NumPy Arrays- Basic Indexing and Slicing - Boolean Indexing- Transposing Arrays and Swapping Axes.

Universal Functions: Fast Element-Wise Array Functions- Mathematical and Statistical Methods- Sorting Unique and Other Set Logic.

UNIT IV DATA MANIPULATION WITH PANDAS (9 Hrs)

Introduction to pandas Data Structures: Series, DataFrame, Essential Functionality: Dropping Entries Indexing, Selection, and Filtering- Function Application and Mapping- Sorting and Ranking.

UNIT V DATA CLEANING AND PREPARATION (9 Hrs)

Data Cleaning and Preparation: Handling Missing Data - Data Transformation: Removing Duplicates,

Transforming Data Using a Function or Mapping, Replacing Values, Detecting and Filtering Outliers-String.
Manipulation: Vectorized String Functions in pandas. Plotting with pandas: Line Plots, Bar Plots, Histograms and Density Plots, Scatter or Point Plots.

Text Books

1. Y. Daniel Liang, "Introduction to Programming using Python", Pearson, 2012.
2. Wes McKinney, "Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython", O'Reilly, 2nd Edition, 2018.
3. Jake Vander Plas, "Python Data Science Handbook: Essential Tools for Working with Data", O'Reilly, 2017.

Reference Books

1. Wesley J. Chun, "Core Python Programming", Prentice Hall, 2006.
2. Mark Lutz, "Learning Python", O'Reilly, 4th Edition, 2009.
3. Steven S. Skiena, "Data Science Design Manual", Spring International Publication, 2017.
4. Rajendra Akerkar, PritiSrinivas Sajja, "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.programmer-books.com/introducing-data-science-pdf/
2. https://www.cs.uky.edu/~keen/115/Haltermanpythonbook.pdf
3. http://math.ecnu.edu.cn/~lfzhou/seminar/[Joel_Grus]_Data_Science_from_Scratch_First_Princ.pdf
4. https://www.edx.org/course/python-basics-for-data-science
5. https://www.edx.org/course/analyzing-data-with-python

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

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

U19CCO76	MOBILE APPLICATIONS DEVELOPMENT USING ANDROID	L	T	P	C	Hrs
		3	0	0	3	45

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

Course Objectives

- Understand system requirements for mobile applications
- Generate suitable design using specific mobile development frameworks
- Generate mobile application design
- Implement the design using specific mobile development frameworks
- Deploy the mobile applications in marketplace for distribution

Course Outcomes

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

CO1- Describe the requirements for mobile applications **(K2)**

CO2- Explain the challenges in mobile application design and development **(K3)**

CO3- Develop design for mobile applications for specific requirements **(K3)**

CO4- Implement the design using Android SDK. **(K2)**

CO5- Implement the design using Objective C and iOS. **(K2)**

UNIT I INTRODUCTION **(9 Hrs)**

Introduction to mobile applications – Embedded systems - Market and business drivers for mobile applications – Publishing and delivery of mobile applications – Requirements gathering and validation for mobile applications

UNIT II BASIC DESIGN **(9 Hrs)**

Introduction – Basics of embedded systems design – Embedded OS - Design constraints for mobile applications, both hardware and software related – Architecting mobile applications – user interfaces for mobile applications – touch events and gestures – Achieving quality constraints – performance, usability, security, availability and modifiability.

UNIT III ADVANCED DESIGN **(9 Hrs)**

Designing applications with multimedia and web access capabilities – Integration with GPS and social media networking applications – Accessing applications hosted in a cloud computing environment – Design patterns for mobile applications.

UNIT IV ANDROID **(9 Hrs)**

Introduction – Establishing the development environment – Android architecture – Activities and views – Interacting with UI – Persisting data using SQLite – Packaging and deployment – Interaction with server side applications – Using Google Maps, GPS and Wifi – Integration with social media applications.

UNIT V IOS **(9 Hrs)**

Introduction to Objective C – iOS features – UI implementation – Touch frameworks – Data persistence using Core Data and SQLite – Location aware applications using Core Location and Map Kit – Integrating calendar and address book with social media application – Using Wifi - iPhone marketplace.

Text Books

1. Lauren Darcey and Shane Conder, "Android Wireless Application Development", Pearson Education, 2nd edition 2011.
2. Charlie Collins, Michael D. Galpin, Matthias Käppler, "Android in Practise", Manning Publications Co., 1st edition, 2012.
3. Jeff McWherter, Scott Gowell, "Professional Mobile Application Development", John Wiley & Sons, Inc., 2012.

Reference Books

1. Jeff McWherter and Scott Gowell, "Professional Mobile Application Development", Wrox, 2012
2. Charlie Collins, Michael Galpin and Matthias Kappler, "Android in Practice", DreamTech, 2012
3. James Dovey and Ash Furrow, "Beginning Objective C", Apress, 2012
4. David Mark, Jack Nutting, Jeff LaMarche and Frederic Olsson, "Beginning iOS 6 Development: Exploring the iOS SDK", Apress, 2013.
5. Mark L Murphy, "Beginning Android", Wiley India Pvt Ltd.

Web Reference

1. http://developer.android.com/develop/index.html
2. http://developer.android.com/reference/
3. https://www.udacity.com/course/developing-android-appsfundamentals--ud853-nd

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

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

U19ADO75	DATA SCIENCE APPLICATION OF NLP (Common to EEE, ECE, CSE, IT, ICE, MECH, CIVIL, CCE, BME, Mechatronics)	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To introduce the fundamental concepts and techniques of Natural language Processing(NLP)
- To analyzing words based on Text processing.
- To analyzing words based on Morphology.
- To examine the syntax and language modeling
- To get acquainted with syntax and semantics

Course Outcomes

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

CO1 - Understand the principles and process the Human Languages such as English using computers. **(K2)**

CO2 - Creating CORPUS linguistics based on digestive approach (Text Corpus method). **(K2)**

CO3 - Demonstrate the techniques for text-based Processing of NLP with respect to morphology. **(K4)**

CO4 - Perform POS tagging for a given natural language. **(K3)**

CO5 - Check the syntactic and semantic correctness of sentences using grammars and labelling. **(K3)**

UNIT I INTRODUCTION TO NLP (9 Hrs)

Introduction to various levels of natural language processing, Ambiguities and computational challenges in processing various natural languages. Introduction to Real life applications of NLP such as spell and grammar checkers, information extraction, and machine translation.

UNIT II TEXT PROCESSING (9 Hrs)

Character Encoding, Word Segmentation, Sentence Segmentation, Introduction to Corpora, Corpora Analysis.

UNIT III MORPHOLOGY (9 Hrs)

Inflectional and Derivation Morphology, Morphological Analysis and Generation using finite state transducers.

UNIT IV LEXICAL SYNTAX ANDLANGUAGE MODELING (9 Hrs)

Introduction to word types, POS Tagging, Maximum Entropy Models for POS tagging, Multi-word Expressions- The role of language models. Simple N-gram models. Estimating parameters and smoothing. Evaluating language models.

UNIT V SYNTAX AND SEMANTICS (9 Hrs)

Introduction to phrases, clauses and sentence structure, Shallow Parsing and Chunking, Shallow Parsing with Conditional Random Fields (CRF), Lexical Semantics, Word Sense. Disambiguation, WordNet, Thematic Roles, Semantic Role Labelling with CRFs. Applications of NLP.

Text Books

1. Dan Jurafsky, James H. Martin, "Speech and Language Processing", Third Edition, Prentice Hall, 2018.
2. EmilyBender,"LinguisticsFundamentalsforNLP",MorganClaypoolPublishers,2013.

3. Jacob Eisenstein, "Introduction to Natural Language Processing", MIT Press, 2019.

Reference Books

1. Chris Manning, Hinrich Schuetze, "Foundations of Statistical Natural Language Processing", MIT Press, 1999.
2. Cole Howard, Hobson Lane, Hannes Hapke, "Natural Language Processing In Action" Manning Publication 2019.
3. Li Deng, Yang Liu "Deep Learning in Natural Language Processing "Springer,2018.
4. Tom Hoobyar, Tom Dotz, Susan Sanders, "NLP The Essential Guide to Neuro-Linguistic Programming", William Morrow Paperbacks, 2013.
5. Kate Burton, "Coaching With NLP For Dummies", Wiley, 2011.

Web Resources

1. https://machinelearningmastery.com/natural-language-processing/
2. https://towardsdatascience.com/your-guide-to-natural-language-processing-nlp-48ea2511f6e1
3. https://www.nlp.com/what-is-nlp/

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

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

U19ADO76	ARTIFICIAL INTELLIGENCE APPLICATIONS (Common to EEE, ECE, CSE, IT, ICE, MECH, CIVIL, CCE, BME)	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To study the basic design concept of AI.
- To understand the Machine learning concepts.
- To learn the concept of Deep learning and its applications
- To learn the concept of RPA.
- To acquire the skill to design a chatbot using NLP.

Course Outcomes

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

CO1 - Apply the concept of data science. **(K4)**
CO2 - Understand the concept of Machine learning. **(K2)**
CO3 - Understand the concept of Deep Learning. **(K2)**
CO4 - Apply the design ideas in RPA. **(K4)**
CO5 - Make use of NLP concepts to create chatbot. **(K3)**

UNIT I INTRODUCTION (9 Hrs)

Introduction – Alan Turing and Turing test - The rise and fall of expert system - technological drivers of modern AI -Structure of AI-Data: types of Data - Big Data - Database and other tools - Data Process - Ethics and Governance -Data terms.

UNIT II MACHINE LEARNING (9 Hrs)

Machine learning - Standard deviation - the normal distribution - Naive Bayes Classifier - K-Nearest Neighbor - Linear regression - K-Means Clustering.

UNIT III DEEP LEARNING (9 Hrs)

Deep Learning - Difference between Deep Learning and Machine learning – ANN – Backpropagation – RNN – CNN – GAN - Deep Learning Applications - Use Case: detecting Alzheimer's Disease - Deep Learning Hardware - When to use Deep Leaning? - Drawbacks of deep learning.

UNIT IV ROBOTIC PROCESS AUTOMATION (9 Hrs)

RPA - pros and cons of RPA - Determine the right function to automate - assess the processes - RAP and AI - RPA in the real world.

UNIT V NATURAL LANGUAGE PROCESSING (9 Hrs)

Challenges of NLP - Understanding How AI translated Language - NLP in real World - Voice Commerce - Virtual assistants – Chatbot - Future of NLP - The Future of AI.

Text Books

1. Daniel Jurafsky, James H. Martin, "Speech and Language Processing" Third Edition. 2000.
2. S. Kanimozhi Suguna, M. Dhivya, Sara Paiva,"Artificial Intelligence (AI)Recent Trends and Applications" CRC Press, 2021.
3. Navin Sabharwal; Amit Agrawal, "Cognitive Virtual Assistants Using Google Dialogflow"Apress,2020.

Reference Books

1. Durkin, J., "Expert systems Design and Development", Macmillan, 1994.
2. Peter Jackson, "Introduction to Expert Systems", Addison Wesley Longman, 1999.
3. Amir Shevat," Designing Bots: Creating Conversational Experiences" O'Reilly,2017.
4. Anik Das and Rashid Khan,"Build Better Chatbots: A Complete Guide to Getting Started with Chatbots" Apress,2017.
5. Akhil Mittal "Getting Started with Chatbots: Learn and create your own chatbot with deep understanding of Artificial Intelligence and Machine Learning" BPB Publications,2019

Web Resources

1. https://www.javatpoint.com/application-of-ai
2. https://pytorch.org/tutorials/beginner/chatbot_tutorial.html
3. https://www.mygreatlearning.com/blog/basics-of-building-an-artificial-intelligence-chatbot/
4. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-034-artificial-intelligence-fall-2010/lecture-videos/lecture-3-reasoning-goal-trees-and-rule-based-expert-systems/
5. http://www.umsl.edu/~joshik/msis480/chapt11.htm

COs/POs/PSOs Mapping

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

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