

SRI MANAKULA VINAYAGAR ENGINEERING COLLEGE (An Autonomous Institution)

Autonomous instituti

Puducherry

B.TECH. MECHATRONICS ENGINEERING

ACADEMIC REGULATIONS 2019 (R-2019)

CURRICULUM



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 the society.

DEPARTMENT VISION AND MISSION

Vision

To be a department with outstanding competencies in education and research in interdisciplinary field of Mechatronics Engineering for the prosperity of students and society.

Mission

M1 - Quality Integration: To uphold excellence in education by integrating the teaching learning process with hands-on trainings in updated technologies.

M2 - Research Exploration: To maintain a dynamic balance between learning and research by encompassing activities related to Research, Industrial projects and Innovation Contests.

M3 – Personality Development: To enrich the team spirit and entrepreneurship skills through training programmes on personality development for career prospects.

M4 – Social Ethics: To enhance the principle of highest ethical values by inculcating code of conduct for the betterment of the Society.

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: Strong Knowledge

To provide comprehensive knowledge on Science, Mathematics & multiple Engineering disciplines, alongwith the ability to apply the gained knowledge.

PEO2: Technical Competency

To produce graduates who can demonstrate technical competence in the field of Mechatronics Engineering and develop solutions to the complex problems.

PEO3: Task Orientation

To produce graduates who function effectively in a multi-disciplinary environment, individually and within a society towards accomplishing tasks.

PEO4: Team Work

To produce graduates who would be able to take individual responsibility and work as a part of a team towards the fulfillment of both individual and organizational goals.

PEO5: Professional Competency

To produce graduates with professional competence by life-long learning on advanced studies, professional skills and other professional activities related to Mechatronics Engineering society.

PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO1: Understanding the Concepts

To comprehend the concepts of Mechatronics and their applications in the field of Automated Manufacturing Systems, Robotics, Automobile Technology, Aerial vehicles and other relevant areas.

PSO2: Application of Knowledge

To apply technical knowledge in modern hardware and software tools related to Mechatronics for solving real world problems.

PSO3: Solution Development

To develop the ability to analyze, comprehend and design mechatronics subsystems for a variety of engineering applications for the benefits of society

STRUCTURE FOR UNDERGRADUATE ENGINEERING PROGRAM

SI.No	Course Category	Breakdown of Credits
1	Humanities and Social Science (HS)	9
2	Basic Sciences(BS)	35
3	Engineering Sciences (ES)	32
4	Professional Core (PC)	68
5	Professional Electives (PE)	18
6	Open Electives (OE)	9
7	Project Work and Internship (PW)	12
8	Employability Enhancement Courses (EEC)	-
9	Mandatory courses (MC)	-
	Total	183

SCHEME OF CREDIT DISTRIBUTION - SUMMARY

SI.No	AICTE		Credits per Semester									
	Suggested Course Category	I	II		IV	V	VI	VII	VIII	Credits		
1	Humanities and Social Science (HS)	4	-	-	-	-	3	1	1	9		
2	Basic Sciences(BS)	16	12	3	4	-	-	-	-	35		
3	Engineering Sciences (ES)	10	18	4	-	-	-	-	-	32		
4	Professional Core (PC)	-	-	14	12	15	15	9	3	68		
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	-	2		
9	Employability Enhancement Courses (EEC*)	-	-	-	-	-	-	-	-	-		
10 Mandatory courses (MC*)			-	-	-	-	-	-	-	-		
Total			30	21	22	21	21	20	18	183		

* EEC and MC are not included for CGPA calculation

* To be completed in I and II semesters, under Pass / Fail option only and not counted for CGPA calculation

	SEMESTER – I											
SI.	Course Code	Course Title	Category	Periods		Periods		Periods			Max. M	Marks
No.		oourse mie	outegory	L	Т	Ρ	orcaits	CAM	ESM	Total		
Theo	ory											
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 Electrical and Electronics Engineering	ES	3	1	0	4	25	75	100		
5	T111	Engineering Thermodynamics	ES	3	1	0	4	25	75	100		
6	T112	Computer Programming	ES	3	1	0	4	25	75	100		
Prac	tical	·										
7	P104	Physics Lab	BS	0	0	3	2	50	50	100		
8	P105	Chemistry Lab	BS	0	0	3	2	50	50	100		
9	P106	Workshop Practice	ES	0	0	3	2	50	50	100		
								300	600	900		

	SEMESTER – II									
SI.	Course Code	Course Title	Category	P	erio	ds	Credits		Max. N	/larks
No.	Course Coue	Course The	Category	L	Т	Ρ	Credits	CAM	ESM	Total
Theo	ory		•				1			
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 Civil and Mechanical Engineering	ES	4	0	0	4	25	75	100
5	T105	Engineering Mechanics	ES	3	1	0	4	25	75	100
6	T106	Communicative English	HS	4	0	0	4	25	75	100
Prac	tical		•					•		
7	P101	Computer Programming Laboratory	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 Laboratory	ES	0	0	3	2	50	50	100
Mandatory Course										
10	P107	NSS / NCC *	MC	0	0	0	-	-	-	-
							30	300	600	900

	SEMESTER – III										
SI.	Course Code	Course Title	Category	Р	eriod	ds	Credits	Ν	/lax. Mark	s	
No.	Course Coue	oou se mie	Category	L	Т	Ρ	oreans	CAM	ESM	Total	
Theo	ry		-								
1	U19MCT31	Complex Analysis and Applications of Partial Differential Equations	BS	2	2	0	3	25	75	100	
2	U19MCT32	Data Structures	ES	3	0	0	3	25	75	100	
3	U19MCT33	Analog and Digital Circuits Design	PC	3	0	0	3	25	75	100	
4	U19MCT34	Strength of Materials	PC	2	2	0	3	25	75	100	
5	U19MCT35	Fluid Mechanics and Hydraulic Machinery	PC	2	2	0	3	25	75	100	
6	U19MCT36	Sensors, Transducers and Measurement systems	PC	3	0	0	3	25	75	100	
Pract	ical										
7	U19MCP31	Data Structures Lab	ES	0	0	2	1	50	50	100	
8	U19MCP32	Analog and Digital Circuits Lab	PC	0	0	2	1	50	50	100	
9	U19MCP33	Strength of Materials and Fluid Machinery Lab	PC	0	0	2	1	50	50	100	
Empl	oyability Enhance	ement Course									
10	U19MCC3X	Certification Course – I**	EEC	0	0	4	-	100	-	100	
11	U19MCS31	Skill Development Course 1: General Proficiency - I	EEC	0	0	2	-	100	-	100	
12	U19MCS32	Skill Development Course 2 *	EEC	0	0	2	-	100	-	100	
Mand	latory Course										
13	U19MCM31	Physical Education	MC	0	0	2	-	100	-	100	
							21	700	600	1300	

	SEMESTER – IV										
SI.	Course Code	Course Title	Category	P	eriod	sk	Crodite	I	Max. Mar	ks	
No.	Course coue	Course The	Category	L	Т	Ρ	Creans	CAM	ESM	Total	
Theo	Theory										
1	U19MCT41	Numerical Methods and Statistics	BS	2	2	0	3	25	75	100	
2	U19MCT42	Electronic Devices and Circuits	PC	3	0	0	3	25	75	100	
3	U19MCT43	Power Electronics and Drives	PC	3	0	0	3	25	75	100	
4	U19MCT44	Theory of Machines	PC	2	2	0	3	25	75	100	
5	U19MCE4X	Professional Elective – I [#]	PE	3	0	0	3	25	75	100	
6	U19XXO4X	Open Elective - I ^{\$}	OE	3	0	0	3	25	75	100	
Pract	Practical										
7	U19MCP41	Numerical Methods Lab	BS	0	0	2	1	50	50	100	
8	U19MCP42	Electronic Devices and Circuits Lab	PC	0	0	2	1	50	50	100	
9	U19MCP43	Power Electronics and Drives Lab	PC	0	0	2	1	50	50	100	
10	U19MCP44	Dynamics of Machinery Lab	PC	0	0	2	1	50	50	100	
Empl	oyability Enhance	ement Course	•					•			
11	U19MCC4X	Certification Course – II**	EEC	0	0	4	-	100	-	100	
12		Skill Development Course 3:	FEC	0	0	2	_	100	_	100	
12	01910041	General Proficiency - II	220	0	U	2		100		100	
13	U19MCS42	Skill Development Course 4 *	EEC	0	0	2	-	100	-	100	
Mandatory Course											
13	U19MCM41	Indian Constitution	MC	2	0	0	-	100	-	100	
							22	750	550	1300	

* Professional Electives are to be selected from the list given in Annexure I

^{\$}Open electives are to be selected from the list given in Annexure II

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

* Skill Development Courses (2 and 4) are to be selected from the list given in Annexure IV

	SEMESTER – V									
SI.	Course Code		Cotogory	Pe	eriod	ls	Credits	Max. Marks		Marks
No.	Course Code	Course Title	Calegory	L	LTP			CAM	ESM	Total
Theor	у									
1	U19MCT51	Microprocessors and Controllers	PC	3	0	0	3	25	75	100
2	U19MCT52	Control Systems for Mechatronics Systems	PC	2	2	0	3	25	75	100
3	U19MCT53	CNC and Metrology	PC	3	0	0	3	25	75	100
4	U19MCT54	Thermal Engineering and Heat Transfer	PC	2	2	0	3	25	75	100
5	U19MCE5X	Professional Elective - II [#]	PE	3	0	0	3	25	75	100
6	U19XXO5X	Open Elective – II ^{\$}	OE	3	0	0	3	25	75	100
Pract	Practical									
7	U19MCP51	Microprocessor and Controllers Lab	PC	0	0	2	1	50	50	100
8	U19MCP52	CNC and Metrology Lab	PC	0	0	2	1	50	50	100
9	U19MCP53	Thermal Engineering Lab	PC	0	0	2	1	50	50	100
Emple	oyability Enhanc	ement Course								
10	U19MCC5X	Certification Course – III**	EEC	0	0	4	-	100	-	100
11	U19MCS51	Skill Development Course 5: Foreign Language / IELTS – I/Career and professional skill development program-5	EEC	0	0	2	-	100	-	100
12U19MCS52Skill Development Course 6: Presentation Skills using ICTEEC002-100						100	-	100		
Mand	atory Course									
13	U19MCM51	Essence of Indian Traditional Knowledge	MC	2	0	0	-	100	-	100
							21	700	600	1300

	SEMESTER – VI									
SI.	Course Code	Course Title	Category	F	Perio	ds	Credite		Max. Ma	rks
No	Course Coue	Course ritte	Category	L	Т	Ρ	Cleuits	CAM	ESM	Total
Theo	ry		•							
1	U19MCT61	Embedded System Design	PC	3	0	0	3	25	75	100
2	U19MCT62	Fluid Power Systems	PC	2	2	0	3	25	75	100
3	U19MCT63	Industrial Robotics	PC	3	0	0	3	25	75	100
4	U19MCT64	Design of Mechanical Elements	PC	2	2	0	3	25	75	100
5	U19MCE6X	Professional Elective - III [#]	PE	3	0	0	3	25	75	100
6	U19XXO6X	Open Elective – III ^{\$}	HS	3	0	0	3	25	75	100
Pract	ical									
7	U19MCP61	Embedded System Design Lab	PC	0	0	2	1	50	50	100
8	U19MCP62	Fluid Power Systems Lab	PC	0	0	2	1	50	50	100
9	U19MCP63	Industrial Robotics Lab	PC	0	0	2	1	50	50	100
Empl	oyability Enhanc	ement Course	•							
10	U19MCC6X	Certification Course – IV**	EEC	0	0	4	-	100	-	100
11	U19MCS61	Skill Development Course 7: Foreign Language / IELTS - II/Career and professional skill development program-6	EEC	0	0	2	-	100	-	100
12	U19MCS62	Skill Development Course 8: Technical Seminar	EEC	2	0	0	-	100	-	100
13 U19MCS63 Skill Development Course 9: NPTEL / MOOC - I EEC 0 0 - 100 - 100								100		
Mandatory Course										
14	U19MCM61	Professional Ethics	MC	2	0	0	-	100	-	100
	21 800 600 1400									

	SEMESTER – VII										
SI.	Course Code	Course Title	Category	Periods		Credite	N	lax. Mar	ks		
No	Course Coue		Category	L	L T P		Creats	CAM	ESM	Total	
Theo	Theory										
1	U19MCT71	PLC and Data Acquisition Systems	PC	3	0	0	3	25	75	100	
2	U19MCT72	Design of Mechatronics System	PC	2	2	0	3	25	75	100	
3	U19MCE7X	Professional Elective – IV [#]	PE	3	0	0	3	25	75	100	
4	U19XXO7X	Open Elective – IV ^{\$}	OE	3	0	0	3	25	75	100	
Pract	Practical										
5	U19MCP71	Business Basics for Entrepreneur	HS	0	0	2	1	100	-	100	
6	U19MCP72	Computer Aided Engineering Lab	PC	0	0	2	1	50	50	100	
7	U19MCP73	Industrial Automation Lab	PC	0	0	2	1	50	50	100	
8	U19MCP74	Comprehensive Viva-voce	PC	0	0	2	1	50	50	100	
Proje	Project Work										
9	U19MCW71	Project Phase – I	PW	0	0	4	2	50	50	100	
10	U19MCW72	Internship / Inplant Training	PW	0	0	0	2	100	-	100	
	20 550 450 1000								1000		

	SEMESTER – VIII										
SI.	Course Code	Course Title	Category	F	Perio	ds	Credits	Max. Marks			
No.			Galegory	L	L T P		Orcans	CAM	ESM	Total	
Theor	Theory										
1	U19MCT81	Artificial Intelligence and Machine Learning	PC	3	0	0	3	25	75	100	
2	U19MCE8X	Professional Elective – V#	PE	3	0	0	3	25	75	100	
3	U19MCE8X	Professional Elective – VI [#]	PE	3	0	0	3	25	75	100	
Practi	cal										
4	U19MCP81	Entrepreneurship Management	HS	0	0	2	1	100	-	100	
Proje	ct Work										
5	U19MCW81	Project phase – II	PW	0	0	16	8	40	60	100	
Emplo	Employability Enhancement Course										
6	U19MCS81	Skill Development Course 10: NPTEL / MOOC -II	EEC	0	0	0	-	100	-	100	
						18	315	285	600		

Professional Elective – I (Offered in Semester IV)						
SI. No.	Course Code	Course Title				
1	U19MCE41	Additive Manufacturing				
2	U19MCE42	Heating Ventilation and Air-Conditioning				
3	U19MCE43	Computer Integrated Manufacturing				
4	U19MCE44	Instrumentation for Automotive Industries				
5	U19MCE45	Data Communication and Networking				
Profession	al Elective – II (Off	ered in Semester V)				
SI. No.	Course Code	Course Title				
1	U19MCE51	MEMS and Nano Technology				
2	U19MCE52	IoT for Mechatronics				
3	U19MCE53	Operations Research				
4	U19MCE54	Biomedical Instrumentation				
5	U19MCE55	Data Base Management System				
Profession	al Elective – III (Of	fered in Semester VI)				
SI. No.	Course Code	Course Title				
1	U19MCE61	Introduction to Finite Element Analysis				
2	U19MCE62	Automotive Electronics				
3	U19MCE63	VLSI Design				
4	U19MCE64	Virtual Instrumentation				
5	U19MCE65	Intelligent Control System				
Profession	al Elective – IV (Of	fered in Semester VII)				
SI. No.	Course Code	Course Title				
1	U19MCE71	Non-Destructive Testing Methods				
2	U19MCE72	Product Design and Development				
3	U19MCE73	Automated Material Handling Systems				
4	U19MCE74	Autonomous Mobile Robots				
5	U19MCE75	Digital Image Processing and Machine Vision				
Profession	al Elective – V (Off	ered in Semester VIII)				
SI. No.	Course Code	Course Title				
1	U19MCE80	Reliability Engineering				
2	U19MCE81	Automation in Manufacturing Systems				
3	U19MCE82	Mechatronics System Applications				
4	U19MCE83	Robotics and Machine Vision				
5	U19MCE84	Project Management				
Profession	Professional Elective – VI (Offered in Semester VIII)					
SI. No.	Course Code	Course Title				
1	U19MCE85	Power Plant Instrumentation and Control				
2	U19MCE86	Unconventional Machining Processes				
3	U19MCE87	Unmanned Aerial Vehicles				
4	U19MCE88	Building Automation				
5	U19MCE89	Industrial Engineering				

Annexure - I PROFESSIONAL ELECTIVE COURSES

Annexure – II

OPEN ELECTIVE COURSES

SI. No	Course Code	Course Title	Offering Department	Permitted Departments
Open	Elective – I (Offe	red in Semester IV)		
1	U19EEO41	Solar Photovoltaic Fundamentals and Applications	EEE	ECE, ICE, MECH, CIVIL, Mechatronics
2	U19EEO42	Electrical Safety	EEE	ECE, ICE, MECH, CIVIL, Mechatronics, BME, IT, CSE
3	U19ECO41	Engineering Computation with MATLAB	ECE	ICE, EEE, MECH, CIVIL, BME, Mechatronics
4	U19ECO42	Consumer Electronics	ECE	EEE, ICE, CSE, MECH, IT, CIVIL, BME, Mechatronics
5	U19CSO41	Web Development	CSE	EEE, ECE, ICE, MECH, CIVIL, BME, Mechatronics
6	U19CSO42	Analysis of Algorithms	CSE	EEE, ECE, ICE, MECH, CIVIL, BME, Mechatronics
7	U19CSO43	Programming in JAVA	CSE	ECE, MECH, Mechatronics
8	U19ITO41	Database System: Design & Development	IT	EEE, ECE, ICE, BME
9	U19ITO42	R programming	ІТ	EEE, ECE, ICE, BME, MECH, Mechatronics
10	U19ICO41	Sensors and Transducers	ICE	ECE, CSE, IT, MECH, CIVIL
11	U19ICO42	Control System Engineering	ICE	CSE, IT, MECH
12	U19MEO41	Rapid Prototyping	MECH	EEE, ECE, ICE, CIVIL, BME
13	U19MEO42	Material Handling System	MECH	EEE, ICE, CIVIL, Mechatronics
14	U19MEO43	Power Plants for Electrical Engineering	MECH	EEE
15	U19CEO41	Energy and Environment	CIVIL	EEE, ECE, MECH, BME, IT, Mechatronics
16	U19CEO42	Building Science and Engineering	CIVIL	EEE, MECH, BME
17	U19BMO41	Medical Electronics	BME	EEE, ECE, CSE, IT, ICE, MECH, Mechatronics
18	U19BMO42	Telemedicine	BME	EEE, ECE, CSE, IT, ICE
19	U19CCO41	Basic DBMS	CCE	EEE, ECE, MECH, CIVIL, ICE, Mechatronics, BME
20	U19CCO42	Introduction to Communication Systems	CCE	EEE, CSE, IT, MECH, CIVIL, ICE, Mechatronics
Open E	lective – II / Ope	n Elective – III		
1	U19HSO51 / U19HSO61	Product Development and Design	MBA	Common to B. Tech
2	U19HSO52 / U19HSO62	Intellectual Property and Rights	MBA	(Offered in Semester V for EEE, ECE, ICE, CIVIL, BME)

B.Tech. Mechatronics Engineering

2	U19HSO53 /	Marketing Management and	MRA	
3	U19HSO63	Research	IVIDA	(Offered in Semester VI for
4	U19HSO54 / U19HSO64	Project Management for Engineers	MBA	CSE, IT, MECH, Mechatronics)
5	U19HSO55 / U19HSO65	Finance for Engineers	MBA	
Open E	lective – II / Oper	n Elective – III		
(Offered	d in Semester V fo	or CSE, IT, MECH, Mechatronics)		
(Offered	d in Semester VI fo	or EEE, ECE, ICE, CIVIL, BME)		
	U19EEO53 /	Conventional and Non-		ECE, ICE, MECH, CIVIL,
1	U19EEO63	Conventional Energy Sources	EEE	BME. Mechatronics
	U19FF054 /			FCF ICF MECH
2	U19EE064	Industrial Drives and Control	EEE	Mechatronics
	U19EC053 /	Electronic Product Design and		FEE CSE IT ICE MECH
3	U19EC063	Packaging	ECE	BME Mechatronics
		1 dokuging		
4	U19ECO64	Automotive Electronics	ECE	EEE, ECE, ICE, MECH
5	U19030347	Platform Technology	CSE	BME
	U1903004			
6	019030357	Graphics Designing	CSE	
7		Essentials of Data Science	IT	
8		Mobile App Development	IT	EEE, ECE, ICE, MECH, CIVIL,
				BIVIE, Mechatronics
9	019110557	Data Structures	IT	MECH
	01911065			
10	U19ICO53 /	Fuzzy logic and neural networks	ICE	CSE, IT, CIVIL, BME
	U19ICO63	, ,		
11	U19ICO54 / U19ICO64	Measurement and Instrumentation	ICE	ECE, Mechatronics
12	U19MEO54 /	Heating, ventilation and air	MECH	FEE ECE ICE CIVII
	U19MEO64	conditioning system (HVAC)		
13	U19MEO55 /	Creativity Innovation and New	MECH	EEE, ECE, ICE, CIVIL, BME,
	U19MEO65	Product Development	MEON	Mechatronics
14	U19CEO53 /	Disaster Management	CIVII	EEE, ECE, CSE, IT, ICE,
17	U19CEO63	Disaster Management	OTTL	MECH, BME
15	U19CEO54 /	Air Pollution and Solid Waste	CIVII	EEE, ECE, CSE, IT, ICE,
	U19CEO64	Management	OTTL	MECH, BME
16	U19BMO53 /	Biometric Systems	BME	EEE, ECE, CSE, IT, ICE,
10	U19BMO63	Districtine Oystemis	DIME	MECH, Mechatronics
17	U19BMO54 /	Madical Pabatics	BME	EEE, ECE, CSE, IT, ICE,
17	U19BMO64	Medical Robotics	DIVIL	MECH, CIVIL, Mechatronics
10	U19CCO53 /	Network Eccenticle	005	EEE, MECH, CIVIL, ICE,
10	U19CCO63	Network Essentials	CCE	Mechatronics, BME
40	U19CCO54 /		005	EEE, ECE, MECH, CIVIL, ICE,
19	U19CCO64	Web Programming	CCE	Mechatronics, BME
00	U19ADO51 /	Principle of Artificial Intelligence and		EEE, ECE, CSE, IT, ICE,
20	U19ADO61	Machine Learning	AI&DS	MECH, CIVIL
<u> </u>		, , , , , , , , , , , , , , , , , , ,		EEE, ECE, CSE, IT, ICE.
21	U19AD052 /	Data science Application of Vision	AI&DS	MECH, CIVIL, BME,
	U19ADO62			Mechatronics

Open E	lective – IV (Offe	ered 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	Mechatronic s	MECH, CIVIL
16	U19MCO72	Automation in Manufacturing Systems	Mechatronic s	MECH, CIVIL
17	U19BMO75	Internet of Things for Healthcare	BME	EEE, ECE, ICE
18	U19BMO76	Telehealth Technology	BME	EEE, ECE, ICE
19	U19CCO75	Data Science using python	CCE	EEE, ECE, MECH, CIVIL, ICE, Mechatronics, BME,
20	U19CCO76	Mobile Applications Development using Android	CCE	EEE, ECE, MECH, CIVIL, ICE, Mechatronics, BME,
21	U19ADO73	Data Science Application of NLP	AI&DS	EEE, ECE, CSE, IT, ICE, MECH, CIVIL, BME, Mechatronics
22	U19ADO74	Artificial Intelligence Applications	AI&DS	EEE, ECE, CSE, IT, ICE, MECH, CIVIL, BME

Annexure - III

EMPLOYABILITY ENHANCEMENT COURSES – (A). CERTIFICATION COURSES

SI. No	Course Code	Course Title
1	U19MCCX1	Artificial Intelligence And Edge Computing
2	U19MCCX2	Auto CAD for Mechanical
3	U19MCCX3	Basic Pneumatics'
4	U19MCCX4	Creo (Modeling and Simulation)
5	U19MCCX5	Electro Hydraulic Automation With PLC
6	U19MCCX6	Embedded System Using C
7	U19MCCX7	Java Programming
8	U19MCCX8	Mechatronics
9	U19MCCX9	Programming using Python

Annexure - IV

EMPLOYABILITY ENHANCEMENT COURSES - (B). SKILL DEVELOPMENT COURSES

SI. No	Course Code	Course Title
1	U19MCS31	Skill Development Course 1 : General Proficiency - I
		Skill Development Course 2 *
	14040000	1) Excel for Statistical Approach
2	019100532	2) Training on Arduino
		3) Computer Vision
3	U19MCS41	Skill Development Course 3 : General Proficiency - II
		Skill Development Course 4 *
4	U19MCS42	1) Power Transmission Systems
, T	010110042	2) 3D Printing
		3) Non-Destructive Testing
5	U19MCS51	Skill Development Course 5 : Foreign Language/ IELTS -I
6	U19MCS52	Skill Development Course 6 : Presentation Skills using ICT
7	U19MCS61	Skill Development Course 7 : Foreign Language/ IELTS - II
8	U19MCS62	Skill Development Course 8 : Technical Seminar
9	U19MCS63	Skill Development Course 9 : NPTEL/MOOC - I
10	U19MCS81	Skill Development Course 10 : NPTEL/MOOC-II
	*	Any one source to be calcoted from the list

Any one course to be selected from the list

T101	MATHEMATICS – I	L	Т	Ρ	С
	(Common to all branches)	3	1	0	4

Course Objectives

- To introduce the idea of applying calculus concepts to problems in Engineering.
- To understand the concept of partial differentiation ٠
- To develop logical thinking and analytic skills in evaluating multiple integrals. •
- To introduce mathematical tools to solve first order differential equations. ٠
- 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

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

UNIT II FUNCTIONS OF SEVERAL VARIABLES

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

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

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)

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
- 2. Grewal B.S., Higher Engineering Mathematics, Khanna Publishers, New Delhi, 41stEdition, 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

B.Tech. Mechatronics Engineering

Hrs

17

(12Hrs)

(12Hrs)

(12Hrs)

(12Hrs)

(12Hrs)

60

Academic Curriculum and Syllabi R-2019 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

C 0 6					Prog	ram (Dutco	mes	(POs)			Program Specific Outcomes (PSOs)			
003	PO	PO	PO	PO	PO	PO12	PSO1	PSO2	PSO3							
	1	2	3	4	5	6	7	8	9							
1	2	1	-	-	-	1	1	-	-	-	-	1	2	2	-	
2	3	2	1	1	-	1	1	-	-	-	-	1	2	2	-	
3	2	1	-	-	-	-	-	-	-	-	-	1	2	1	-	
4	3	2	1	1	-	1	1	-	-	-	-	1	3	1	-	
5	3	2	1	1	-	1	1	-	-	-	-	1	2	1	-	

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

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PHYSICS (COMMON TO ALL BRANCH)

Course Objectives

T102

- 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 Ultrasonics, optics and some optical devices, Lasers and Fiber optics, Nuclear energy sources and wave mechanics

Course Outcomes

On 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**)

C05- 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)

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

UNIT I – ACOUSTICS & NDT

ultrasonic - 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 application to Radarrs.(elementary ideas)

UNIT II – OPTICS

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

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, CO

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 MECHANICS** (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.

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(9 Hrs)

(9 Hrs)

Hrs С 45

(9 Hrs)

UNIT V – NUCLEAR ENERGY SOURCE

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, 2nd Edition, TMH, New Delhi 2011(For units I to IV only)
- 2. Arthur Beiser, Concepts of Modern Physics, 6th Edition, TMH, New Delhi 2008.(For unit V only)

Reference Books

- 1. Ajoy Ghatak, Optics, 5th Edition TMH, New Delhi, 2012.
- 2. K. Thyagarajan and Ajoy Ghatak, Lasers Fundamentals and Applications, 2nd Edition, Springer 2010.
- 3. R. Murugesan, Modern Physics, S. Chand & Co, New Delhi 2006.
- 4. K.R.Nambiar, Lasers, New Age International, New Delhi, 2008.
- 5. Science of Engineering Materials, 2nd Edition, C.M. Srivastava and C. Srinivasan, New Age Int. (P) Ltd, New Delhi, 1997.
- 6. Avadhanulu M N, Engineering Physics, S. Chand & Co, 2009.

Web Resources

- 1. https://swayam.gov.in/nd1_noc20_ph15/preview
- 2. https://swayam.gov.in/nd1_noc20_ph22/preview

COs/POs/PSOs Mapping

COs				F	Progra	am O	utcon	nes (F	POs)				Program Specific Outcomes (PSOs)				
	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3		
C01	3	3	3	2	3	-	-	-	-	-	-	-	1	2	1		
C02	3	3	2	2	3	-	-	-	-	-	-	-	1	1	-		
C03	3	3	2	3	3	-	-	-	-	-	-	-	1	2	-		
C04	3	3	3	3	2	-	-	-	-	-	-	-	-	1	-		
C05	3	3	3	1	3	-	-	-	-	-	-	-	1	2	1		

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

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(9 Hrs)

Г103	ENGINEERING CHEMISTRY	L	Т	Ρ	С	Hrs
	(Common to all branches)	4	0	0	4	45

Course Objectives

- Know the fundamental principles of Engineering Chemistry required solving engineering problems.
- Practical implementation of fundamental theory concepts.
- Introducing 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 completion of the course, the 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 (K3)
- 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 (K3)
- CO5 Understand the concept of phase equilibrium and its application to different types of heterogeneous equilibrium system like eutectic alloys.(K3)

UNIT I–WATER

Hardness of water-units and calcium carbonate equivalent. Determination of hardness of water - EDTA method. Disadvantages of hardwater - 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-POLYMER

Classification, types of polymerization reactions – mechanism of radical, ionic and Ziegler-Natta polymerizations. Polymerproperties -chemical resistance, crystallinity and effect of temperature, Mn and Mw. Thermoplastics and thermosets. Preparation, properties and uses of PVC, TEFLON, Nylons, Bakelite, Polyurithane, Rubbersvulcanization, 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-ELECTROCHEMICAL CELLS

Galvaniccells, 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/AgCI & glass electrodes. Batteries- primary and secondary cells, Leclanche cell, Lead acid storage cell, Ni-Cd battery& alkaline battery. Fuel cells-H2-O2 fuel cell.

UNITIV-CORROSION AND ITSCONTROL

Chemical & electrochemical corrosion-Galvanic, pitting, stress and concentration cell corrosion. Factors influencing corrosion - corrosion control methods - cathodic protection and corrosion inhibitors. Protective

(9Hrs)

(9Hrs)

(9 Hrs)

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(9Hrs)

coating-types of protective coatings- metallic coating-tinning and galvanizing, cladding, electroplating and anodizing

UNIT V- PHASE RULE

(9Hrs)

Definition and derivation of phase rule. Application to one component system– water and sulfur systems. Thermal analysis, condensed phaserule. Two component systems– Pb-Ag, Cu-Ni, and Mg-Zn systems.

Text Books

- 1. P.C. Jain and Monika Jain, Engineering Chemistry, DhanpatRai 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.
- 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, 11th Ed, S.Chand& Co., Ltd. New Delhi, 2008.
- 2. B. K. Sharma, Engineering Chemistry, 3rdedition Krishna Prakashan Media (P) Ltd., Meerut, 2001.
- 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, 2ndEd. PHI Learning PVT., LTD, New Delhi, 2008
- 5. C.V.Agarwal, C.P.Naidu, "A text book of Engineering Chemistry", BS Publication, Hyderabad.

Web Resources

- 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					Program Specific Outcomes (PSOs)										
	P01	PO2	PO3	PO4	PO12	PSO1	PSO2	PSO3							
1	2	1	-	-	-	1	1	-	-	-	-	1	1	3	2
2	2	1	-	-	-	1	1	-	-	-	-	1	-	3	2
3	2	1	-	-	-	1	1	-	-	-	-	1	1	2	2
4	2	1	-	-	-	1	1	-	-	-	-	1	-	3	1
5	2	1	-	-	-	1	1	-	-	-	-	1	-	1	-

COs/POs/PSOs Mapping

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

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BASIC ELECTRICAL AND ELECTRONICS

ENGINEERING

23

Hrs

T104

(Common to all branches)

3 1 4 60 0

С

ТР

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

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

Concepts of AC circuits - rms value, average value, form and peak factors - Simple RLC series circuits -Concept of real and reactive power - Power factor - Introduction to three phase system - Power measurement by two wattmeter method.

UNIT III ELECTRICAL MACHINES AND POWER PLANTS

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

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

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. Sequential logic - Ripple counters and shift registers.

UNIT VI COMMUNICATION AND COMPUTER SYSTEMS

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 to III)

2. Rajendra Prasad, "Fundamentals of Electronic Engineering", Cengage learning, New Delhi, First Edition,

(10 Hrs)

(10 Hrs)

(10 Hrs)

(10 Hrs)

(10 Hrs)

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(10 Hrs)

2011. (For Unit IV)

- 3. Morris Mano, "Digital design", PHI Learning, Fourth Edition, 2008. (For Unit V)
- 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
- 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 Resources

- 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 Specific Outcomes (PSOs)											
	P01	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	P011	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	2	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

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T105

ENGINEERING THERMODYNAMICS

(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

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

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

Equilibrium and the second law – Heat engines – Kelvin-Plank statement of second law of thermodynamics – Reversible and irreversible processes – Carnot principle – Clausius inequality – Entropy

UNIT IV GAS POWER CYCLES

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

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. P.K.Nag, "Engineering Thermodynamics", 4th edition, Tata Mc-Graw Hill Publishing Co. Ltd., New Delhi, 2008.
- 2. R. K. Singal, Mridul Singal "A text book of Engineering Thermodynamics", I.K. International Publishing House Pvt. Limited, 2010.
- 3. Er.S.K.Gupta, "Engineering Thermodynamics", S. Chand publishers, 2013.

Reference Books

- 1. Arora, C.P., "Thermodynamics", Tata Mc-Graw Hill Publishing Co. Ltd., New Delhi, 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.,

B.Tech. Mechatronics Engineering

Hrs

60

ТРС

3 1 0 4

(12 Hrs)

(12 Hrs)

(12 Hrs)

(12 Hrs)

(12 Hrs)

N.Y., 2011.

- 4. Cengel, Y.A. and Boles, M.A., "Thermodynamics An Engineering approach", 5th edition, Mc Graw Hill, 2008.
- 5. Wark, K., "Thermodynamics", 4th edition Mc-Graw Hill, N.Y., 2009.

Web Resources

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

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

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T106

COMPUTER PROGRAMMING

(Common to all branches)

Course Objectives

- To introduce the basics of computers and information technology.
- To educate problem solving techniques.
- To impart programming skills in C language.
- To practice structured programming to solve real life problems.
- To study the basic concepts of File operations.

Course Outcomes

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

- CO1 Identify and understand the working components of a computer system. (K1)
- CO2 Understand, analyze and implement like algorithm, pseudo codes and programming structures. (K2)
- **CO3** Analyze and make use of logical structure of a C program. **(K3)**
- CO4 Make use of pointers, memory allocation and data handling to implement C programs. (K3)
- CO5 Understand the working of files and directives. (K3)

UNIT I INTRODUCTION TO COMPUTERS

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 INTRODUCTION TO C (12 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 DECISION MAKING AND ARRAYS

Decision making statements - branching and looping - arrays - multidimensional arrays- Functions - Recursion - Passing array to functions. Storage classes - Strings - String library functions.

UNIT IV STRUCTURES AND POINTERS

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 FILE MANAGEMENT AND PREPROCESSORS

Files – operations on a file – Random access to files – command line arguments. Introduction to preprocessor – 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 Book

- 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 Resources

- 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

B.Tech. Mechatronics Engineering

27

Hrs LTPC 60 3 1 0 4

(12 Hrs)

(12 Hrs)

(12 Hrs)

(12 Hrs)

5. https://www.w3schools.in/c-tutorial/command-line-arguments/

COs					Program Specific Outcomes (PSOs)										
	P01	PO2	PO3	PO4	PO5	PO6	PO7	P08	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	1	-	-	3	-	-	-	-	-	-	-	2	1	2
2	2	1	-	-	3	-	-	-	-	-	-	-	2	1	2
3	3	2	1	1	3	-	-	-	-	-	-	-	2	1	2
4	3	2	1	1	3	-	-	-	-	-	-	-	2	1	2
5	3	2	1	1	3	-	-	-	-	-	-	-	2	1	2

COs/POs/PSOs Mapping

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

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P101	COMPUTER PROGRAMMING LABORATORY	L	т	Ρ	С	Hrs
	(Common to all branches)	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. (K2) environment, compiling, debugging, linking and executing a program using the development environment.
- 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 Exercises

- Study of OS Commands 1.
- 2. Write a simple C program to find the Area of the triangle.
- 3. Write a simple C program to find the total and average percentage obtained by a student for 6 subjects.
- Write a simple C program to read a three digit number and produce output like 4.
 - 1 hundreds
 - 7 tens
 - 2 units

for an input of 172.

- Write a simple C program to check whether a given character is vowel or not using Switch -5. Case statement.
- Write a simple C program to print the numbers from 1 to 10 along with their squares. 6.
- 7. Write a simple C program to find the sum of 'n' numbers using for, do – while statements.
- Write a simple C program to find the factorial of a given number using Functions. 8.
- Write a simple C program to swap two numbers using call by value and call by reference. 9.
- 10. Write a simple C program to find the smallest and largest element in an array.
- 11. Write a simple C program to perform matrix multiplication.
- 12. Write a simple C program to demonstrate the usage of Local and Global variables.
- 13. Write a simple C program to perform various string handling functions: strlen, strcpy, strcat, strcmp.
- 14. Write a simple C program to remove all characters in a string except alphabets.
- 15. Write a simple C program to find the sum of an integer array using pointers.
- 16. Write a simple C program to find the Maximum element in an integer array using pointers.
- 17. Write a simple C program to create student details using Structures.
- 18. Write a simple 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 simple 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 Book

- 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 Resources

- 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 Specific Outcomes (PSOs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2	PSO3
1	2	1	-	-	3	-	-	-	-	-	-	-	2	1	2
2	2	1	-	-	3	-	-	-	-	-	-	-	2	1	2
3	3	2	1	1	3	-	-	-	-	-	-	-	2	1	2
4	3	2	1	1	3	-	-	-	-	-	-	-	2	1	2
5	3	2	1	1	3	-	-	-	-	-	-	-	2	1	2

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

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P102	ENGINEERING GRAPHICS (Common to all branches)	L 2	Т 0	Р 3	C 2	Hrs 60
 Course Objectives To convey the basics of engined To explain the importance of an To teach different methods of m To establish the importance of p To develop the role of computer 	ering drawing engineering drawing naking the drawing projects and developments mode in drawing that are r aided design Auto Cad and significance of using the	used ese dr	in re awin	al sy igs	vstem	IS
Course Outcomes After completion of the course, to CO1 - Understand the basic concept CO2 - Apply various concepts like projection. (K3) CO3 - Improve their imagination and CO4 - Create engineering drawing CO5 - Analysis the different views a	the students will be able to pts of engineering drawings. (K2) ke dimensioning, conventions and BIS codes, the ad visualization skills to design new products. (K4) of physical object representing engineering systems. and computer aided drafting tools. (K3)	theor (K4)	ry ai	nd r	netho	ods of
Introduction to Standards for Engine UNIT I Conic sections, Involutes, Spirals, H	eering Drawing practice, Lettering, Line work and Dir Helix. Projection of Points, Lines and planes	nensio	oninę	g	(12	2 Hrs)
UNIT II Projection of Solids and Sections of	f solids.				(12	? Hrs)
UNIT III Development of surfaces – Intersec	ction of surfaces (Cylinder-Cylinder, cylinder-cone)				(12	2 Hrs)
UNIT IV Isometric projections and Orthograp	phic projections				(12	2 Hrs)
UNIT V					(12	2 Hrs)

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.

2. Dhananjayan A. Jolhe, Engineering Drawing with introduction to Autocad, Tata McGrawHill Publishing company

Limited, 2008.

3. Basant Agrwal and Agarwal C W., Engineering Drawing, Tata Tata McGrawHill Publishing company limited, 2008.

Reference Books

- 1. N.D. Bhatt, Engineering Drawing, 49th edition, Chorotar Publishing House, 2006.
- 2. K. Venugopal, Engineering Drawing and Graphics + Auto CAD, 4th edition, New Age International Publication Ltd., 2004.
- 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.

Web Resources

- 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 Specific Outcomes (PSOs)											
	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	1	-	-	3	-	-	-	-	-	-	3	1	-	2
2	3	1	-	-	3	-	-	-	-	-	-	3	1	-	2
3	3	1	-	-	3	-	-	-	-	-	-	3	1	-	2
4	3	1	-	-	3	-	-	-	-	-	-	3	1	-	2
5	3	1	-	-	3	-	-	-	-	-	-	3	1	-	2

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

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BASIC ELECTRICAL AND ELECTRONICS

LABORATORY

33

Hrs

P103

(Common to all branches)

0 0 3 2 45

LTPC

Course Objectives

- To get an exposure on the basic electrical tools, applications and precautions
- To gain training on different types of wiring used in domestic and industrial applications.
- To detect and find faults in electrical lamp and ceiling fan
- To get an exposure on the measurements of voltage and phase using CRO, basic operation and applications devices such as PN junction diode and transistor
- To gain a practical knowledge on the functions and application of basic logic gates and flip flops

Course Outcomes

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

- CO1 Follow the safety procedures when working with electricity and various tools. (K4)
- CO2 Do line diagram and wiring practices for domestic application. (K5)
- CO3 Use the protection circuits for electrical networks. (K3)
- CO4 Design and verify the kirchoff's law. (K4)
- CO5 Analyze the characteristics of PN diode and use it for rectifier applications. (K4)
- CO6 Gain knowledge on digital electronics to solve problems related to boolean algebra. (K4)

ELECTRICAL LAB

List of Experiments

- 1. Electrical Safety, Precautions, study of tools and accessories.
- 2. Practices of different joints.
- 3. Wiring and testing of series and parallel lamp circuits.
- 4. Staircase wiring.
- 5. Doctor's room wiring.
- 6. Bed room wiring.
- 7. Go down wiring.
- 8. Wiring and testing a ceiling fan and fluorescent lamp circuit.
- 9. Study of different types of fuses, circuits breakers and A.C and D.C meters.

ELECTRONICS LAB

List of Experiments

- 1. Study of CRO
 - (a) Measurement of AC and DC voltages
 - (b) Frequency and phase measurements (using Lissajou's figures)
- 2. Verification of Kirchoff's Voltage and Current Laws

Determine the voltage and current in given circuits using Kirchoff's laws theoretically and verify the laws experimentally.

- 3. Characteristics and applications of PN junction diode.
 - Forward and Reverse characteristics of PN junction diode.

Application of Diode as Half wave Rectifier – Measurement of ripple factor with and without capacitor filter 4. Frequency Response of RC Coupled Amplifiers

Determination of frequency response of given RC coupled amplifier - Calculation of bandwidth.

- 5. Study of Logic Gates
 - (a) Verification of Demorgan's theorems
 - (b) Verification of truth tables of OR, AND, NOT, NAND, NOR, EX-OR, EX-NOR gates and Flipflops JK, RS, T and D

(c) Implementation of digital functions using logic gates and Universal gates.

Reference Books

- 1. Kothari D P and Nagrath I J, Basic Electrical Engineering, Tata McGraw Hill, 2009.
- 2. R.Muthusubramaniam, S.Salivahanan and K.A. Mureleedharan, Basic Electrical Electronics and Computer Engineering, Tata McGraw Hill, 2004
- 3. Sudhakar and S. P. Shyam Mohan, "Circuits and Networks Analysis and Synthesis", Tata McGraw Hill Publishing Company Ltd., New Delhi, 4th Edition, 2010.
- 4. Rajendra Prasad, "Fundamentals of Electronic Engineering", Cengage learning, New Delhi, First Edition, 2011.
- 5. Donald P Leach, Albert Paul Malvino and Goutam Saha, "Digital Principles and Applications," 6th edition, Tata McGraw Hill Publishing Company Ltd.,New Delhi,2008
- 6. Morris Mano, "Digital design", PHI Learning, Fourth Edition, 2008
- 7. Edward Hughes, John Hiley, Keith Brown, Ian McKenzie Smith, "Electrical and Electronics Technology", Pearson Education Limited, New Delhi, 10th Edition, 2010.

Web Resources

- 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 Specific Outcomes (PSOs)										
	P01	PO2	PO3	PO4	PO5	P06	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	3	3	3	-	-	-	3	-	-	-	2	1	1
2	3	3	3	3	3	-	-	-	3	-	-	-	2	1	1
3	3	3	2	3	3	-	-	-	3	-	-	-	2	1	2
4	3	3	2	3	2	-	-	-	3	-	-	-	2	1	1
5	3	3	2	3	2	-	-	-	3	-	-	-	2	1	2
6	3	3	2	3	2	-	-	-	3	-	-	-	2	1	2

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

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Academic Curriculum	and Syllabi R-2019					
T407	MATHEMATICS – II	L	Т	Ρ	С	Hrs
1107	(Common to all branches)	3	1	0	4	60

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)

UNIT I MATRICES

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

Gradient, divergence and curl, their properties and relations. Gauss divergence theorem and Stoke's theorem (without proof).Simple application problems.

UNIT III LAPLACE TRANSFORMS

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

Methods for determining inverse Laplace Transforms, convolution theorem, Application to differential equations and integral equations. Evaluation of integrals by Laplace transforms.

UNIT V FOURIER TRANSFORMS

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, 1st 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.
- 5. Bali N. and Goyal M., Advanced Engineering Mathematics, Lakshmi Publications Pvt. Ltd., New Delhi, 7th Edition, 2010.

35

(12Hrs)

(12 Hrs) ication by

(12 Hrs)

(12 Hrs)

(12 Hrs)

Web Resources

- 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

C0e				Program Specific Outcomes (PSOs)											
003	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO10	PO11	PO12	PSO1	PSO2	PSO3
	1	2	3	4	5	6	7	8	9						
1	2	1	-	-	-	1	1	-	-	-	-	1	3	1	-
2	2	1	-	-	-	1	1	-	-	-	-	1	1	-	-
3	3	2	1	1	-	1	-	-	-	-	-	1	2	1	-
4	3	2	1	1	-	1	-	-	-	-	-	1	2	1	-
5	3	2	1	1	-	1	-	-	-	-	-	1	1	-	-

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

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T108

B.Tech. Mechatronics Engineering

Course Objectives

• To understand the importance of Material Science as a subject that revolutionized modern day technologies

MATERIAL SCIENCE

(COMMON TO ALL BRANCH)

- 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

On successful completion of the course, 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 materials 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)

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

UNIT I - CRYSTAL STRUCTURE AND LATTICE DEFECTS

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

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

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 – SEMICONDUCTORS AND SUPERCONDUCTORS

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)

37

Hrs

45

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3

(9 Hrs)

(9 Hrs)

(9 Hrs)

(9 Hrs)

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Superconductivity - Basic concepts – transition temperature – Meissener effect – Type I and II superconductors – high temperature superconductors – 123 superconductor – Applications of superconductors.

UNIT V – ADVANCED MATERIALS

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 nanomaterials. carbon nanotubes– Properties and applications.

Text books

1. V Rajendran, Engineering Physics, 2nd Edition, TMH, New Delhi 2011.

2.

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 Resources

- 1. https://swayam.gov.in/nd1_noc20_ph15/preview
- 2. https://swayam.gov.in/nd1_noc20_ph22/preview

COs				F	Progra	am O	utcon	nes (F	POs)				Program	Specific C (PSOs)	outcomes
	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
C01	3	3	3	1	2	3	1	1	1	2	3	3	2	2	1
C02	3	3	3	1	2	3	1	1	1	2	1	3	3	1	1
C03	3	3	3	1	3	3	2	1	1	2	1	3	3	1	1
C04	3	3	3	1	3	3	2	1	1	2	2	3	2 1		-
C05	3	1	3	1	3	3	2	1	1	2	3	3	3	2	1

COs/POs/PSOs Mapping

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

Dr.G.Balamuruga Mohan kay M.Tech, Ph.D., Professor, & Head, Dept. of Mechatronics Engineering Manakula Vinayagar Engineering College, Madagadipet, Puducherry-605 107.

(9 Hrs)

T109

ENVIRONMENTAL SCIENCE (Common to all branches)

39

T P C Hrs 0 0 4 45

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Course Objectives

- To know about the environment
- To understand about environmental pollution
- To apply the knowledge in understanding various environmental issues and problems
- communicate clearly and competently matters of environmental concern and understanding to a variety of audiences in appropriate forms
- Evaluate and interpret various forms of evidence, including text, data, and other media about the environment

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. (K2)
- CO2 Understand the study of ecology of various systems of nature and also about the diverse species present and its protection. (K3)
- CO3 Understand various sources of air pollution, the scientific basis behind it and its effect on nature. (K2)
- 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. (K3)
- CO5 Understand the concept of spectroscopy and its application to monitor pollution. (K3)

UNIT I – ENVIRONMENT AND ENERGY RESOURCES

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

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 ex-situ conservation of biodiversity.

UNIT III - Air Pollution

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.

UNIT IV- Water and Land Pollution

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 and control measures of urban and industrial wastes. Thermal and radioactive pollution.

(9 Hrs)

(9 Hrs)

(9 Hrs)

(9 Hrs)

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 – NO_x , CO_x , SO_x , H_2S , Hydrocarbons and particulates.

Text Books

- 1. PK. De, "Environmental chemistry" 7th Ed; New age international (P) Ltd, New Delhi, 2010.
- K. RaghavanNambiar, "Text Book of Environmental Studies" 2ndEd, Scitech Publications (India) Pvt Ltd, India, 2010.
- 3. G. S. Sodhi, Fundamental concepts of environmental chemistry, I Ed, Alpha Science International Ltd, India, 2000.
- 4. Essentials of Ecology and Environmental Science, S. V. S. Rana , PHI learning, 2009
- 5. Basics of Environmental Science and Engineering, Sivashanmugam, P., new publishing book house, 2007

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
- 3. Environmental Science, P N Palanisamy, Pearson publications, 2012
- 4. Fundamentals of Environmental Studies, Mahua Basu, Xavier Savarimuthu, SJ, Cambridge University Press- 2017

Web Resources

- 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/https://www.tceq.texas.gov/airquality/monops/sites
- 5. https://guides.library.illinois.edu/c.php?g=347044&p=2349046

COs/POs/PSOs Mapping

COs					Prog	jram (Outco	mes	(POs)				Progi Outco	ram Spe omes (P	cific SOs)
003	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO10	PO11	PO12	PSO1	PSO2	PSO3
	1	2	3	4	5	6	7	8	9						
1	2	1				1	3	-	-	-	-	2	-	2	-
2	2	1	1	1	-	1	3	-	-	-	-	2	-	2	-
3	3	1	1	1	-	1	3	-	-	-	-	2	-	2	-
4	3	1	1	1	-	1	3	-	-	-	-	2	-	2	-
5	3	1	1	1	-	1	3	-	-	-	-	2	-	2	-

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T110

BASIC CIVIL AND MECHANICAL ENGINEERING

(Common to all branches)

Course Objectives

- To be able to differentiate the type of buildings according to national building code.
- To understand building components and their functions.
- Discuss the different types of roads, bridges and dams.
- To describe different types of combustion systems such as Internal and External Combustion systems
- To discuss various Energy Resources available for power generation.
- To explain the working of various different manufacturing process.

Course Outcomes

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

- CO1 Understand the basic concepts of different types of buildings and building materials. (K3)
- CO2 Learn various types of building components and their functions. (K3)
- CO3 Describe the importance of the basic infrastructure. (K3)
- CO4 Understand the classification of engines, low pressure Steam generators, its mounting and accessories. (K2)
- **CO5** Apply the knowledge of thermal systems and equipment's in power plants and analyze the way of harnessing the renewable energies and its utilization. **(K3)**
- **CO6** Understand the basic principles of machining, manufacturing and metal joining processes such as Lathe machine, Drilling, Grinding, Welding, green sand moulding foundry process. **(K2)**

PART – A CIVIL ENGINEERING

UNIT I BUILDINGS, BUILDING MATERIALS

Buildings-Definition-Classification according to NBC-plinth area, Floor area, carpet area, floor space indexconstruction materials-stone, brick, cement, cement-mortar, concrete, steel-their properties and uses.

UNIT II BUILDINGS AND THEIR COMPONENTS

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 and types.

UNIT III BASIC INFRASTRUCTURE

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

IC engines – Classification – Working principles – Diesel and petrol engines: two stroke and four stroke engines – Merits and demerits.

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

UNIT – V POWER GENERATION SYSTEMS

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 PROCESS

Machines – Lathe – Drilling – Bending – Grinding – Shearing (Description only) Machine Process – Turning – **B.Tech. Mechatronics Engineering**

(8 Hrs) d types.

(7 Hrs)

(7 Hrs)

(7 Hrs)

(8 Hrs)

(8 Hrs) e index-

41

Hrs

45

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Planning – Facing – Blanking – Drilling – Punching – Shearing – Bending – Drawing – Filling – 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-1, 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 Book Co., 1985.
- 6. Hajra Choudhry, et. al., Workshop Technology Vol I and II, Media promoters publishers Pvt. Ltd., Bombay, 2004.

Web Resources

- 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/ lecturenotes/
- 4. https://nptel.ac.in/courses/105102088/
- 5. https://nptel.ac.in/courses/105104101/

COs					Progr	am O	utcon	nes (P	Os)				Prog Outo	gram Spe comes (P\$	cific SOs)
	PO1	PO2	PO3	PO4	PO5	PO6	P07	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	2	1	1
5	3	2	2	2	2	2	2	-	-	-	-	3	2	1	1
6	3	2	2	2	2	2	2	-	-	-	-	3	2	1	1

COs/POs/PSOs Mapping

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T111	ENGINEERING MECHANICS	L	т	Ρ	С	Hrs
	(Common to all branches)	3	1	0	4	60

- 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 MECHANICS

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

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

Properties of sections – area, centroids of lines, areas and volumes, moment of inertia first moment of inertia, second moment of inertia and product of moment of inertia, polar moment of inertia, radius of gyration, mass moment of inertia.

UNIT IV KINEMATICS AND KINETICS OF PARTICLES

Equations of motion – Rectilinear motion, curvelinear 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

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

(12 Hrs)

(12 Hrs)

(12 Hrs)

(12 Hrs)

(12 Hrs)

43

Ltd., 2002.

- 2. Dr.I.S.Gujral, "Engineering Mechanicas" second edition, Lakshmi Publication (P), Ltd., 2011.
- 3. Dr. Sadhu Singh, A Textbook Of Engineering Mechanics, SChand & company Pvt Ltd., 2013.

Reference Books

- 1. Palanichamy, M.S. Nagan, S., Engineering Mechanics Statics & Dynamics, Tata McGraw-Hill, 2011.
- 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 Resources

- 1. http://nptel.iitm.ac.in/video.php?subjectId=112103108
- 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					Progr	am O	utcon	nes (F	POs)				Prog Oute	gram Spe comes (P	cific SOs)
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2	PSO3
1	3	2	2	3	-	-	-	-	-	-	-	1	2	1	2
2	3	2	2	3	-	-	-	-	-	-	-	1	2	1	2
3	3	2	2	3	-	-	-	-	-	-	-	1	2	1	2
4	3	2	2	3	-	-	-	-	-	-	-	1	2	1	2
5	3	2	2	3	-	-	-	-	-	-	-	1	2	1	2

COs/POs/PSOs Mapping

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T440	COMMUNICATIVE ENGLISH	L	Т	Ρ	С	Hrs
1112	(Common to all Branches)	4	0	0	4	45

- 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: Importance of Communication – stages of Communication - modes of communication – barriers to communication – strategies for effective communication – Listening: Importance, types, barriers – Developing effective - listening skills.

UNIT – II

Comprehension and Analysis: 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

UNIT – III

Writing: 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: Report writing – Memoranda – Notice – Instruction– Letters – Resumes – Job applications

UNIT – V

Oral Communication: Basics of phonetics – Presentation skills – Group Discussions – Dialogue writing – Short Extempore – Debates-Role Plays-Conversation Practice

Text Book

1.Ashraf M.Rizvi., Effective Technical Communication. Tata-McGraw, 2005.

Reference Books

- 1. Robert J.Dixson. ,Complete Course in English, Prentice-Hall of India Pvt. Ltd., New Delhi,2006.
- 2. Boove, Courtland R et al., Business Communication Today, Pearson Education, New Delhi, 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., New Delhi, 2007.

B.Tech. Mechatronics Engineering

(9Hrs)

(9Hrs)

(9Hrs)

(9Hrs)

(9Hrs)

5. Sethi, J and Kamalesh Sadanand., A Practical Course in English Pronunciation, Prentice-Hall of India Pvt. Ltd, New Delhi, 2007

Web Resources

- 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

					Drogr		utoon						Prog	ram Sp	ecific
COs					Frogr		utcon	ies (r	05)				Outco	omes (F	'SOs)
	P01	PO2	PO3	PO12	PSO1	PSO2	PSO3								
1	1	-	-	-	-	-	-	-	-	3	-	1	1	-	-
2	1	-	-	-	-	-	-	-	-	3	-	1	1	-	-
3	1	-	-	-	-	-	-	-	-	3	-	1	1	-	-
4	1	-	-	-	-	-	-	-	-	3	-	1	1	-	-
5	1	-	-	-	-	-	-	-	-	3	-	1	1	-	-

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

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P104	PHYSICS LAB	L	т	Ρ	С	Hrs
F 104	(COMMON TO ALL BRANCH)	0	0	3	2	30

• To provide a practical understanding of some of the concepts learnt in the theory course on Physics.

Course Outcomes

On successful completion of the course, 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 (Any 10 Experiments)

- 1. Thermal conductivity Lee's DISC
- 2. Thermal conductivity Radial flow
- 3. Spectrometer Prism or Hollow prism
- 4. Spectrometer Transmission grating
- 5. Spectrometer Ordinary & Extraordinary rays
- 6. Newton's rings
- 7. Air wedge
- 8. Half shade polarimeter Determination of specific rotatory power
- 9. Jolly's experiment determination of α
- 10. Magnetism: i h curve
- 11. Field along the axis of coil carrying current
- 12. Vibration magnetometer calculation of magnetic moment & pole strength
- 13. Laser experiment: wavelength determination using transmission grating, reflection grating (vernier calipers)
- & particle size determination
- 14. Determination of optical absorption coefficient of materials using laser
- 15. Determination of numerical aperture of an optical fiber
- 16. Electrical conductivity of semiconductor two probe / four probe method
- 17. Hall effect in semiconductor

COs/POs/PSOs Mapping

COs				F	Progra	am O	utcon	nes (F	POs)				Program	Specific C (PSOs)	Outcomes
	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
C01	3	3	1	1	3	3	2	2	3	3	2	3	-	2	1
C02	3	3	1	1	3	3	1	2	3	3	2	3	-	1	-
C03	3	3	2	1	3	3	2	2	3	3	2	3	1	1	1
C04	3	3	2	1	-	3	2	3	3	3	2	3	-	2	1

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D105	CHEMISTRY LAB	L	т	Ρ	С	Hrs
FIUJ	(Common to all branches)	0	0	3	2	30

- 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.
- To learn the laboratory skills needed to design, safely conduct and interpret chemical research.

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

- 1. Determination of COD of water sample.
- 2. Determination of lead by conductometry

Reference Books

- 1. Vogel's Text book of Macro and Semimicro Qualitative Analysis G. Svehla, Longman Inc., Newyork. 1997
- 2. Basic Principles of Practical Chemistry, Venkateswaran. V, Veeraswmay. R, Kulandaivelu. A.R., Pearson Education. 1989.
- 3. Vogel's Text book of Quantitative Analysis, Mendham. J, Denney. R.C, Bames. J.D, and Thomas, M. Pearson Education. 1989.
- 4. Practical Chemistry, D. N Bajpai, S. Giri and O P Pandey, Chand Publishing 2013
- 5. Allied Practical Chemsitry, A R Kulandaivelu, V Venkateswaran & R Veeraswamy, Chand Publications, 2001

Web Reference

- 1. https://edu.rsc.org/resources/titration-screen-experiment/2077.article
- 2. https://edu.rsc.org/resources/aspirin-screen-experiment/1644.article
- 3. https://www.stem.org.uk/resources/collection/3959/practical-chemistry
- 4. https://www.scienceinschool.org/2010/issue14/practical

5. http://www.chemlabs.bris.ac.uk/outreach/resources/Teachers_Websites.html

$C \cap c$					Prog	ram (Dutco	mes	(POs)			Progr Outco	am Spe mes (P	cific SOs)
CUS	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO11	PO11	PO11	PSO1	PSO2	PSO3
	1	2	3	4	5	6	7	8	9	0	1	2			
1	-	-	-	2	2	-	-	1	3	1	-	-	-	2	-
2	-	-	-	2	2	-	-	1	3	1	-	-	-	2	-
3	-	-	-	2	2	-	-	1	3	1	-	-	-	2	-
4	-	-	-	2	2	-	-	1	3	1	-	-	1	1	-
5	-	-	-	2	2	-	-	1	3	1	-	-	1	1	-

COs/POs/PSOs Mapping

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P106	WORKSHOP PRACTICE	L	т	Ρ	С	Hrs
1 100	(Common to all branches)	0	0	3	2	30

- 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)**

SI. No.	Trade	List of Exercises
1	Fitting	Study of tools and Machineries. Exercises on symmetric joints and joints with acute angle.
2	Welding	Study of arc and gas welding equipment and tools – Edge preparation – Exercise on lap joint and V Butt joints – Demonstration of gas welding
3	Sheet metal work	Study of tools and Machineries – Exercise on simple products like Office tray and waste collection tray.
4	Carpentry	Study of tools and Machineries – Exercises on Lap joints and Mortise joints

LIST OF EXERCISES

I - FITTING

- 1. Study of tools and Machineries
- 2. Symmetric fitting
- 3. Acute angle fitting

II - WELDING

- 1. Study of arc and gas welding equipment and tools
- 2. Simple lap welding (Arc)
- 3.M Single V butt welding (Arc)

III - SHEET METAL WORK

- 1. Study of tools and machineries
- 2. Frustum
- 3. Waste collection tray

IV - CARPENTRY

- 1. Study of tools and machineries
- 2. Half lap joint
- 3. Corner mortise joint.

Reference Books

- 1. HS Bawa, Workshop Practices, Tata Mc Graw 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 Resources

- 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					Progr	am O	utcon	nes (F	Os)				Pro Outo	gram Spe comes (P\$	cific SOs)
	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	1	1	1	-	-	-	-	-	-	-	3	2	1
2	3	2	1	1	1	-	-	-	-	-	-	-	3	2	1
3	3	2	1	1	1	-	-	-	-	-	-	-	3	2	1
4	3	2	1	1	1	-	-	-	-	-	-	-	3	2	1
5	3	2	2	2	1	-	-	-	-	-	-	-	3	2	1

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

- High

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P107

NCC / NSS

NCC / NSS training is compulsory for all the Undergraduate students

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

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COMPLEX ANALYSIS AND APPLICATIONS OF

PARTIAL DIFFERENTIAL EQUATIONS

(Common to EEE, ICE, MECH, MECHATRONICS)

Course Objectives

U19MCT31

- To understand the analytic functions of complex variables.
- To apply the analytic function techniques to transform irregular geometry into regular geometry.
- Expose to 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 concepts 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

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

Conformal mapping – Simple and standard transformations like w = z+c, cz, z^2 , e^z , sin z, cosh 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

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

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

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, 44th Edition, 2020.
- 2. N.P. Bali and Dr. Manish Goyal, "Engineering Mathematics", Lakshmi Publications Pvt. Ltd., New Delhi, 9th Edition. 2015.
- 3. P. Sivaramakrishna Das and C. Vijayakumari, "Engineering Mathematics", Pearsons Publications, New Delhi, 4th Edition, 2017.

Reference Books

- 1. C. Gupta, B. Shree Ram Singh, M. Kumar, "Engineering Mathematics for semester I & II", Tata McGraw Hill, New Delhi, 1st Edition, 2015.
- 2. H.K. Dass & Dr. Rama Verma, "Introduction to Engineering Mathematics Volume II", S. Chand & Co, New Delhi, 9th Edition, 2019.

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- 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 Resources

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

COs				F	Progra	am O	utcon	nes (F	POs)				Program	Specific O (PSOs)	outcomes
	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	1	-	-	-	-	-	-	1	1	-	-			
2	3	2	1	1	-	-	1	1	-	-					
3	3	2	1	1	-	-	-	-	-	-	-	1	1	1	-
4	2	1	-	-	-	1	-	-	-	-	-	1	2	2	-
5	3	2	1	1	-	1	-	-	-	-	-	1	2	2	-

COs/POs/PSOs Mapping

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

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U19MCT32

DATA STRUCTURES

(Common to ECE, EEE, IT, ICE, MECH, CIVIL, BME,

MECHTRONICS,CCE)

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

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 and their complexity analysis.

UNIT II STACK AND QUEUE OPERATIONS

Stacks and Queues: ADT Stack and its operations, Applications of Stacks: Expression Conversion and evaluation. ADT Queue: Types of Queue: Simple Queue, Circular Queue, Priority Queue. Operations on each type of Queues.

UNIT III LINKED LIST OPERATIONS

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

UNIT IV TREES

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

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

Text Books

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

Reference Books

- 1. Mark Allen Weiss," Algorithms, Data Structures and Problem Solving with C++", Illustrated Edition, Addison-Wesley Publishing Company, 1995.
- 2. D.Samanta, "Classic Data Structures, Second Edition, Prentice-Hall of India, Pvt. Ltd., India 2012.

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- 3. Robert Kruse, C.L. Tondo and Bruce Leung, "Data Structures and Program Design in c", Prentice-Hall of India, Pvt.Ltd., Second edition, 2007.
- 4. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C", Pearson Education, Second edition, 2006.
- 5. Balagurusamy, "Data Structures", Tata McGraw-Hill Education, 2019.

Web Resources

- 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					Prog	ram O	utcom	es (PC)s)				Prog Outc	ram Spo omes (F	ecific 'SOs)
	PO1	PO2	PO3	PO12	PSO1	PSO2	PSO3								
1	3	2	1	1	-	-	-	-	-	-	-	-	2	2	3
2	3	2	1	1	-	-	-	-	-	-	-	-	2	2	3
3	3	2	1	1	-	-	-	-	-	-	-	-	2	2	3
4	3	2	1	1	-	-	-	-	-	-	-	-	2	2	3
5	3	2	1	1	-	-	-	-	-	-	-	-	2	2	3

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U19MCT33

To Understand the current voltage characteristics of PN junction diode and special diodes.

ANALOG AND DEGITAL CIRCUITS DESIGN

- To Explain principle of operation of Bipolar junction transistor. •
- To Describe the characteristics of power amplifier and its distortion. •
- To present the Digital fundamentals, Boolean algebra and its applications in digital systems. •
- To familiarize with the design of various combinational digital circuits using logic gates

Course Outcomes

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

- CO1 Understand the current voltage characteristics of PN junction diode and special diodes.(K2)
- CO2 Explain principle of operation of Bipolar junction transistor. (K2)
- CO3 Describe the characteristics of power amplifier and its distortion. (K2)
- CO4 Understand about the logic gates and apply the techniques to simplify the expression. (K3)
- CO5 Examine the various combinational digital circuits using logic gates. (K3)

UNIT I SEMICONDUCTOR DIODE

Theory of PN junction diode, Band structure of open circuited PN junction, Volt-Ampere Characteristics, Temperature Dependence of PN diode, LED, LCD and Photo- diodes, Tunnel diode , Zener diode as Voltage Regulator

UNIT II TRANSISTORS, CHARACTERISTICS AND BIASING

Transistor, Types of Transistor, Transistor current components, Transistor as an Amplifier, Transistor characteristics in CB, CE and CC modes. Operating point, bias stability, various biasing circuits, stabilization against Ico, VBE and beta, Construction, Characteristics & applications of Junction Field Effect Transistor (JFET), UJT and MOSFET

UNIT III LARGE SIGNAL AMPLIFIERS

Class A direct coupled with resistive load, Transformer coupled with resistive load, harmonic distortion, variation of output power with load, Push-Pull Amplifiers, operation of class- B push-pull amplifier, crossover distortion, transistor phase inverter, complementary- symmetry amplifier

UNIT IV DIGITAL FUNDAMENTALS

Number Systems – Decimal, Binary, Octal, Hexadecimal, 1's and 2's complements, Codes – Binary, BCD, Excess 3, Gray, Alphanumeric codes, Boolean theorems, Logic gates, Universal gates, Sum of products and product of sums, Minterms and Maxterms, Karnaugh map Minimization and Quine-McCluskey method of minimization

UNIT V COMBINATIONAL CIRCUIT DESIGN

Design of Half and Full Adders, Half and Full Subtractors, Binary Parallel Adder - Carry look ahead Adder, BCD Adder, Multiplexer, Demultiplexer, Magnitude Comparator, Decoder, Encoder, Priority Encoder

Text Books

- 1. Electronic Devices & Circuits by Millman- Halkias, Tata Mcgraw Hill, 2015.
- 2. Electronic Devices & Circuits Theory by Boylested, Pearson Education, 2013.
- 3. M. Morris Mano and Michael D. Ciletti, "Digital Design", 5th Edition, Pearson, 2014

References

1. Electronic Devices, by Floyd, Pearson Education, 2012.

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- 2. Charles H.Roth. "Fundamentals of Logic Design", 6th Edition, Thomson Learning, 2013.
- 3. S.Salivahanan and S.Arivazhagan"Digital Electronics", Ist Edition, Vikas Publishing House pvt Ltd, 2012.
- 4. Anil K.Maini "Digital Electronics", Wiley, 2014.
- 5. A.Anand Kumar "Fundamentals of Digital Circuits", 4th Edition, PHI Learning Private Limited, 2016.
- 6. Soumitra Kumar Mandal " Digital Electronics", McGraw Hill Education Private Limited, 2016

Web Resources

- 1. https://www.electronics-notes.com/
- 2. https://www.tutorialspoint.com/semiconductor_devices/index.htm
- 3. https://www.electronics-tutorial.net/electronic-devices/
- 4. https://www.allaboutcircuits.com/video-tutorials/
- 5. https://www.makerspaces.com/basic-electronics/

COs/POs/PSOs Mapping

COs					Prog	ram Ou	utcome	es (PO:	s)				Prog Outco	ram Spe omes (P	ecific 'SOs)
	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	P011	PO12	PSO1	PSO2	PSO3
1	2	1	2	3	-	-	-	-	-	-	-	2	2	-	2
2	2	1	2	3	-	-	-	-	-	-	-	2	2	-	2
3	3	1	2	3	-	-	-	-	-	-	-	2	2	-	2
4	3	3	1	3	-	-	-	-	-	-	-	2	2	-	2
5	3	3	1	3	-	-	-	-	-	-	-	2	2	-	2

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

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		L	Т	Ρ	С	Hrs
0191010134	STRENGTH OF MATERIALS	2	2	0	3	60

- To understand the concepts of stress, strain, principal stresses and principal planes.
- To study the concept of shearing force and bending moment due to external loads in determinate beams and their effect on stresses.
- To determine stresses and deformation in circular shafts and helical spring due to torsion.
- To compute slopes and deflections in determinate beams by various methods.
- · To study the stresses and deformations induced in thin and thick shells

Course Outcomes

On successful completion of this course, the student will be able to

- **CO1** Understand the concepts of stress and strain in simple and compound bars, the importance of principal stresses and principal planes.
- **CO2** Understand the load transferring mechanism in beams and stress distribution due to shearing force and bending moment.
- CO3 Apply basic equation of simple torsion in designing of shafts and helical spring
- CO4 Calculate the slope and deflection in beams using different methods.
- CO5 Analyze and design thin and thick shells for the applied internal and external pressures

UNIT I STRESS, STRAIN AND DEFORMATION OF SOLIDS

Rigid bodies and deformable solids – Tension, Compression and Shear Stresses – Deformation of simple and compound bars – Thermal stresses – Elastic constants – Volumetric strains –Stresses on inclined planes – principal stresses and principal planes – Mohr's circle of stress

UNIT II TRANSVERSE LOADING ON BEAMS AND STRESSES IN BEAM

Beams – types transverse loading on beams – Shear force and bending moment in beams – Cantilevers – Simply supported beams and over – hanging beams. Theory of simple bending– bending stress distribution – Load carrying capacity – Proportioning of sections – Flitched beams – Shear stress distribution

UNIT III TORSION

Torsion formulation stresses and deformation in circular and hollows shafts – Stepped shafts– Deflection in shafts fixed at the both ends – Stresses in helical springs – Deflection of helical springs, carriage springs.

UNIT IV DEFLECTION OF BEAMS

Elastic curve of neutral axis of the beam under normal loads – Evaluation of beam deflection and slope: Double integration method and Macaulay's method.

UNIT V THIN CYLINDERS, SPHERES AND THICK CYLINDERS

Stresses in thin cylindrical shell due to internal pressure circumferential and longitudinal stresses and deformation in thin and thick cylinders – spherical shells subjected to internal pressure –Deformation in spherical shells – Lame's theorem.

Text Books

- 1. Bansal R.K, "Strength of Materials", Laxmi Publications, Sixth Edition 2019.
- 2. Bedi D.S, "Strength of Materials", Khanna Publishing, Sixth 2019.
- 3. Rajput R.K, "Strength of Materials", S. Chand Publications, Seventh Edition 2018.

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References

- 1. Punmia, Jain and Jain, "Mechanics of Materials", Laxmi Publications, 2019
- 2. Hibbeler, R.C., "Mechanics of Materials", Pearson Education, 9th Edition, 2018.
- 3. Egor. P.Popov "Mechanics of Materials" Pearson Education, 2nd Edition, 2016.
- 4. Subramanian R, "Strength of Materials", Oxford University Press, 3rd Edition 2016.
- 5. Jindal U.C., "Strength of Materials", Asian Books Pvt. Ltd., Second Edition New Delhi, 2018.

Web Resources

- 1. https://nptel.ac.in/courses/112107146/
- 2. https://nptel.ac.in/courses/112/106/112106141/
- 3. https://www.udemy.com/course/strengthofmaterials/
- 4. https://ae.linkedin.com/company/strength-of-materials-dept-spbstu
- 5. https://www.coursera.org/learn/mechanics

COs		-		Р	rogra	ım O	utcor	nes (POs))			Prog Outo	gram Spe comes (P\$	cific SOs)
	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	2	2	-	-	-	-	1	-	-	1	2	1	1
2	3	2	2	2	-	-	-	-	1	-	-	1	2	-	1
3	3	2	2	2	-	-	-	-	1	-	-	1	2	1	1
4	3	2	2	2	-	-	-	-	1	-	-	1	2	-	1
5	3	2	2	2	-	-	-	-	1	-	-	1	2	-	1

Cos Mapping with POs and PSOs

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U19MCT35

FLUID MECHANICS AND HYDRAULIC MACHINERY

Course Objectives

- To understand the structure and the properties of the fluid
- To understand and appreciate the complexities involved in solving the fluid flow problems.
- To understand the Impact of Fluid Jet on plates
- To understand energy exchange process in turbines
- To understand the working of Pumps and Air Vessels

Course Outcomes

On successful completion of this course, the student will be able to

- CO1 Understand the basic fluid property and law with their application..
- **CO2** Acquire knowledge regarding fluid static, kinematic, dynamic and study the different type of flow and boundary layer theory.
- CO3 Complete knowledge in Fluid Jet on plates
- CO4 Calculate the force, Power and efficiency in turbines
- **CO5** Understand the working of turbo machine like Pumps and Air Vessels.

UNIT I FLUID PROPERTIES AND FLOW CHARACTERISTICS

Units and dimensions- Properties of fluids- mass density, specific weight, specific volume, specific gravity, viscosity, compressibility, vapor pressure, surface tension and capillarity. Flow characteristics – concept of control volume - application of continuity equation, energy equation and momentum equation.

UNIT II FLOW THROUGH CIRCULAR CONDUITS

Hydraulic and energy gradient - Laminar flow through circular conduits and circular annuli-Boundary layer concepts – types of boundary layer thickness – Darcy Weisbach equation –friction factor Moody diagram-commercial pipes- minor losses – Flow through pipes in series and parallel.

UNIT III IMPACT OF JETS

Principles of Turbo Machinery: Fluid Machines – Classification – Impact of Fluid Jet on Stationary plates, Moving Plates and Vanes – Unit and Specific Quantities.

UNIT IV HYDRAULICS TURBINES

Classification – Impulse Turbine – Pelton Wheel – Reaction Turbines – Francis and Kaplan Turbines – Draft Tube Theory – Velocity Triangle – Estimation of force, Power and efficiency – General Characteristics of Turbine – Similarity Study – Governing of Turbine – Cavitation in Turbine.

UNIT V HYDRAULICS PUMPS

Classification - Centrifugal Pump – Velocity Triangle – Estimation of Power Required and efficiency – General characteristics - Similarity study – Cavitation in Pump – Reciprocating– Ideal and Actual Indicator Diagram – Estimation of Power Required, percentage Slip and Efficiency – Cavitation in Reciprocating pump.

Text Books

- 1. Streeter, V.L., and Wylie, E.B., "Fluid Mechanics", McGraw-Hill, 2010.
- 2. Kumar, K.L., "Engineering Fluid Mechanics", SchandPublications (P) Ltd., New Delhi (8th edition), 2009
- 3. Rajput.R.K "Fluid Mechanics and Hydraulics Machines", S. Chand Limited, 2008.

References

- 1. Bansal, R.K., "Fluid Mechanics and Hydraulics Machines", (5th edition), Laxmi publications (P) Ltd., New Delhi, 2010.
- 2. White, F.M., "Fluid Mechanics", Tata McGraw-Hill, 5th Edition, New Delhi, 2016.

B.Tech. Mechatronics Engineering

(12 Hrs)

(12 Hrs)

(12 Hrs)

(12 Hrs)

(12 Hrs)

61

T P C Hrs 2 0 3 60

2

- 3. Som, S.K., and Biswas, G., "Introduction to fluid mechanics and fluid machines", Tata McGraw-Hill, 2nd edition, 2011.
- 4. K. Subramanya "Hydraulic Machines" Tata McGraw-Hill Education, 2013.
- 5. Goyal, Manish Kumar "Fluid Mechanics and Hydraulic Machines" PHI Learning Pvt. Ltd., 31-Aug-2015

Web Resources

- 1. https://nptel.ac.in/courses/112104118/
- 2. https://nptel.ac.in/courses/112104117
- 3. http://fm-nitk.vlabs.ac.in
- 4. https://www.coursera.org/courses?query=fluid%20mechanics
- 5. https://www.virtulearn.in/course/fluid-mechanics-and-hydraulic-machines-online-classes

Cos Mapping with POs and PSOs

COs				P	rogra	im O	utcor	nes ((POs))			Prog Oute	gram Spe comes (P୧	cific SOs)
	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	P011	PO12	PSO1	PSO2	PSO3
1	3	2	2	2	-	-	-	-	1	-	-	1	2	-	1
2	3	2	2	2	-	-	-	-	1	-	-	1	2	-	1
3	3	2	2	2	-	-	-	-	1	-	-	1	2	-	1
4	3	2	2	2	-	-	-	-	1	-	-	1	2	-	1
5	3	2	2	2	-	-	-	-	1	-	-	2	2	-	1

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

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С Hrs **U19MCT36** SENSORS TRANSDUCERS AND MEASUREMENT SYSTEMS 3 3 45 0

Course Objectives

- To understand the concepts of measurement systems.
- To know the principle of transduction and the characteristics of different transducers.
- To learn the various sensors used to measure various physical parameters.
- To know the various types of sensors in mechatronics applications.
- To learn the fundamentals of signal conditioning and data acquisition systems.

Course Outcomes

After completion of the course, the students are able to

CO1. Define the role of sensor module for automated system.(K2)

CO2. Apply the motion sensors for the required applications. **(K3)**

CO3. Apply the required force and heading sensors for the Mechatronics applications.(K3)

CO4. Apply the optical, pressure and temperature sensors for the required applications. (K3)

CO5. Find suitable DAQ systems and data logging systems for real time requirements.(K4)

UNIT I INTRODUCTION

Basics of Measurements - Classification of errors - Error analysis - Static and dynamic characteristics of transducers - Performance measures of sensors - Classification of sensors - Sensor calibration techniques -Sensor Output Signal Types.

UNIT II MOTION, PROXIMITY AND RANGING SENSORS

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

Strain Gage, Load Cell, and Magnetic Sensors - types, principle, requirement and advantages: Magnetorestrictive - Hall Effect - Current sensor Heading Sensors - Compass, Gyroscope, Inclinometers.

UNIT IV OPTICAL, PRESSURE AND TEMPERATURE SENSORS

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.

UNIT V SIGNAL CONDITIONING AND DAQ SYSTEMS

Amplification - Filtering - Sample and Hold circuits - Data Acquisition: Single channel and multi channel data acquisition - Data logging – applications - Automobile, Aerospace, Home appliances, Manufacturing, Environmental monitoring.

Text Books

1. Patranabis D, "Sensors And Transducers", Prentice-Hall India, 2nd Edition, 2011.

- 2. Ramon Pallas & John G. Webster, "Sensors and Signal Conditioning", John Wiley & Sons, 2nd Edition, 2011.
- 3. Webster John G, "Instrumentation and Sensors Handbook", CRC Press, 1st Edition, 2010.
- 4. Jacob Fraden, "Handbook of Modern Sensors: Physics, Designs and Applications", Springer, 3rd Edition, 2012.
- Shawhney A. K., "Electrical And Electronics Measurements And Instrumentation", Dhanpat Rai & Sons, 2010.

Reference Books

1. John Turner and Martyn Hill, "Instrumentation for Engineers and Scientists", Oxford Science Publications, 2011.

2. Richard Zurawski, "Industrial Communication Technology Handbook" 2nd edition, CRC Press, 2015.

3. Nakra, B. C. and Chaudhry, K. K., Instrumentation Measurement and Analysis, Tata McGraw Hill 2010.

(9 Hrs)

(9 Hrs)

(9 Hrs)

(9 Hrs)

(9 Hrs)

4. Murthy, D.V.S., Transducers and Instrumentation, Prentice Hall of India Private Limited, 2012.

5. Doeblin, E.O., Measurement systems, Applications and Design, McGraw Hill, 2009.

Web Resources

1. https://nptel.ac.in/content/storage2/courses/112103174/pdf/mod2.pdf

2. https://www.electronics-tutorials.ws/

3. https://www.analog.com/en/analog-dialogue/articles/transducer-sensor-excitation-and-measurement techniques

4. http://www.kelm.ftn.uns.ac.rs/literatura/si/pdf/Measurement%20Instrumentation%20Sensors.pdf

5, https://www.udemy.com/course/sensors-sensor-fundamentals/

CO / PO / PSO Mapping

						CC) / PO /	/ PSO	MAPPI	NG					
СО	PO	PO	PO	PO1	PO1	PO1	PSO	PSO	PSO						
S	1	2	3	4	5	6	7	8	9	0	1	2	1	2	3
1	2	3	-	-	2	-	-	-	-	-	-	3	3	3	2
2	3	2	3	3	3	-	-	-	-	-	-	3	3	3	2
3	3	2	3	3	3	-	-	-	-	-	-	3	-	-	-
4	3	2	3	3	3	-	-	-	-	-	-	3	-	-	-
5	3	3	3	3	3	-	-	-	-	-	-	3	3	3	3

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U19MCP31 DATA STRUCTURES LAB	L	т	Р	с	Hrs
(Common to CSE, ECE, EEE, IT, ICE, MECH, CIVIL, BME	0	n	2	1	30
MECHTRONICS,CCE)	5	5	£	-	50

 $\hfill\square$ To learn the basic concepts of Data Structures.

 $\hfill\square$ To learn about the concepts of Searching and Sorting.

 $\hfill\square$ To study about the linear and non-linear Data Structures.

Course Outcomes

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

- CO1 Implement exemplary applications related to searching and sorting techniques. (K3)
- CO2 Compile, run and manipulate Programs using core data structures. (K3)
- CO3 Solve problems by applying linear Data Structures. (K3)
- CO4 Solve problems by applying non-linear Data Structures (K3)
- CO5 -. Build solutions for online coding challenges (K3)

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 dequeue (double ended queue) ADT using a doubly linked list and an array.
- 7. Write a C program to perform the following operations:
 - a) Insert an element into a binary 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) Inorder and c) Postorder.
- 9. Write a C program to perform the AVL tree operations.
- 10. Write a C program to implement Graph Traversal Techniques.

Reference Books

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

Web Resources

- 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/

Academic Curriculum and Syllabi R-2019 COs/POs/PSOs Mapping (MECHTRONICS)

					Drogr	0	utoor		0-1				Prog	ram Sp	ecific
COs					Fiogr		utcon	ies (r	05)				Outco	omes (F	PSOs)
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO 9	PO10	P011	PO12	PSO1	PSO2	PSO3
1	3	2	1	1	3	-	-	-	-	-	-	-	2	2	3
2	3	2	1	1	3	-	-	-	-	-	-	-	2	2	3
3	3	2	1	1	3	-	-	-	-	-	-	-	2	2	3
4	3	2	1	1	3	-	-	-	-	-	-	-	2	2	3
5	3	2	1	1	3	-	-	-	-	-	-	-	2	2	3

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U19MCP32 ANALOG AND DIGITAL CIRCUITS LAB

T P C Hrs 0 2 1 30

Course Objectives

- Study the characteristic of CE, CB and CC Amplifier and simulate using SPICE simulation
- Learn the frequency response of CS Amplifiers
- Study the Transfer characteristic of differential amplifier
- Perform experiment to obtain the bandwidth of single stage and multistage amplifiers
- Design and demonstrate various combinational and sequential circuits using Flip-flop

Course Outcomes

After completion of the course, the students are able to

CO1 -Differentiate various amplifiers and Simulate amplifiers using Spice.(K4)

CO2 -Analyse the limitation in bandwidth of single stage and multi stage amplifier. (K4)

CO3 - Measure CMRR in differential amplifier. (K3)

CO4 - Design and demonstrate various combinational logic circuits. (K5)

CO5 - Design and demonstrate various types of counters and Registers using Flip-flops. (K5)

List of Experiments

- 1. Frequency Response of CE, CB, CC and CS amplifiers
- 2. Construction of Darlington Amplifier
- 3. Differential Amplifiers- Transfer characteristic, CMRR Measurement
- 4. Class A and Class B Power Amplifiers
- 5. Determination of bandwidth of single stage and multistage amplifiers
- 6. Spice Simulation of Common Emitter and Common Source amplifiers
- 7. Design and implementation of code converters using logic gates
- (i) BCD to excess-3 code and vice versa (ii) Binary to Gray and vice-versa
- 8. Design and implementation of 4 bit binary Adder/ Subtractor and BCD adder using IC 7483
- 9. Design and implementation of Multiplexer and De-multiplexer using logic gates
- 10. Design and implementation of encoder and decoder using logic gates
- 11. Construction and verification of 4 bit ripple counter and Mod-10 / Mod-12 Ripple counters
- 12. Design and implementation of 3-bit synchronous up/down counter
- 13. Implementation of SISO, SIPO, PISO and PIPO shift registers using Flip- flops.
- 14. Study of Shift register IC

References

- 1. Electronic Devices & Circuits Theory by Boylested, Pearson Education. 2015
- 2. A.Anand Kumar "Fundamentals of Digital Circuits", 4th Edition, PHI Learning Private Limited, 2016

Web Resources

- 1. https://www.industrial-electronics.com/experiments_0.html
- 2. http://vlabs.iitb.ac.in/vlabs-dev/labs/digital-electronics/index.html
- 3. https://de-iitr.vlabs.ac.in/
- 4. http://vlabs.iitb.ac.in/vlab/electrical/index.html
- 5. https://www.iare.ac.in/sites/default/files/lab1/Electronic%20Circuit%20laboratory%20MANUAL%20.p

COs				<u> </u>	Prog	ram Ou	utcome	es (PO	s)				Prog Outco	ram Spe omes (P	ecific PSOs)
	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	1	2	3	-	-	-	-	-	-	-	2	2	-	2
2	2	1	2	3	-	-	-	-	-	-	-	2	2	-	2
3	3	1	2	3	-	-	-	-	-	-	-	2	2	-	2
4	3	3	1	3	-	-	-	-	-	-	-	2	2	-	2
5	3	3	1	3	-	-	-	-	-	-	-	2	2	-	2

COs/POs/PSOs Mapping

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

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U19MCP33 STRENGTH OF MATERIALS AND FLUID MACHINERY LAB L T P C Hrs 0 0 2 1 30

Course Objectives

- To study the mechanical properties of materials when subjected to different types of loading.
- To verify the principles studied in Fluid Mechanics theory by performing experiments in lab

Course Outcomes

On successful completion of this course, the student will be able to

CO1 - Perform Tension, Torsion, Hardness, Compression, and Deformation test on Solid materials.

- CO2- Use the measurement equipment's for flow measurement
- CO3 Perform test on different fluid machinery

List of Experiments

STRENGTH OF MATERIALS

- 1. Tension test on a mild steel rod
- 2. Double shear test on Mild steel and Aluminium rods
- 3. Torsion test on mild steel rod
- 4. Impact test on metal specimen
- 5. Hardness test on metals Brinnell and Rockwell Hardness Number
- 6. Deflection test on beams
- 7. Compression test on helical springs

FLUID MECHANICS AND MACHINES

- 1. Determination of the Coefficient of discharge of given Orifice meter.
- 2. Determination of the Coefficient of discharge of given Venturi meter.
- 3. Conducting experiments and drawing the characteristic curves of centrifugal pump/ submergible pump
- 4. Conducting experiments and drawing the characteristic curves of reciprocating pump.
- 5. Conducting experiments and drawing the characteristic curves of Gear pump.
- 6. Conducting experiments and drawing the characteristic curves of Pelton wheel.
- 7. Conducting experiments and drawing the characteristics curves of Francis turbine.
- 8. Conducting experiments and drawing the characteristic curves of Kaplan turbine

References

- 1. CWR, Hydraulics Laboratory Manual, 2004
- 2. N. Kumarasamy, Fluid Mechanics and Machinery laboratory manual, Charotar Publishing House Pvt. Ltd. 2008.
- 3. S C Gupta, Fluid Mechanics and Hydraulic Machines, Pearson Education India, 2006

Web Resources

- 6. https://nptel.ac.in/courses/112107146/
- 7. https://www.udemy.com/course/strengthofmaterials/
- 8. http://fmc-nitk.vlabs.ac.in/

Cos Mapping with POs and PSOs

COs	Program Outcomes (POs)										Program Specific Outcomes (PSOs)				
	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	2	2	-	-	-	2	3	-	-	1	1	1	1
2	3	2	2	2	-	-	-	2	3	-	-	1	1	1	1
3	3	2	2	2	1	-	-	2	3	-	-	1	1	1	1

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		L	Т	Ρ	С	Hrs
UTSINICCSX	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.

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	GENERAL PROFICIENCY-I	L	Т	Ρ	С	Hrs
U19MCS31	(Common to all branches)	0	0	2	1	30

- 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

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

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

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

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

Language Enhancement: Articles, Preposition, Tenses

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

Reference Books

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

(6Hrs)

(6Hrs)

(6Hrs)

(6Hrs)

(6Hrs)
Academic Curriculum and Syllabi R-2019 Web Resources

- 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					Progr	am O	utcon	nes (P	Os)				Prog Outco	ram Sp omes (F	ecific 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	1	-	-
4	1	-	-	-	-	-	-	-	-	3	-	1	1	-	-
5	1	-	-	-	-	-	-	-	-	3	-	1	1	-	-

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U19MCS32 SKILL DEVELOPMENT COURSE - II L T P C Hrs (Choose anyone of the below three courses) 0 0 2 - 30

1. EXCEL FOR STATISTICAL APPROACH

Course Content:

MODULE I SPREADSHEET ADMINISTRATION

Basic Navigation and Editing - Customizing Excel – Housekeeping - Connecting Workbooks - Sharing and Protecting - Excel Crashes

MODULE II ORIENTATION AND EFFICIENCY

Editing – Viewing – Outline - Cell References

MODULE III DATA HANDLING

Data Validation - Sorting and Filtering - Date and Time Functions - Text Functions - Lookup and Reference Functions - Logical and Informational Functions - Named Ranges – Macros

MODULE IV DATA ANALYSIS

Mathematical Functions - Summarising Data - Pivot Tables - Formula Auditing - What-If Analysis - Modelling Principles - Modelling Techniques

MODULE V PRESENTATION

Cell Formatting - Number Formatting - Conditional Formatting - Graphs and Charts – Review - Page and Print Setup

2. TRAINING ON ARDUINO

Course Content:

MODULE I INTRODUCTION OF ARDUINO AND BASIC PROGRAMMING

Introduction to Arduino, Pin configuration and architecture, Device and platform features, Concept of digital and analog ports, Familiarizing with Arduino Interfacing Board. Basic Concepts: Arduino data types, Variables and constants, Operators, Control Statements, Arrays, Functions.

MODULE II ARDUINO I/O FUNCTIONS AND ARDUINO TIME

Pins Configured as INPUT, Pull-up Resistors, Pins Configured as OUTPUT, pinMode() Function, digitalWrite() Function, analogRead() function, Arduino Interrupts. Arduino Time: Incorporating Arduino time, delay() function, delayMicroseconds() function, millis() function, micros() function.

MODULE III ARDUINO DISPLAYS AND ARDUINO SENSORS

Working with Serial Monitor, Line graph via serial monitor, Interfacing a 8 bit LCD to Arduino, Fixed one line static message display, Running message display, Using the LCD Library of Arduino. Arduino Sensors: Arduino – Humidity Sensor, Temperature Sensor, Water Detector, PIR Sensor, Ultrasonic Sensor, Connecting Switch (Magnetic relay switches).

MODULE IV ARDUINO SECONDARY INTEGRATIONS AND INPUT TO THE CONTROLLER

Types of Relay, Controlling Electrical appliances with electromagnetic relays, working of a matrix keypad, Using the keypad library to interface with Arduino, Interfacing Servo motors to Arduino, Interfacing a RF Module. Input to the Controller: Using serial input, Controlling LEDs with keys, Keys as toggle switch, Interfacing a piezo Buzzer, Using a buzzer as an alarm unit

MODULE V ARDUINO COMMUNICATIONS AND ARDUINO PROJECTS

Parallel Communication, Serial Communication Modules, Types of Serial Communications, Arduino UART, GSM/GPRS Arduino Interfacing.

Arduino Projects (It involves designing, developing, coding and implement Arduino project): Intelligent home locking system, Intelligent water level management system, Home automation using RFID, Real time clock-based home automation, Intelligent Automatic Irrigation System.

3. COMPUTER VISION

Course Content:

MODULE I INTRODUCTION TO COMPUTER VISION AND IMAGE FORMATION

Background, requirements and issues, human vision. Image formation: geometry and photometry (brightness and color), quantization, camera calibration.

MODULE II SEGMENTATION, EXTRACTION, VIEW GEOMETRY, OBJECTRECOGNITION

Various methods of image segmentation, edge detection, object proposals, SIFT features. Multi-view Geometry: Shape from stereo and motion, feature matching, surface fitting, Active ranging. Object Recognition: Traditional Methods – HoG / SIFT features, Bayes classifiers, SVM classifiers

MODULE III NEURAL NETWORKS AND DEEP LEARNING

Introduction to Neural Networks: Artificial neural networks, loss functions, back propagation and SGD, Batch Normalization. Object Recognition: Deep Learning Methods, Image classification, object detection and semantic segmentation, adversarial attacks. Various neural network architectures, visualization techniques.

MODULE IV MOTION ANALYSIS AND ACTIVITY RECOGNITION

Motion analysis and Activity Recognition: Motion detection and tracking, Inference of human activity from image sequences

MODULE V CASE STUDIES AND EXAMPLES

Examples: Face recognition, Image grounding, Visual question answering

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U19MCM31

L	Т	Ρ	С	Hrs
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.

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U19MCT41

Course Objectives

- Learn the techniques of solving algebraic and transcendental equations.
- To introduce the numerical techniques of differentiation and integration.
- To know the basic concepts of statistical parameters like mean, median, mode etc.

NUMERICAL METHODS AND STATISTICS

- To understand the concept of testing of hypothesis using statistical analysis.
- Identify the direction and strength of a linear correlation between two factors.

Course Outcomes

After completion of the course, students will be able to

- CO1 Solve algebraic and transcendental equations. (K3)
- CO2 Apply the knowledge of interpolation by using the numerical methods. (K3)
- CO3 Understand the basic concepts of Statistics. (K2)
- CO4 Apply the concept of testing of hypothesis for small and large samples. (K3)
- **CO5** Know the applications of linear regression and correlation. **(K2)**

UNIT I SOLUTION OF EQUATIONS AND EIGEN VALUE PROBLEMS

Solution of algebraic and transcendental equations – Newton Raphson method – Gauss elimination method – Gauss Jordan method – Iterative methods of Gauss Jacobi and Gauss Seidel.

UNIT II NUMERICAL DIFFERENTIATION AND INTEGRATION

Interpolation: Interpolation by Newton's forward and backward difference formulae for equal intervals – Solution of ordinary differential equations – Single step methods – Taylor series method – Euler methods – Integration by Trapezoidal and Simpson's rules – Lagrange's method for unequal intervals.

UNIT III MEASURES OF DISPERSION

Standard deviation – Mean deviation – Quartile deviation – Range – Measures of Skewness and Pearson's coefficient of skewness – Moments about the arbitrary origin and moments based on measures of skewness and kurtosis.

UNIT IV TESTING OF HYPOTHESIS

Test of significance: Large sample test for single proportion, difference of proportions, single mean, difference of means and difference of standard deviations. Small samples: Test for single mean, difference of means and correlation coefficients – test for ratio of variances – Chi–Square test for goodness of fit and independence of attributes.

UNIT V CORRELATION AND REGRESSION

Curve fitting – Method of least squares – Correlation – Rank correlation – Regression – Multiple and partial correlation – Plane of regression – Coefficient of multiple correlation – Coefficient of partial correlation.

Text Books

- 1. B. S. Grewal, "Numerical Methods in Engineering and Science ", Mercury learning & Information, Kindle Edition, 2018.
- 2. T. Veerarajan and T. Ramachandran, "Statistics and Numerical methods", McGraw Hill, 1st Edition, 2019.
- 3. Richard A. Johnson, Irwin Miller and John E. Freund, "Probability and Statistics for Engineers", Pearson Education, Asia, 9th Edition, 2018.

(12 Hrs)

(12 Hrs)

(12 Hrs)

(12 Hrs)

(12 Hrs)

Hrs

60

LTP

2 2 0

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Reference Books

- 1. Rajesh Kumar Guptat, "Numerical Methods, Fundamental and its Applications", Cambridge University, 2019.
- 2. Erwin Kreyszig, "Advanced Engineering Mathematics", John Wiley & Sons, New Delhi, 10th Edition, 2019
- 3. Timothy Sauer, "Numerical Analysis", Pearson Education, 3rd Edition, 2017.
- 4. Arvind Pragati Gautam, "Numerical Methods", Alpha Science International Limited, 2019.
- N. P. Bali and Dr. Manish Goyal, "Engineering Mathematics", Lakshmi Publications Pvt. Ltd., New Delhi, 9th Edition, 2015.

Web Resources

- 1. http://nptel.ac.in/courses/111107063/
- 2. https://nptel.ac.in/courses/111107119/
- 3. https://easyengineering.net/ma6452-statistics-and-numerical-methods/
- 4. https://nptel.ac.in/courses/110/105/110105087/
- 5. https://nptel.ac.in/courses/111/105/111105077/

COs/POs/PSOs Mapping

COs					Progr	am O	utcom	nes (P	Os)				Program	Specific O (PSOs)	utcomes
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	1	1	-	1	-	-	-	-	-	1	3	3	2
2	3	2	1	1	-	1	-	-	-	-	-	1	3	3	2
3	2	1	-	-	-	1	-	-	-	-	-	1	3	2	1
4	3	2	1	1	-	-	-	-	-	-	-	1	3	2	1
5	2	1	-	-	-	-	-	-	-	-	-	1	3	2	1

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U19MCT42 ELECTRONIC DEVICES AND CIRCUITS

Course Objectives

- To study the applications of diodes and rectifiers.
- To know about the Bipolar Junction Transistor and their operation.
- To analyse about junction field effect transistor and then the special purpose devices.
- To analyse and Design of Small Signal Low Frequency BJT Amplifiers.
- To give understanding of various types of amplifier circuits.

Course Outcomes

After completion of the course, the students are able to

CO1 - Discuss the characteristics of diodes and its applications.(K2)

- CO2 Devise the configuration and biasing concepts of Bipolar Junction.(K2)
- **CO3** Describe the characteristics if JFET and special diodes. (K2)
- CO4 Illustrate the characteristics of various BJT small signal amplifier circuits. (K3)

CO5 - Interpret the characteristics of various FET amplifiers. (K3)

UNIT I DIODE AND APPLICATIONS

Diode - Static and Dynamic resistances, Equivalent circuit, Load line analysis, Diffusion and Transition Capacitances, Diode Applications: Switch-Switching times. Rectifier - Half Wave Rectifier, Full Wave Rectifier, Bridge Rectifier, Rectifiers with Capacitive and Inductive Filters, Clippers-Clipping at two independent levels, Clamper-Clamping Circuit Theorem, Clamping Operation, Types of Clampers.

UNIT II BIPOLAR JUNCTION TRANSISTOR (BJT)

Principle of Operation, Common Emitter, Common Base and Common Collector Configurations, Transistor as a switch, switching times, Transistor Biasing and Stabilization - Operating point, DC & AC load lines, Biasing - Fixed Bias, Self-Bias, Bias Stability, Bias Compensation using Diodes.

UNIT III JUNCTION FIELD EFFECT TRANSISTOR (FET)

Construction, Principle of Operation, Pinch-Off Voltage, Volt-Ampere Characteristic, Comparison of BJT and FET, Biasing of FET, FET as Voltage Variable Resistor.

Special Purpose Devices: Zener Diode - Characteristics, Voltage Regulator. Principle of Operation - SCR, Tunnel diode, UJT, Varactor Diode.

Transistor Hybrid model, Determination of h-parameters from transistor characteristics, Typical values of hparameters in CE, CB and CC configurations, Transistor amplifying action, Analysis of CE, CC, CB Amplifiers and CE Amplifier with emitter resistance, low frequency response of BJT Amplifiers, effect of coupling and bypass

Small Signal Model, Analysis of JFET Amplifiers, Analysis of CS, CD, CG JFET Amplifiers. MOSFET

UNIT IV ANALYSIS AND DESIGN OF SMALL SIGNAL LOW FREQUENCY BJT AMPLIFIERS

Text Books

capacitors on CE Amplifier.

UNIT V FET AMPLIFIERS

1. Electronic Devices and Circuits- Jacob Millman, McGraw Hill Education.

Characteristics in Enhancement and Depletion mode, Basic Concepts of MOS Amplifiers.

- 2. Electronic Devices and Circuits theory-Robert L. Boylestead, Louis Nashelsky, 11th Edition, 2009.
- 3. Thomas L.Floyd, "Electronic devices" Conventional current version, Pearson prentice hall, 10th Edition, 2017.

B.Tech. Mechatronics Engineering

L T P C Hrs 3 0 0 3 45

(9 Hrs)

(9 Hrs)

(9 Hrs)

(9 Hrs)

(9 Hrs)

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Reference Books

- 1. The Art of Electronics, Horowitz, 3rd Edition Cambridge University Press.
- 2. Electronic Devices and Circuits, David A. Bell 5th Edition, Oxford.
- 3. Pulse, Digital and Switching Waveforms –J. Millman, H. Taub and Mothiki S. Prakash Rao, 2Ed., 2008, Mc Graw Hill.

Web Resources

- 1. http://www.electronics-tutorials.ws
- 2. www.allaboutcircuits.com
- 3. www.tutorialspoint.com
- 4. https://nptel.ac.in/courses/117/103/117103063/
- 5. https://www.electrical4u.com/diode-working-principle-and-types-of-diode/

COs/POs/PSOs Mapping

COs					Progr	ram Oເ	utcom	es (PO	s)				Prog Outco	ram Sp omes (F	ecific PSOs)
	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	1	2	1	-	-	-	-	-	-	-	-	2	-	-
2	2	1	2	1	-	-	-	-	-	-	-	-	2	-	-
3	2	1	2	1	-	-	-	-	-	-	-	-	2	-	
4	2	1	2	1	-	-	-	-	-	-	-	-	2	-	1
5	2	1	2	1	-	-	-	-	-	-	-	-	2	-	1

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U19MCT43 POWER ELECTRONICS AND DRIVES

Course Objectives

- To get an overview of different types of power devices and their switching characteristics.
- To understand the operation, characteristics and performance parameters of controlled rectifiers.
- To study the operation, switching techniques and basics topologies of DC-DC switching regulators.
- To study the operation of induction motor drives and various configurations.
- To learn the operation of DC drives and their control using power electronic circuits.

Course Outcomes

After completion of the course, the students are able to

- CO1 Define about various power switching circuits used in Electrical drives. (K1)
- CO2 Explain the operations of controlled converters for different types of Loads.(K2)
- CO3 –Classify the different controlled chopper. (K2)
- CO4 Discuss different types of drives used in automation. (K2)
- CO5 Explain the concept of DC motor drives and their control using power electronic circuits. (K2)

UNIT I INTRODUCTION

Power Devices-MOSFET, IGBT, SCR- Linear regulated vs Switched mode power supplies Electrical drive system-Advantages-Types of Electric drives-Dynamic of Drives- selection of electrical drives- Modes of operation of electrical drives- -closed loop control of Drives.

UNIT II CONTROLLED RECTIFIERS (CONVERTERS) FED DC DRIVES

Single Phase Half wave / full wave half controlled /fully controlled converters with R, RL and RLE loads, Continuous and discontinuous current operations- Evaluation of performance parameters - Phase controlled DC drives.

UNIT III CHOPPER CONTROLLED DC DRIVES

Principle of operation of chopper-Types-Four Quadrant Chopper Circuits- Buck and Boost Chopper fed DC machines.

UNIT IV INDUCTION MOTOR DRIVES

Dynamic Modelling of Induction machines- Single phase bridge inverters with R, RL and RLE loads -Phase controlled Induction motor drive-Frequency controlled Induction motor drives-Variable frequency Drives Three phase 120 and 180 degree mode Inverter fed AC machine –Vector controlled Induction motor drives –Direct and Indirect vector control.

UNIT V PERMANENT MAGNET SYNCHRONOUS AND BRUSHLESS DC MOTOR DRIVES (9 Hrs)

Synchronous Machines with PMs-Vector control of PMSM-Permanent magnet brushless DC motor-Sensor less control BLDC motor.

Text Books

- 1. R.Krishnan, "Electrical motor drives modelling, analysis and control" Pearson India, 2015.
- 2. Gopal K.Dubey, "Fundamentals of Electrical Drives" Narosa Publishing house, 2017.

Reference Books

- 1. P. S. Bimbhra, "Power Electronics" KHANNA PUBLISHSERS-DELHI, 2012.
- 2. Mohammed H Rashid, "Power electronics" Pearson Education India, 2009.
- 3. Bimal Bose, "Power electronics and driver circuits" Elseveir, 2006.
- 4. Bogdan M. Wilamowski, J. David Irwin," Power Electronics and Motor Drives" CRC Press, 2011.
- 5. Bimal K Bose, "Modern Power electronics and AC drives" Prentice hall, 2002.

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L T P C Hrs 3 0 0 3 45

(9 Hrs)

(9 Hrs)

(9 Hrs)

(9 Hrs)

Web Resources

- 1. https://onlinecourses.nptel.ac.in/noc19_ee03
- 2. https://nptel.ac.in/downloads/108105066/
- 3. https://nptel.ac.in/content/storage2/courses/108105066/PDF/L(SSG)(PE)%20((EE)NPTEL).pdf
- 4. https://www.hindustanuniv.ac.in/assets/pdf/pg/PED_Syllabus.pdf
- 5. http://vnit.ac.in/academic/wp-content/uploads/2019/01/M.-Tech.-in-Power-Electronics-and-Drives-.pdf

COs/POs/PSOs Mapping

000					Progr	ram Oເ	utcom	es (PO	s)				Prog	ram Sp	ecific
COS				-			-	-	-	-	-	-	Outco	omes (F	250s)
	PO1 PO2 PO3 PO4 PO5 PO6 PO7 PO8 PO9 PO10 PO11 PO1													PSO2	PSO3
1	2	1	-	-	-	-	-	-	-	-	-	-	1	-	-
2	2	1	-	1	-	-	-	-	-	-	-	-	2	-	-
3	2	1	-	1	-	-	-	-	-	-	-	-	2	-	-
4	2	2	-	2	-	-	-	-	-	-	-	-	2	-	-
5	2	2	-	1	-	-	-	-	-	-	-	-	2	-	-

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		L	Т	Ρ	С	Hrs
019WC144	THEORY OF MACHINES	2	2	0	3	60

Course Objectives

- To understand the principles in the formation of mechanisms and their kinematics
- To understand velocity and acceleration of different mechanisms •
- To analyze the principles in mechanisms used for speed control and stability control •
- To understand balancing of mass and its position •
- To understand the effect of Dynamics of undesirable vibrations

Course Outcomes

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

- CO1 Understand the principles of mechanisms and their kinematics (K1)
- CO2 Extract velocity and acceleration of different mechanisms(K2)
- CO3 Apply the forces in speed and stability control systems(K3)
- CO4 Analyzing balancing of mass and its position(K4)
- CO5 Prioritize different types of vibration, their causes and remedies(K5)

Unit I INTRODUCTION

Theory of machines: introduction, need, scope and importance in design and analysis. Kinematics, kinetics and dynamics-concept and examples. Basic terminology related to machines and mechanisms. Development different mechanisms and its inversions like four bar chain mechanism, slider crank mechanism, double slider crank mechanism

Unit II VELOCITY AND ACCELERATION DIAGRAM

Basic concept used in solving velocity and acceleration problems. Approach to solve velocity and acceleration related to mechanisms using, Relative velocity method for single slider crank mechanism and Four bar chain mechanism. Klein's construction for single slider cranks mechanism

Unit III GOVERNOR AND GYROSCOPES

Governors - Types - Centrifugal governors, Gyroscopes - Gyroscopic forces and torques - Gyroscopic stabilization -Gyroscopic effects in Automobiles, ships and airplanes

Unit IV BALANCING OFMASSES

Concepts and types of balancing. ,Effects of unbalanced masses. Balancing of revolving masses in same plane: Analytical and graphical methods to find balancing mass. Balancing of reciprocating masses

Unit V VIBRATIONS

Vibration-Terminology-Effects-Causes-Remedies. Free Vibration – Damped vibrations – Forced vibrations, Transverse vibrations, Torsional Vibrations - Equivalent shaft systems, single, Double and triple rotor systems

Text Books

- 1. Rattan S.S, "Theory of Machines" Tata McGraw-Hill Publishing Company Ltd., New Delhi, and 2nd edition -2005.
- 2. Sadhu Singh, "Theory of Machines," Pearson Education (Singapore) Pvt. Ltd., India Branch, New Delhi, 2ND Edi. 2006.

References

- 1. Shigley. J. V. and Uickers, J.J., "Theory of Machines & Mechanisms" OXFORD Universitypress.2004
- 2. Theory of Machines -I", by A.S.Ravindra, Sudha Publications, Revised 5th Edi. 2004.
- 3. Grover. G.T., "Mechanical Vibrations", Nem Chand and Bros., 2006.
- 4. JagadishLal, 'Theory of Machine', DhanpatRai Publications, New Delhi.
- 5. Rao.J.S. and Dukkipatti R.V. "Mechanisms and Machines", Wiley-Eastern Ltd., New Delhi, 2012

(12 Hrs)

(12 Hrs)

(12 Hrs)

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(12 Hrs)

(12 Hrs)

Web Resources

- 1. http://mm-nitk.vlabs.ac.in/
- 2. https://nptel.ac.in/courses/112104114
- 3. https:/ocw.mit.edu
- 4. https://www.researchgate.net/publication/278026450_Introduction_to_Theory_of_Machines
- 5. http://ecoursesonline.iasri.res.in/mod/page/view.php?id=1303

Cos Mapping with POs and PSOs

COs				Ρ	rogra	ım O	utcor	nes ((POs))			Pro Out	gram Spe comes (P\$	cific SOs)
	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	P011	PO12	PSO1	PSO2	PSO3
CO1	3	2	3	3	-	-	-	-	-	-	-	2	1	-	1
CO2	3	2	3	3	-	-	-	-	-	-	-	2	2	1	1
CO3	3	2	3	3	-	-	-	-	-	-	-	1	2	2	1
CO4	3	2	3	3	-	-	-	-	-	-	-	1	1	1	2
CO5	3	2	3	3	-	-	-	-	-	-	-	1	1	-	1

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U19MCP41

NUMERICAL METHODS LAB

L T P C Hrs 0 0 2 1 30

Course Objectives

- To learn the techniques of solving non-linear equation.
- To find the solutions of simultaneous equations.
- To introduce the numerical techniques of differentiation and integration.
- To understand the curve fitting techniques.
- To study about the single mean and difference of means.

Course Outcomes

After completion of the course, students will be able to

- CO1 Solve algebraic and transcendental equations. (K3)
- CO2 Solve the system of simultaneous equations. (K3)
- CO3 Apply the knowledge of interpolation by using the numerical methods. (K3)
- CO4 Apply the concept of least square method. (K3)
- CO5 Know the concept of testing of hypothesis. (K3)

List of Experiments

- 1. Roots of non-linear equation using bisection method.
- 2. 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 by using trapezoidal rule.
- 7. Fit a straight line by method of least squares.
- 8. Fit a parabola by method of least squares.
- 9. Test for Single mean.
- 10. Test for difference of mean.

Reference Books

- 1. Rajesh Kumar Guptat, "Numerical Methods, Fundamental and its Applications", Cambridge University, 2019.
- 2. Erwin Kreyszig, "Advanced Engineering Mathematics", John Wiley & Sons, New Delhi, 10th Edition, 2019
- 3. Timothy Sauer, "Numerical Analysis", Pearson Education, 3rd Edition, 2017.
- 4. Arvind Pragati Gautam, "Numerical Methods", Alpha Science International Limited, 2019.
- 5. N. P. Bali and Dr. Manish Goyal, "Engineering Mathematics", Lakshmi Publications Pvt. Ltd., New Delhi, 9th Edition, 2015.

Web Resources

- 1. http://scilab.in
- 2. http://nptel.ac.in/courses/111107063
- 3. http://nptel.ac.in/courses/122102009
- 4. https://youtu.be/luEOMyGuulg
- 5. https://youtu.be/i_VKsST3kkQ

COs					Pro	ogram C)utcor	nes (F	POs)				Prog Outco	ram Sp omes (F	ecific PSOs)
	P01	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO110	PO111	PO112	PSO1	PSO2	PSO3
1	3	2	1	1	-	1	-	-	-	-	-	1	3	1	-
2	3	2	1	1	-	1	-	-	-	-	-	1	3	1	-
3	3	2	1	1	-	1	-	-	-	-	-	1	2	2	-
4	3	2	1	1	-	-	-	-	-	-	-	1	2	2	-
5	3	2	1	1	-	-	-	-	-	-	-	1	2	2	-

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

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U19MCP42	ELECTRONIC DEVICES AND CIRCUITS	L	Т	Ρ	С	Hrs
	LAB	0	0	2	1	30

Course Objectives

- To study the characteristics of diodes.
- To make the student to understand about rectifiers.
- To enable the student to understand about the Bipolar Junction Transistor and their operation.
- To analyse about junction field effect transistor, UJT and SCR.
- To give understanding of various types of amplifier circuits.

Course Outcomes

After completion of the course, the students are able to

- CO1 Examine the characteristics of various Diodes. (K4)
- CO2 Distinguish the principles of rectifier circuits. (K4)
- CO3 Appraise the BJT operations in various configurations (K4)
- CO4 Experiment the various characteristics of FET, UJT and SCR. (K4)
- CO5 Test the frequency responses of various types of amplifiers. (K4)

LIST OF EXPERIMENTS

- 1. PN Junction diode characteristics A. Forward bias B. Reverse bias.
- 2. Zener diode characteristics and voltage regulator
- 3. Half wave Rectifier with and without filter.
- 4. Full wave Rectifier with and without filter.
- 5. Transistor CB characteristics (Input and Output).
- 6. Transistor CE characteristics (Input and Output).
- 7. FET Characteristics
- 8. UJT characteristics.
- 9. SCR characteristics.
- 10. Frequency response of CE Amplifier
- 11. Frequency response of CC Amplifier (Emitter Follower).
- 12. Frequency Response of CS Amplifier and CD Amplifier

Reference Books

- 1. The Art of Electronics, Horowitz, 3rd Edition Cambridge University Press.
- 2. Electronic Devices and Circuits, David A. Bell 5th Edition, Oxford.
- 3. Pulse, Digital and Switching Waveforms –J. Millman, H. Taub and Mothiki S. Prakash Rao, 2Ed.,2008, Mc Graw Hill.

Web Resources

- 1. http://www.electronics-tutorials.ws
- 2. https://nptel.ac.in/courses/117/103/117103063/
- 3. https://www.electrical4u.com/diode-working-principle-and-types-of-diode/
- 4. www.allaboutcircuits.com
- 5. www.tutorialspoint.com

COs					Progr	am Ou	utcome	es (PO	s)				Progr Outco	ram Spo omes (F	ecific PSOs)
	P01	PO2	PO3	PO4	P05	PO6	P07	P08	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	1	2	-	1	-	-	-	3	-	-	-	2	-	-
2	2	1	2	-	1	-	-	-	3	-	-	-	2	-	-
3	2	2	2	-	1	-	-	-	3	-	-	-	2	-	-
4	2	2	2	-	1	-	-	-	3	-	-	-	2	-	-
5	2	2	2	-	1	-	-	-	3	-	-	-	2	-	-

COs/POs/PSOs Mapping

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		L	Т	Ρ	С	Hrs
019101743	FOWER ELECTRONICS AND DRIVES LAD	0	0	2	1	30

Course Objectives

- To study about switching characteristics of different types of power semi-conductor devices
- To determine the operation, characteristics and performance parameters of converters
- To understand the concept of DC and AC drives

Course Outcomes

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

- CO1 Know the construction, operation and characteristics of different types of power semiconductor devices.(K2)
- CO2 Understand the operation, characteristics and performance parameters of converters and choppers. (K2)
- CO3 Interpret the operation and characteristics of invertors and its related techniques.(K3)
- CO4 Acquire the knowledge on solid-state DC drives and its control.(k3)

LIST OF EXPERIMENTS

- 1. Gate Pulse Generation using R, RC and UJT.
- 2. Characteristics of SCR and TRIAC.
- 3. Characteristics of MOSFET and IGBT
- 4. AC to DC half controlled converter
- 5. AC to DC fully controlled Converter
- 6. Step down and step up MOSFET based choppers
- 7. IGBT based single phase PWM inverter
- 8. IGBT based Three Phase PWM Inverter Fed AC Drives
- 9. AC Voltage controller
- 10. Switched mode power converter.
- 11. Characteristics of PMBLDC motor.
- 12. Resonant dc to dc converter
- 13. Speed control of Universal Motor
- 14. Intelligent Power Module of DSP based AC Drives
- 15. Vector control of Induction Motor Drive

References

- 1. Bogdan M. Wilamowski, J. David Irwin, "Power Electronics and Motor Drives", CRC Press, 2017.
- 2. K Sundareswaran, "Elementary Concepts of Power Electronic Drives", CRC Press, 2019.
- 3. Vinod Kumar, Ranjan Kumar Behera, Dheeraj Joshi, Ramesh Bansal, "Power Electronics, Drives, and Advanced Applications", CRC press, 2020.
- 4. Orlowska-Kowalska, Teresa, Blaabjerg, Frede, Rodríguez, José, "Advanced and Intelligent Control in Power Electronics and Drives", Springer, 2014.
- 5. Vukosavic, Slobodan-Boban, "Digital Control of Electrical Drives", Springer, 2007.

Web Resources

- 1. https://www.vvitengineering.com/lab/EE6611-POWER-ELECTRONICS-AND-DRIVES-LAB.pdf
- 2. http://www.srmvalliammai.ac.in/qb/EEE/UG/6th%20Semester/EE8661-Power%20Electronics%20and%20Drives-Lab%20Manual.pdf
- http://pnbalamurugan.yolasite.com/resources/EE6611%20POWER%20ELECTRONICS%20AND%20DRIVES %20LAB%20MANUAL.pdf
- 4. https://lecturenotes.in/practicals/19388-lab-manuals-for-power-electronics-and-drives-power-electronics-byanna-superkings
- 5. http://ezhil-ecesait.webs.com/Power-Electronics-Lab-Manual.pdf

COs					Prog	ram O	utcom	es (PC	Ds)				Prog Outco	ram Spe omes (P	ecific SOs)
	P01	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	2	3	3	-	-	-	3	2	2	3	3	2	2
2	3	2	2	3	3	-	-	-	3	2	2	3	3	2	2
3	3	2	2	3	3	•	-	-	3	2	2	3	3	2	2
4	3	2	2	3	3	-	-	-	3	2	2	3	3	2	2

COs/POs/PSOs Mapping

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U19MCP44 DYNAMICS OF MACHINERY LAB L T P C 0 0 2 1

Course Objectives

- To teach the students principle of working of various governor
- To teach the students the different modes of balancing
- To teach the students, various modes of vibration

Course Outcomes

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

- CO1 Ability to perform the working of various governor
- **CO2** Ability to perform different modes of balancing and cam analysis
- CO3 Ability to perform different types various modes of vibration

List of Experiments

- 1. Demonstration of four bar inversion mechanism
- 2. Natural frequency of single mass, single helical spring system.
- 3. Natural frequency of combination of springs springs in parallel, springs in series
- 4. Natural frequency of undamped torsional single rotor, double rotor system. Effect of inertia (I)and stiffness(k).
- 5. Determination of radius of gyration of a given compound pendulum
- 6. Determination of radius of gyration, moment of inertia bifilar suspension method trifler suspension method

7. Damping coefficient of torsional single rotor system - Effect of depth of immersion in oil and damping ratio

8. Resonance frequency of equivalent spring mass system - undamped and damped condition

- a) To plot amplitude Vs frequency graph for different damping.
- 9. Determination of characteristic curves of Watt, Porter, Proell and spring loaded governors.
- 10. Static and Dynamic balancing.
- 11. Whirling of shafts/ determination of critical speed with and without Rotors.
- 12. Gyroscopic couple verification.
- 13. Journal bearing pressure distribution of different loads at different Speeds.
- 14. Cam motion analysis.

Reference Books

- 1. S.S.Rattan, Theory of Machines, 3rd edition, Tata McGraw-Hill Education India, 2019
- Sadhu Singh, Theory of Machines: Kinematics and Dynamics, 3rd Edition, Publisher: Pearson Education India, 2014
- 3. Ghosh. A and Mallick, A.K., "Theory of Mechanisms and Machines", 3rd Edition Affiliated East-West Pvt. Ltd., New Delhi, 2006
- 4. Ghosh, Amitabha, "Introduction to Dynamics", Springer, 2018.
- 5. David Myszka, "Machines & Mechanisms: Applied Kinematic Analysis", Pearson, 2010.

Web Resources

- 1. http://mm-nitk.vlabs.ac.in/
- 2. https://nptel.ac.in/courses/112104114
- 3. https:/ ocw.mit.edu

Hrs

30

Academic Curriculum and Syllabi R-2019 COs/POs/PSOs Mapping

CO/P	PO	PO1	PO1	PO1	PSO	PSO	PSO								
0	1	2	3	4	5	6	7	8	9	0	1	2	1	2	3
CO1	3	2	2	2	3	-	-	-	3	-	-	3	3	2	2
CO2	3	2	2	2	3	-	-	-	3	-	-	3	3	2	2
CO3	3	2	2	2	3	-	-	-	3	-	-	3	3	2	2

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		L	Т	Ρ	С	Hrs
UT9WCC4X	CERTIFICATION COURSE = II	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.

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	GENERAL PROFICIENCY-II	L	т	Ρ	С	Hrs
0191010541	(Common to all branches)	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

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

UNIT I -CAREER SKILLS

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

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

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

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

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.
- 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.

(6Hrs)

(6Hrs)

(6Hrs)

(6 Hrs)

(6Hrs)

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- 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 Resources

- 1. https://www.englishclub.com/grammar/nouns-compound.htm
- 2. https://lofoya.com/Verbal-Test-Questions-and-Answers/Sentence-Completion/I3p1
- 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	;				Progr	am O	utcon	nes (P	Os)				Program Specific Outcomes (PSOs)						
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2	PSO3				
1	1	-	-	-	-	-	-	1	-	3	-	1	1	-	-				
2	1	-	-	-	-	-	-	1	-	3	-	1	1	-	-				
3	1	-	-	-	-	-	-	-	-	3	-	1	1	-	-				
4	1	-	-	-	-	-	-	1	-	3	-	1	1	-	-				
5	1	-	-	-	-	-	-	-	-	3	-	1	1	-	-				

COs/POs/PSOs Mapping

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

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U19MCS42 Skill Development Course IV L T P C Hrs (Choose anyone of the below three courses) 0 0 2 - 30

1. Power Transmission Systems

Mechanical power transmission involves using different types of systems to transfer energy from one component to another without changing its nature. When motion coming from a driving mechanical component is transferred to another without being changed, there is power transmission. In a mechanical power transmission system, the moving component transfers the energy to the receiving component. These two components can be in direct contact, but power can also be transmitted via an intermediary component. **Gears:** Characteristics of gear systems – Advantages and Limitations - Applications

Chain drive systems: Characteristics of chain drive systems – Advantages and Limitations - Applications

Worm drives: Characteristics of worm systems - Advantages and Limitations - Applications

Rack and Pinion: Characteristics of rack and pinion systems – Advantages and Limitations – Applications

Belt and pulley systems: Characteristics of belt and pully systems – Advantages and Limitations - Applications

2. 3D Printing

The official said that the theory classes have been designed in a simple manner to ensure that the students are able to grasp the topics in a short period of time. On successful completion of this course, student will be able to Acquire knowledge in 3D printing Machine, Analyze the fundamental concepts of software and hardware of 3D printing. Design and development of simple model by 3D printing. Create real time model of 3D Printing object. The duration of the course is 40-50 hours specified in the curriculum, which will be offered through Centre of Excellence. The skill training to improve the employability of the students and also impart industry relevant training for up-skilling the faculty and Industrial persons.

3. Non – Destructive Testing

Non – Destructive Testing is a testing and analysis technique used by industry to evaluate the properties of a material, component, structure or system for characteristic differences or welding defects and discontinuities without causing damage to the original part.

Electromagnetic Testing (ET) - Ground Penetrating Radar (GPR) - Laser Testing Methods (LM) - Leak Testing (LT) - Magnetic Flux Leakage (MFL) - Microwave Testing - Liquid Penetrant Testing (PT) - Magnetic Particle Testing (MT) - Radiographic Testing (RT).

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U19MCM41

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.

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С Hrs т Ρ **U19MCT51** MICROPROCESSORS AND CONTROLLERS 3 0 0 3 45

Course Objectives

- To achieve knowledge about 8085 and 8051 microcontrollers
- To know about C programming using 8051 microcontroller
- To expand knowledge of internal and external peripherals
- To apply microcontroller for mechatronics applications
- To pioneer the architecture of advanced microprocessors and microcontrollers.

Course Outcomes

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

CO1 - Explain the basic concepts of 8085 microprocessor and 8051 microcontroller (K2)

- CO2 Interpret the Embedded C programming concepts with 8051 microcontroller (K2)
- CO3 Develop programming using internal and external peripherals with microcontroller (K3)
- CO4 Function of a microcontroller based system for Mechatronics applications (k5)
- CO5 Design the architecture of ARM processor and PIC microcontroller.(K6)

UNIT I 8085 MICROPROCESSOR

8085 Architecture - Pin configuration - Register organization - Memory organization - memory and I/O decoding Interrupts

UNIT II 8051 MICROCONTROLLERS

Selection of Microcontrollers - 8051 Microcontroller Architecture - Pin configuration - Memory organization -Special function registers – Program Counter – PSW register – Stack and stack pointer

UNIT III 8051 ASSEMBLY LANGUAGE/EMBEDDED C PROGRAMMING

Compiler C - programming structure, Data types, memory models, infinite loops and handling interrupts in C. Intel Hex file format. Instruction set – Addressing modes – I/O port programming – Timer programming – Counter programming – Serial communication programming – Interrupt programming.

UNIT IV PERIPHERAL INTERFACING

Introduction to Embedded C programming – Peripheral interfacing Switch –key pad, LCD –LED – A/D and D/A converters - High Power devices using relays. Speed control: DC Motor - Stepper motor, servomotor.

UNIT V MICROCONTROLLER FOR MECHATRONICS APPLICATIONS

Application case studies related to Interfacing of sensors analog and discrete type (Temperature, Pressure, Level, Proximity sensors). Interfacing of actuators (Servo motor, pneumatic cylinders, PWM control of a DC motor). RF module Interfacing - IR module interfacing. Traffic light control application

Text Books

- 1. Mazidi Muhammad Ali, Mazidi Janice Gillispie and McKinlayRolin, "The 8051 Microcontroller and Embedded Systems", 2nd Edition, Prentice Hall of India, New Delhi, 2013.
- 2. Patel, "The 8051 Microcontroller based Embedded Systems", 1st Edition, Tata McGraw Hill Publishing Company, New Delhi, 2014.
- 3. Ramesh Goankar, "Microprocessor 8085 Architecture, Programming and Interfacing", Penram International publishers, Mumbai, 2013.

Reference Books

- 1. A Nagoorkani, "8085 Microprocessor and its Applications", 2017
- 2. Kenneth Ayala, "The 8051 Micro controller", 3rd edition cengage learning 2007
- SubrataGhoshal, "Embedded Systems & Robots : Projects Using the 8051 Microcontroller", 2009.

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(9 Hrs)

(9 Hrs)

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(9 Hrs)

(9 Hrs)

- 4. Lyla B. Das," The X86 Microprocessor", Pearson India, 2014
- Dan Harres "MSP430-based Robot Applications: A Guide to Developing Embedded Systems" Newnes; 1 edition 2013

Web Resources

- 1. https://swayam.gov.in/nd1_noc20_ee42/preview
- 2. https://nptel.ac.in/courses/108/105/108105102/
- 3. https://www.youtube.com/watch?v=liRPtvj7bFU

COs				Р	rogra	ım Oı	utcor	nes (POs)				Prog Outo	gram Spe comes (P	cific SOs)
	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	P011	PO12	PSO1	PSO2	PSO3
1	3	2	2	3	-	-	-	-	-	-	-	2	2	2	3
2	3 2 2 3									-	-	2	2	2	3
3	3	2	2	3	-	-	-	-	-	-	-	2	2	2	3
4	3	2	3	3	-	-	-	-	-	-	-	2	2	2	3
5	3 2 2 3										2	2	2	3	

COs/POs/PSOs Mapping

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

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U19MCT52 CONTROL SYSTEMS FOR MECHATRONICS SYTEMS L T P C Hrs 2 2 0 3 60

Course Objectives

- To introduce the elements of control system and their modelling using various techniques.
- To revise the procedures for analyzing the time response in a system.
- To find out the frequency response and analyzing the system.
- To be familiar with the stability of systems.
- To establish the state variable analysis method

Course Outcomes

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

CO1 - Demonstrate the various control system elements and their representations.(K2)

CO2 - Develop the various time domain parameters. (K3)

- CO3 Analyze the various frequency response plots and its system. (K4)
- CO4 Estimate the concepts of various system stability criterions.(K5)
- CO5 Design various transfer function of digital control system using variable models. (K6)

UNIT I CONTROL SYSTEM MODELING

Basic Elements of Control System – Open loop and Closed loop systems - Differential equation - Transfer function, Modelling of Electric systems, Translational and rotational mechanical systems - Block diagram reduction Techniques - Signal flow graph.

UNIT II TIME RESPONSE ANALYSIS

Time response analysis - First Order Systems - Impulse and Step Response analysis of second order systems - Steady state errors – P, PI, PD and PID Compensation.

UNIT III FREQUENCY RESPONSE ANALYSIS

Frequency Response - Bode Plot, Polar Plot, Nyquist Plot - Frequency Domain specifications from the plots - Constant M and N Circles - Nichol's Chart - Use of Nichol's Chart in Control System Analysis. Series, Parallel, series-parallel Compensators - Lead, Lag, Lead Lag Compensators.

UNIT IV STABILITY ANALYSIS

Stability, Routh-Hurwitz Criterion, Root Locus Technique, Construction of Root Locus, Stability, Dominant Poles, Application of Root Locus Diagram - Nyquist Stability Criterion - Relative Stability.

UNIT V STATE VARIABLE ANALYSIS

State space representation of Continuous Time systems – State equations – Transfer function from State Variable Representation – Solutions of the state equations - Concepts of Controllability and Observability – State space representation for Discrete time systems.

Text Books

- 1. J.Nagrath and M.Gopal, "Control System Engineering", New Age International Publishers, 5thEdition, 2007.
- 2. Richard C. Dorf and Robert H. Bishop, "Modern Control Systems", Addison Wesley, 1999.

Reference Books

- 1. Benjamin.C.Kuo, "Automatic control systems", Prentice Hall of India, 7th Edition, 1995.
- 2. M.Gopal, "Control System Principles and Design", Tata McGraw Hill, 2nd Edition, 2002.
- 3. Schaum's Outline Series, "Feedback and Control Systems" Tata McGraw-Hill, 2007.
- 4. John J.D'Azzo& Constantine H.Houpis, "Linear Control System Analysis and Design", Tata McGraw-Hill, Inc.,.

(12 Hrs)

(12 Hrs)

(12 Hrs)

(12 Hrs)

(12 Hrs)

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Web Resources

- 1. https://en.wikibooks.org/wiki/Control_Systems/Resources
- 2. https://www.tutorialspoint.com/control_systems/control_systems_useful_resources.htm
- 3. https://mechatronics.colostate.edu/resources/

COs/POs/PSOs Mapping

COs				Pi	rogra	m O	utcor	nes (POs)			Program Specific Outcomes (PSOs)				
	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	P011	PO12	PSO1	PSO2	PSO3		
	3	2	2	3	-	-	-	-	-	-	-	2	2	2	3		
	3 2 2 3												2	2	3		
	3	2	2	3	-	-	-	-	-	-	-	2	2	2	3		
	3 2 3 3												2	2	3		
	3	2	2	3	-	2	2	2	3								
Corrolati	on I ou			2_Mo	dium	2_ []	iah										

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

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1140MCTE2	L	Т	Ρ	С	Hrs
01910155	3	0	0	3	45

Course Objectives

- To be familiar with about basic concepts of metal cutting and CNC machines
- To recognize about various tooling systems and fixtures
- To expand knowledge in economics
- To grow up knowledge in angular measurement systems
- To determination of the process capabilities and ensure that these are better than the relevant component tolerances.

Course Outcomes

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

- CO1 Explain the parameters of metal cutting and comprehend the basic components, drives and controls involved in a CNC system (K2)
- CO2 Select various tooling systems and fixtures for CNC and identify maintenance features of CNC machines (K3)
- CO3 Apply the concepts of economics in CNC machine handling (K3)
- CO4 Infer linear and angular measurements using various instruments (K2)
- CO5 Conclude methods of measurement for various physical quantities.(K5)

UNIT I BASICS OF CNC MACHINES

CNC machines: Classification – Construction details: Structure, Configuration of CNC system – Compensations for Machine accuracy – DNC – Adaptive control CNC systems, Drives and Controls - Drive Mechanism, gearbox, Spindle Drives, Axes drives - Magnetic Levitation and Linear motors. Timing belts and pulleys, Spindle bearing – Arrangement and installation. Slide ways. Re-circulating ball screws – Backlash measurement and compensation, linear motion guide ways.

UNIT II TOOLING FOR CNC MACHINES

Interchangeable tooling system – Preset and qualified tools – coolant fed tooling system – Modular fixturing – Quick change tooling system – Automatic head changers – Tooling requirements for Turning and Machining centres – Tool holders – Tool assemblies – Tool Magazines – ATC Mechanisms – Automatic Pallet Changer-Tool management. Principles of location, clamping and work holding devices.

UNIT III ECONOMICS OF CNC MACHINES

Economics of CNC Machines and Retrofitting: Factors influencing selection of CNC Machines – Cost of operation of CNC Machines – Practical aspects of introducing CNC machines in industries – Maintenance features of CNC Machines – Preventive Maintenance, Other maintenance requirements. Retrofitting.

UNIT IV LINEAR AND ANGULAR MEASUREMENTS

Basic concepts: Legal metrology- Precision- Accuracy- Types of errors – Standards of measurement- Traceability – Interchangeability and selective assembly. Introduction to limits, fits and tolerances, Gauge design-Comparators-Angular measurement: bevel protractor - Angle gauges - Sine bar.

UNIT V INTERFEROMETRY AND LASER METROLOGY

Principle of light wave interference – Optical flats -Michelson and NPL flatness interferometer, Laser interferometer. Advances in Metrology: Coordinate Measuring Machine (CMM): Types - Constructional features-Possible causes of errors in CMM - Probing system – Performance and applications of CMM. Machine Vision System: Applications of machine vision in measurement- In process and On line measurement.

Text Books

1. Narang J.S. and Narang V.D.S., "CNC Machines and Automation", Dhanpat Rai and Co. Pvt. Ltd., 2016.

2. HMT Limited, "Mechatronics", Tata McGraw-Hill, New Delhi, 2001

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(9 Hrs)

(9 Hrs)

(9 Hrs)

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(9 Hrs)

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3. Jain R.K., -Engineering Metrologyll, Khanna Publishers, New Delhi, 2013

Reference Books

- 1. M. Adithan, B.S. Pable, "CNC Machines", New age international publications, 2016
- 2. Mahesh Dhotre, D. Rao, "CNC Machine Tool Technology with Programming and Operating", Saitech publications 2016
- 3. Mahajan M, "Textbook Of Metrology", Dhanpat rai & Co.2010.
- 4. Raghavendra,, Krishnamurthy," Engineering Metrology and Measurements" OUP India, 2013
- 5. Anil Akdogan" Metrology " BoD Books on Demand 2018
- 6. E. Mainsah, J.A. Greenwood, D.G. Chetwynd Metrology and Properties of Engineering Surfaces" Springer Science & Business Media 2013.

Web Resources

- 1. https://nptel.ac.in/courses/112/105/112105211/
- 2. https://nptel.ac.in/courses/112/106/112106179/
- 3. https://swayam.gov.in/nd1_noc19_me46/preview
- 4. https://swayam.gov.in/nd1_noc20_me94/preview

COs/POs/PSOs Mapping

COs				P	rogra	im O	utcor	nes ((POs))			Program Specific Outcomes (PSOs)					
	P01	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3			
1	3	2	2	3	-	-	-	-	-	-	-	2	2	2	3			
2	3	3 2 2 3 2										2	2	2	3			
3	3	2	2	3	-	-	-	-	-	-	-	2	2 2		3			
4	4 3 2 3 3									-	2	2	2	3				
5	3 2 2 3										2	2	2	3				

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U19MCT54 THERMAL ENGINEERING AND HEAT TRANSFER

Course Objectives

- To discuss first law of thermodynamics with respect to closed and open systems
- To impart the knowledge on second law of thermodynamics and entropy
- To recognize various modes of heat transfer in steady and transient condition.
- To discuss convective heat transfer in various systems.
- To describe radiation heat transfer for various geometries.

Course Outcomes

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

- CO1 Recognize the basic concepts associated with the first law of thermodynamics.(K2)
- CO2 Comprehend the basic concepts associated with the second law of thermodynamics.(K2)
- CO3 Analyze steady state and transient heat conduction problems of real life Thermal systems.(K4)
- CO4 Value the convective heat transfer problems in various thermal systems.(K4)
- CO5 Evaluate radiation heat transfer problems in various thermal systems.(K5)

UNIT I IC ENGINES

Classification of IC engines – petrol and diesel engines; two stroke and four stroke engines – scavenging in two stroke engines - port and valve timing diagram - fuel supply system in SI and CI engines - ignition system and its types – cooling system and its types – lubrication system and its types - lubricants - governing of IC engines – engine operating characteristics – power – cruising – idle and low engine speed – high engine speed – cold start - performance characteristics – heat balance test for IC engines.

UNIT II JET PROPULSION

Principle of jet propulsion – air craft jet engines – jet engine cycle – turbojet – turbofan – turboprop – turbofan engines - engine performance – thrust and efficiency, thrust power, propulsion power, propulsion efficiency and thermal efficiency – engine aircraft matching. Rocket engines – introduction – space missions

UNIT III – CONDUCTION

Introduction of heat transfer – conduction - convection and radiation – Laws – General equation of heat conduction – Derivation in Cartesian - cylindrical and spherical coordinates – One dimensional steady state heat conduction in simple geometries – plane wall - cylinder and sphere –Conduction with Internal Heat Generation – Extended Surfaces – Unsteady Heat Conduction – Lumped Analysis – Semi Infinite and Infinite Solids –Use of Heisler's charts

UNIT IV – CONVECTION

Boundary layer theory – Hydrodynamic and Thermal Boundary Layer- Dimensional Analysis-Flow over a flat-Flow over cylinders -spheres - tube bank.

UNIT V - RADIATION

Radiation heat transfer – Thermal radiation – Laws of radiation – Black body concept – Greay body radiation - Emissive power – Radiation shape factor-radiation heat exchange between surfaces – Electrical Analogy – Radiation Shields-Radiation through gases.

Text Books

- 1. Nag P. K., Engineering Thermodynamics, McGraw Hill Education India Pvt. Ltd, 2017.
- 2. Sachdeva R. C., Fundamentals of Heat and Mass Transfer, New AgeInternationalPublishers, 2017.
- 3. Rajput R K "A text book of Engineering Thermodynamics", S. Chand publishers, 2016

(12 Hrs)

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Hrs

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Reference Books

- 1. Moran and Shapairo, Principles of Engineering Thermodynamics, 8th Edition, Wiley, 2015
- 2. Yunus A. Cengel, Heat and Mass Transfer: Fundamentals and Applications, McGraw Hill Education, 2016.
- 3. Frank P. Incropera and David P. Dewitt, Incropera's principles of Heat and Mass Transfer, Wiley India Edition, 2018.
- 4. C. P. Kothandaraman and S. Subramanyan, Heat and Mass Transfer Data Book, Fifth Edition, New Age International Publishers, 2018.
- 5. Arora C.P, "Thermodynamics", 25th Reprint, McGraw-Hill, New Delhi, 2013.

Web Resources

- 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				Рі	rogra	m O	utcor	nes (POs)				Program Specific Outcomes (PSOs)					
	P01	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3			
1	3	2	2	3	-	-	-	-	-	-	-	2	2	2	3			
2	3	2	2	3	-	-	-	-	-	-	-	2	2	2	3			
3	3	2	2	3	-	-	-	-	-	-	-	2	2	2	3			
4	3 2 3 3 .					-	-	-	-	-	-	2	2	2	3			
5	3 2 2 3										2	2	2	3				

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U19MCP51 MICROPROCESSORS AND CONTROLLERS LAB

Course Objectives

- To know about programming for 8085 microprocessor and 8051 microcontrollers
- To enlarge a microcontroller based system for Mechatronics applications
- To Verify programming logic and interfacing circuits using simulation software
- To develop the quality of assessing and analyzing the obtained data.
- To expose students to the operation of typical microprocessor (8085) trainer kit.

Course Outcomes

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

- CO1 Relate programming for 8085 microprocessor and 8051 microcontroller (K2)
- CO2 Utilize programming logic and interfacing circuits using simulation software (K3)
- CO3 Develop a microcontroller based system for Mechatronics applications (K3)
- CO4 Compare testing and experimental procedures on Microprocessor and Microcontroller analyze their operation under different cases. (K5)
- **CO5** Prove professional quality textual and computational results, incorporating accepted data analysis and synthesis methods, simulation software, and word-processing tools.(K5)

List of Experiments

Assembly Language Programming

- 1. Arithmetic functions using 8085 Microprocessor
- 2. Arithmetic functions using 8051 Microcontroller.

Embedded C Programming and hardware interfacing using 8051 Microcontroller

- 3. Interfacing of switch, LED and seven segment LED
- 4. Interfacing of LCD
- 5. DC motor programming for the given case study
- 6. Stepper motor programming for the given case study
- 7. Servo motor programming for the given case study
- 8. Actuation of pneumatic cylinders for the given case study
- 9. Interfacing of high power devices for the given case study
- 10. Study on Interfacing sensors, microcontroller with IoT module

Reference Books

- 1. G.T. Swamy "Microprocessor (8085) Lab Manual" Firewall Media. 2006
- 2. KalpathiRamani "Microcontrollers And Applications With Lab Manual" Pearson Education India 2010
- 3. Navas, K. A. "Electronics Lab Manual (Volume 2)" PHI Learning Pvt. Ltd. 2018
- 4. D.A.GodseA.P.Godse" Microprocessors and microcontroller" Technical Publications. 2008
- Dr Anita Gehlot, Dr Rajesh Singh, P. Raja "Microprocessor and Microcontroller Interview Questions: A complete question" BPB Publication – 2020

Web Resources

- 1. https://www.iitk.ac.in/new/microprocessor-and-microcontroller-laboratory.
- 2. http://vlabs.iitb.ac.in/vlabs-dev/labs_local/microprocessor/labs/explist.php
- 3. http://iiekalyani.com/electronics-communication-engineering/microprocessor-microcontroller-lab/

Hrs

30

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COs/POs/PSOs Mapping

COs				P	rogra	m O	utcor	nes (POs)			Program Specific Outcomes (PSOs)					
	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3			
1	3	2	2	1	3	-	-	-	3	-	-	1	2	2	3			
2	3 2 2 1 3 3 - 1										1	2	2	3				
3	3	3	-	-	-	3	-	-	1	2	2	3						
4	3 2 2 1 3 3										1	2	2	3				
5	3 2 2 1 3 3											1	2	2	3			

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

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	L		Р	С	Hrs
UT9WCF32	0	0	2	1	30

Course Objectives

- To practice and execute the part program using CNC trainer machines
- To interpret the fundamentals of calibration and measurements processes and perform the characteristics on instruments
- To measurements with and calibration of instruments
- To simulate using CAM package and interface the developed program with the machines
- To develop, simulate and execute part program using CNC production machines

Course Outcomes

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

- CO1 Relate and execute the part program using CNC trainer machines (K2)
- CO2 Develop, simulate and execute part program using CNC production machines(K3)
- CO3 Discover using CAM package and interface the developed program with the machines(K4)
- CO4 Interpret the fundamentals of calibration and measurements processes and perform the characteristics on instruments(K5)
- CO5 The select and use the appropriate measuring instrument according to a specific requirement (K5)

List of Experiments

- 1. Study of G codes and M codes for machining centre and turning centre
- 2. Programming and machining of given component using MTAB trainer machine
- 3. Programming and machining of given component using CNC turning centre
- 4. Programming and machining of given component using CNC turning centre
- CNC code generation of given component using MASTER CAM (Lathe) and interfacing it to CNC turning centre
- 6. Programming and machining of given component using CNC machining centre
- 7. Programming and machining of given component using CNC machining centre
- 8. CNC code generation of given component using MASTER CAM (Mill) and interfacing it to CNC machining centre
- 9. Calibration of Vernier / Micrometer; static characteristic study- Measurement of Components like V block etc.
- 10. Calibration of Dial Gauge; static characteristic study; Use of dial gauge as measuring device and Comparator.
- 11. Calibration of profile projector and measurement of micro components.
- 12. Study of Autocollimator, Surface roughness tester and coordinate measuring machine (CMM).

Reference Books

- Peter Smid "CNC Control Setup for Milling and Turning: Mastering CNC Control Systems"Industrial Press Inc - 2010
- 2. Dennis A. Keeling "How to Use a Cnc Router: A Practical Guide for Beginners "Create Space Independent Publishing Platform, 2017
- 3. James A. Harvey" CNC Trade Secrets: A Guide to CNC Machine Shop Practices" Industrial Press, Incorporated, 2014
- 4. Bewoor "Metrology & Measurement" Tata McGraw-Hill Education 2009
- 5. Zhiyong Ma, David G. Seiler "Metrology and Diagnostic Techniques for Nanoelectronics CRC Press. "- 2017.
- 6. Jerzy A. Sładek "Coordinate Metrology: Accuracy of Systems and Measurements "Springer.- 2015
Web Resources

- 1. https://www.youtube.com/watch?v=pPwyYFvRLts
- 2. https://www.youtube.com/watch?v=HpIEeBtJupY
- 3. https://mech.iitd.ac.in/content/cnc-lab

COs/POs/PSOs Mapping

COs				P		Program Specific Outcomes (PSOs)									
	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	P011	PO12	PSO1	PSO2	PSO3
1	3	2	2	1	3	-	-	-	3	-	-	1	2	2	3
2	3	2	2	1	3	-	-	-	3	-	-	1	2	2	3
3	3	2	2	1	3	-	-	-	3	-	-	1	2	2	3
4	3	2	2	1	3	-	-	-	3	-	-	1	2	2	3
5	3	2	2	1	3	-	-	-	3	-	-	1	2	2	3

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

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		L	Т	Ρ	С	Hrs
019101755	THERMAL ENGINEERING LAD	0	0	2	1	30

Course Objectives:

- To discuss various properties of liquid fuels.
- To relate convection heat transfer concepts to do experimentation on the heat transfer systems.
- To apply conduction heat transfer concepts to do an analysis on heat transfer equipment.
- To understand the functioning and performance of Air compressor and Blower.
- To describe the principle of parallel flow and counter flow heat exchangers.

Course Outcomes

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

CO1 - Understand about various fuels and their properties.(K2)

- CO2 Demonstrate the fundamental principles of convective heat transfer in practice (K3)
- CO3 Reveal the fundamental principles of conductive heat transfer in real life systems practice (K3)
- CO4 Analyse and assess the performance of Air compressor and Blower (K4)

CO5 - Model and test heat exchanging system.(K5)

List of Experiments

- 1. Determination of Kinematic Viscosity using Redwood viscometer
- 2. Determination of Flash and fire point using Cleveland apparatus
- 3. Determination of Heat transfer coefficient for heat transfer from cylindrical surface by natural convection
- 4. Determination of Heat transfer coefficient for heat transfer from cylindrical surface by forced convection
- 5. Determination of Heat transfer coefficient for heat transfer from Pin fin by natural convection
- 6. Determination of Heat transfer coefficient for heat transfer from Pin fin by forced convection
- 7. Determination of thermal resistance and conductivity of a composite wall
- 8. Determination of emissivity of a specimen
- 9. Performance test on reciprocating air compressor
- 10. Performance test on air blower
- 11. Performance analysis of Parallel and Counter flow heat exchanger
- 12. Heat transfer studies using a plate type heat exchanger

Reference Books

- 1. Sachdeva R. C. Fundamentals of Heat and Mass Transfer, New Age International (P) Ltd, (2017),
- 2. Holman J. P.Heat Transfer, 9th Edition, McGraw-Hill Publishing Company Limited, 2011),
- 3. Kothandaraman C. P. and Subramanyan.S, Heat and Mass Transfer Data Book, Fifth Edition, New Age International Publishers (2018),
- 4. R.K.Rajput, Thermal Engineering, 10th edition, Lakshmi Publications, 2018.
- 5. Yunus A. Cengel, Robert H. Turner, John M. Cimbala, Fundamentals of Thermal-Fluid Sciences, Indian edition, 2016

Web Resources

- 1. https://mech.iitm.ac.in/meiitm/course/thermal-engg-lab-i/
- 2. https://krithikasivaram.github.io/tdce-iitm.github.io/teaching
- 3. http://telab.vuse.vanderbilt.edu/

COs/POs/PSOs Mapping

COs				Pi	rogra	m O	utcor	nes ((POs))			Program Specific Outcomes (PSOs)					
	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3			
1	3	3	3	3	3	-	-	-	3	-	-	3	1	2	2			
2	3	3	3	3	3	-	-	-	3	-	-	3	1	2	2			
3	3	3	3	3	3	-	-	-	3	-	-	3	1	2	2			
4	3	2	2	3	3	-	-	-	3	-	-	3	1	2	2			
5	3	2	2	3	3	-	-	-	3	-	-	3	1	2	2			

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

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		L	Т	Ρ	С	Hrs
UTSINICCOA	CERTIFICATION COURSE - III	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.

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U10MCS51		L	Т	Ρ	С	Hrs
01910031	SKILL DEVELOPMENT COURSE = V	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

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U19MCS52SKILL DEVELOPMENT COURSE - VILTPCHrs(Presentation Skills using ICT)002-30

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 workflow 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 audiovisual activities.
- Handle audiovisual 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 of 100 marks. The marks attained for this course is not considered for CGPA calculation.

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U19MCM51 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, ISBN 13: 978-8187276333, 2007
- 3. NCERT, "Position paper on Arts, Music, Dance and Theatre", ISBN 81-7450 494-X, 200
- 4. S. Narain, "Examinations in ancient India", Arya Book Depot, 1993
- 5. Satya Prakash, "Founders of Sciences in Ancient India", Vijay Kumar Publisher, 1989
- M. Hiriyanna, "Essentials of Indian Philosophy", Motilal BanarsidassPublishers, ISBN 13: 978- 8120810990, 2014

ohan kay M.Tech, Ph.D. Dr.G.Balamuruga rofessor & Head, of Mechatronics Engineering Vinayagar Engineering College Madagadipet, Puducherry-605 107.

LI10MCT61		L		Р	C	Hrs
	EMBEDDED STSTEM DESIGN	3	0	0	3	45
Course Objectives						

Course Objectives

- To understand the Embedded concepts and Embedded System Architecture
- To learn the architecture and programming of ARM Cortex Microcontroller
- To select a proper Microcontroller for an application
- To understand the usage of the development and debugging tools
- To learn and apply the knowledge of Memory systems and Peripherals

Course Outcomes

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

CO1- Infer the fundamentals of an embedded system and compare with general purpose System (K2)

- **CO2-** Illustrate the methods adapted for the development of a typical Embedded system (K3)
- **CO3** Demonstrate the RTOS and related mechanisms like an ability to design a system, component,
- or process to meet desired needs within realistic constraints (K3)
- CO4- Identify, formulate, and solve engineering problems (K4)

CO5- Use the techniques, skills, and modern engineering tools necessary for engineering practice (K4)

UNIT I INTRODUCTION TO EMBEDDED SYSTEM

Embedded system processor, hardware unit, software embedded into a system, Example of an embedded system, Embedded Design life cycle, Embedded System modelling [flow graphs, FSM, Petri nets], Layers of Embedded Systems.

UNIT II PROCESSOR AND MEMORY ORGANIZATION

Bus Organization, Memory Devices and their Characteristics, Instruction Set Architecture [RISC, CISC], Basic Embedded Processor/Microcontroller Architecture [8051, ARM, DSP, PIC], memory system architecture [cache, virtual, MMU and address translation], DMA, Co-processors and Hardware Accelerators, pipelining.

UNIT III I/O DEVICES AND NETWORKS

I/O Devices[Timers, Counters, Interrupt Controllers, DMA Controllers, A/D and D/A Converters, Displays, Keyboards, Infrared devices], Memory Interfacing, I/O Device Interfacing [GPIB, FIREWIRE, USB, IRDA], Networks for Embedded systems(CAN, I2C, SPI, USB, RS485, RS 232), Wireless Applications [Bluetooth, Zigbee].

UNIT IV OPERATING SYSTEMS

Basic Features of an Operating System, Kernel Features [polled loop system, interrupt driven 113 system, multi rate system], Processes and Threads, Context Switching, Scheduling[RMA, EDF, fault tolerant scheduling], Interprocess Communication, real Time memory management [process stack management, dynamic allocation], I/O[synchronous and asynchronous I/O, Interrupts Handling, Device drivers], RTOS [VxWorks, RT-LINUX].

UNIT V EMBEDDED SYSTEM DEVELOPMENT

Design Methodologies [UML as Design tool, UML notation, Requirement Analysis and Use case Modeling], Design Examples[Telephone PBX, Inkjet Printer, PDA ,Elevator Control System, ATM System], FaulttoleranceTechniques, Reliability Evaluation Techniques.

Text Books

1. Rajkamal, Embedded System-Architecture, Programming, Design, Mc Graw Hill, 2013.

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(9 Hrs)

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- 2. Peckol, Embedded system Design, John Wiley and Sons, 2010
- 3. Lyla B Das, Embedded Systems-An Integrated Approach, Pearson, 2013

Reference Books

- 1. Shibu. K.V, Introduction to Embedded Systems, Tata Mcgraw Hill, 2009.
- 2. Elicia White, Making Embedded Systems, O Reilly Series, SPD, 2011.
- 3. Tammy Noergaard Embedded Systems Architecture, Elsevier, 2006.
- 4. Han-Way Huang, Embedded system Design Using C8051, Cengage Learning, 2009.
- 5. Rajib Mall Real-Time systems Theory and Practice Pearson Education, 2007.

Web Resources

- 1. https://www.inspirenignite.com/anna-university/introduction-to-embedded-systems-mechatronics-7th-semsyllabus-for-be-2017-regulation-anna-univ-open-elective-ii/
- 2. https://www.edn.com/mechatronics-based-embedded-design/
- 3. https://www.intechopen.com/books/design-control-and-applications-of-mechatronic-systems-inengineering/embedded-controller-design-for-mechatronics-system
- 4. https://www.embeddedcomputing.com/application/misc/mechatronics-aids-in-embedded-system-design
- 5. https://www.hindawi.com/journals/jr/2012/932305/

COs				Р	rogra	im O	utcor	nes (POs))			Program Specific Outcomes (PSOs)				
	P01	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3		
1	3	2	2	1	1	-	-	-	-	-	-	1	1	1	2		
2	3	3	3	2	2	-	-	-	-	-	-	2	1	1	2		
3	2	2	2	-	1	-	-	-	-	-	-	2	1	1	2		
4	2	3	3	2	2	-	-	-	-	-	-	2	1	1	2		
5	3	3	3	-	2	-	-	-	-	-	-	2	1	1	2		

COs/POs/PSOs Mapping

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

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LI10MCT62		L		Ρ	C	Hrs
01310102	FLOID FOWER STSTEWIS	2	2	0	3	60
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Course Objectives

- To understand the concepts, construction and working principles of fluid power system
- To recognize the construction and working of pumps and actuators for hydraulic system •
- To identify the usage of various directional control valves in hydraulic systems
- To be aware of the performance of pneumatic systems
- To apply various methods to design and execute hydraulic and pneumatic systems. •

Course Outcomes

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

CO1 - Illustrate the fundamentals of hydraulic systems and determine losses incurred in hydraulic circuit (K2)

- CO2 Experiment with the suitable pump and actuators for particular application.(K3)
- CO3 Make use of various hydraulic valves.(K3)
- CO4 Analyze various fundamentals of pneumatic systems. (K4)
- CO5 Develop hydraulic and pneumatic circuits for simple application (K5)

UNIT I FLUID POWER SYSTEMS

Introduction to fluid power – History – Pascal's law – Components - Advantages – Drawbacks – Applications. Hydraulic fluids: Functions, Properties. Darcy's equation – Frictional losses – Losses in valves and fittings – Determination of head losses & pump power in a hydraulic circuit.

UNIT II HYDRAULIC PUMPS AND ACTUATORS

Positive and Non-positive displacement pumps - Pumping theory - Pump classification - Construction and working principle of Gear, Vane and Piston pumps. Pump performance - Pump performance curves. Hydraulic cylinder (double acting) - Construction & Working principle - Double rod cylinder - Telescopic cylinder. Hydraulic motors: Gear, Vane and Piston motor.

UNIT III HYDRAULIC VALVES

Directional control valves: Check valve - Pilot operated check valve - 3/2 valves - 4/2 valves - methods of valve actuation - Shuttle valve. Pressure control valves: Pressure relief valves - Pressure reducing valve, Unloading valves, Counter balance valves - Flow control valves - Servo valves: Mechanical type.

UNIT IV PNEUMATIC SYSTEMS

Introduction - Properties of air - gas laws - Compressors: Piston compressor, Screw compressor and Vane compressor. Fluid conditioners: Air filters, Air pressure regulators, Air lubricators, Pneumatic silencers and Air dryers. Pneumatic actuators: Pneumatic cylinders, Rotary air motors - Performance curves.

UNIT V DESIGN OF HYDRAULIC AND PNEUMATIC CIRCUITS

Sequential circuit design for simple applications: Step counter method, Cascade methods &KarnaughVeitch map method – PLC circuit design using ladder logic.

Text Books

- 1. S. R. Majumdar, Oil Hydraulics, Tata McGraw Hill Publishing Company Pvt Ltd. New Delhi, 2014
- 2. James L. Johnson, Introduction to Fluid Power, Delmar Thomson Learning, 2013.
- 3. Patrick J. Klette "Fluid Power Systems" American Technical Publishers, Incorporated, 2014

(12 Hrs)

(12 Hrs)

(12 Hrs)

(12 Hrs)

(12 Hrs)

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Reference Books

- 1. Anthony Esposito, Fluid Power with Applications, Pearson Education New Delhi, 2015.
- 2. Md Faiyaz Ahmed "Fluid Power Control Systems"Lulu.com. 2016.
- 3. NicolaeVasiliu, Daniela Vasiliu, Constantin C?Linoiu" Simulation of Fluid Power Systems with SimcenterAmesim "CRS Press – 2018
- 4. Yaobao Yin "Electro Hydraulic Control Theory and Its Applications Under Extreme Environment" Butterworth-Heinemann– 2019
- 5. P.K. Guha "Hydraulic Pumps & Motors and their Applications" Dog Ear Publishing. 2018

Web Resources

- 1. https://nptel.ac.in/courses/112/104/112104117/
- 2. https://nptel.ac.in/courses/112/105/112105206/
- 3. https://swayam.gov.in/nd1_noc20_me55/preview
- 4. https://www.youtube.com/watch?v=S_4anj7GpRo

COs/POs/PSOs Mapping

COs				P	rogra	m O	utcor	nes ((POs))			Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	
1	3	2	2	3	-	-	-	-	-	-	-	2	2	2	3	
2	3	2	2	3	-	-	-	-	-	-	-	2	2	2	3	
3	3	2	2	3	-	-	-	-	-	-	-	2	2	2	3	
4	3	2	3	3	-	-	-	-	-	-	-	2	2	2	3	
5	3	2	2	3	-	-	-	-	-	-	-	2	2	2	3	

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

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Course Objectives						
01910103	INDUSTRIAL ROBOTICS	3	0	0	3	45
LIAOMOTE2		L		Р	C	nrs

Course Objectives

- To impart knowledge on direct and inverse kinematics of manipulator
- To understand the basic elements of serial and parallel robots •
- To learn trajectory and motion analysis of robotic movements
- To provide the student with knowledge of the singularity issues associated with the operation of robotic systems.
- To develop the student's knowledge in various robot structures and their workspace. ٠

Course Outcomes

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

- **CO1** Understand the components and parameters of industrial robots (K2)
- CO2 Solve forward kinematics, inverse kinematics and Jacobian for serial and parallel robots (K3)
- CO3 Analyze the classification of end effectors.(K4)
- CO4 Evaluate the kinematic calculations to the industrial robots.(K5)
- **CO5** Choose the trajectory planning to the robots.(K5)

UNIT I INTRODUCTION

A brief history - Definition - Laws of Robotics - Basic components of robot - concept of work cell - degrees of freedom (DOF) - Resolution - Accuracy - Repeatability - Payload - Precision - classification of Industrial robot manipulator - common kinematic arrangement.

UNIT II END EFFECTORS

Unilateral Vs Multilateral end effectors - mechanical grippers: gripping force estimation with payload under acceleration – vacuum - magnetic - air operated grippers Remote centre compliance - Robot cell layouts.

UNIT III KINEMATICS OF ROBOT MANIPULATOR

Representing position and rotation - rotation in plane - rotation in three dimension - Rotational transformation -Rotation with respect to the current frame and fixed frame - Rule for composition of rotational transformation -Parameterization of rotation - Euler angle, Roll, Pitch, Yaw angles Axis/angle representation - rigid motion -Homogeneous transformation - DenavitHartenberg convention

UNIT IV ROBOT DYNAMICS AND TRAJECTORY PLANNING

Velocity kinematics - Jacobian - Derivative of rotation matrix - addition of angular velocity - Derivation of Jacobian combining the linear and angular velocity Jacobian - Euler Lagrange equation, kinetic and potential energy, Equation of motion, Newton Euler formulation - Trajectory planning for point to motion - Cubic polynomial - Quintic polynomial trajectory - Linear segment with parabolic bend (LSPB) minimum time trajectory - trajectory for path specified by via point.

UNIT V ROBOT SENSOR

Ultrasonic sensors -Range finding- time of flight LIDAR- triangulation techniques -Vision for 3D measurement structured lighting stereo vision and camera calibration. For Further Reading-Industrial robots for welding, painting and assembly, remote Controlled robots, Robots for nuclear thermal and chemical plants, Industrial automation, typical example of automated industries, application of visual inspection.

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(9 Hrs)

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Academic Curriculum and Syllabi R-2019

Text Books

- 1. Mikell P. Groover, Mitchell Weiss, Roger N. Nagel, Nicholas G. Odrey, "Industrial Robotics:Technology, Programming and Applications", McGraw Hill Book Company, 2012
- 2. Ashitava Ghosal, Robotics: Fundamental Concepts and Analysis, Oxford University Press, 2008

Reference Books

- 1. J.J. Craig, Introduction to Robotics: Mechanics and Control, Prentice Hall Inc. / Pearson Education, 2008
- 2. Tsai, L. W., Robot Analysis: The Mechanics of Serial and Parallel Manipulators, John Wiley & Sons, Inc, New York, 1999.
- 3. RamachandranNagarajan "Introduction to Industrial Robotics" Pearson Education India, 2016
- 4. TadejBajd, MatjazMihelj, JadranLenarcic, Ales Stanovnik, Marko Munih "Robotics (Intelligent Systems, Control and Automation: Science and Engineering)'Springer 2012
- 5. James Perlberg" Industrial Robotics" Cengage Learning, 2016.

Web Resources

- 1. https://nptel.ac.in/courses/112/105/112105249/
- 2. https://swayam.gov.in/nd1_noc20_me03/preview
- 3. https://www.youtube.com/watch?v=xrwz9IxpMJg

COs 1 2 3 4				Pi	rogra	m O	utcor	nes (POs)			Program Specific Outcomes (PSOs)					
	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3			
1	3	2	2	3	-	-	-	-	-	-	-	2	2	2	3			
2	3	2	2	3	-	-	-	-	-	-	-	2	2	2	3			
3	3	2	2	3	-	-	-	-	-	-	-	2	2	2	3			
4	3	2	3	3	-	-	-	-	-	-	-	2	2	2	3			
5	3	2	2	3	-	-	-	-	-	-	-	2	2	2	3			

COs/POs/PSOs Mapping

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

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LI10MCT64		L		Р	C	Hrs
01910104	DESIGN OF WECHANICAL ELEWENTS	2	2	0	3	60

Course Objectives

- To familiarize the various steps involved in the design process.
- To design shafts, keys and couplings
- To plan gears and analyzing the influence of stresses on it
- · To propose brakes and clutches for automobiles with appropriate assumptions
- To devise bearings and springs with appropriate assumptions

Course Outcomes

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

CO1 - Interpret the influence of steady and variable stresses in machine component design.(K2)

- **CO2** Make use of concepts of shafts, keys and couplings with proper assumptions. (K3)
- CO3 Analyze of spur, helical, bevel, worm gear drives and multi speed gear box (K4)
- CO4 Function of clutches and braking systems (K4)
- CO5 Evaluate bearings and springs problems.(K5)

UNIT I DESIGN FUNDAMENTALS

Design Process – Computer aided design – Optimum design – Material Standards – Industrial design form and shape design, embodiment design and design for manufacture. Types of loads –Stresses – Static, varying, thermal, impact and residual. Factors of safety – Theories of failure – Stress concentration factors – S-N curves and its applications.

UNIT II SHAFTS AND COUPLINGS

Design of Shafts, Keys and Couplings: Design of Solid and Hollow shafts – Based on strength, rigidity and deflection – Torsional rigidity – Lateral rigidity – Material constants. Design of Keys – Types – Keyways. Design of rigid and flexible couplings.

UNIT III DESIGN OF SPUR, HELICAL GEARS

Principles of gear tooth action – Gear correction – Gear Materials- Gear tooth failure modes. Design of spur, helical gears – Multi speed gear box design –Spur gear – Forward Traverse.

UNIT IV DESIGN OF BRAKES AND CLUTCHES

Brakes – Types – Dynamic and thermal aspects of Braking – Braking system in automobiles. Design of clutches – Single plate – Multi plate – Conical clutch – Over running clutch.

UNIT V DESIGN OF BEARINGS AND SPRINGS

Study of Bearings – Design of Bearings – Sliding contact –Rolling contact – Cubic mean load. Design of Journal Bearings – Calculation of Bearing dimensions – Springs - Design of Helical spring, Leaf springs – Types of springs – Wahl factor – Problems.

Text Books

- 1. Bhandari V.B., Design of Machine Elements,4th edition, McGraw Hill Education India ,2017
- 2. Ganesh Babu K., K. Srithar, Design Of Machine Elements,1st Edition, McGraw Hill,2009
- 3. Spotts M.F., Shoup T.E., Hornberger L.E., Design of Machine Elements: 8th edition, Pearson /Prentice Hall,2003

(12 Hrs)

(12 Hrs)

(12 Hrs)

(12 Hrs)

(12 Hrs)

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Academic Curriculum and Syllabi R-2019

Reference Books

- 1. Hamrock B.J., Fundamentals of Machine Elements, 2nd edition, McGraw Hill, 2004
- 2. Juvinall R.C., K.M. Marshek, Fundamentals of machine component design: 6th edition, John Wiley.2011
- 3. Ansel C. Ugural, Mechanical Design of Machine Components, SI Version CRC Press, 2018.
- 4. Wei Jiang, Analysis and Design of Machine Elements. Wiley, 2019
- 5. Vijay Kumar Jadon, Suresh Verma, Analysis and Design of Machine Elements, I.K. International Publishing House Pvt. Limited, 2010

Web Resources

- 1. https://mech.iitm.ac.in/meiitm/course/design-of-machine-elements/
- 2. https://nptel.ac.in/courses/112/105/112105125/
- 3. http://www.nptelvideos.in/2012/12/design-of-machine-elements.html

COs/POs/PSOs Mapping

COs				P	rogra	im Oi	utcor	nes (POs))			Prog Outo	Program Spe Outcomes (F 01 PS02 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	cific SOs)
	P01	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	2	3	-	-	-	-	-	-	-	2	2	2	3
2	3	2	2	3	-	-	-	-	-	-	-	2	2	2	3
3	3	2	2	3	-	-	-	-	-	-	-	2	2	2	3
4	3	2	3	3	-	-	-	-	-	-	-	2	2	2	3
5	3	2	2	3	-	-	-	-	-	-	-	2	2	2	3

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

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	L	Т	Ρ	С	Hrs
EMIDEDDED STSTEM DESIGN LAD	0	0	2	1	30

Course Objectives

- To introduce using microcontrollers with foundational concepts of microcontroller architecture and programming.
- To establish hardware and software integration for real time systems using microcontrollers
- To commence to embedded systems design tools and hardware.
- To gain both simulation and practical implementation of microcontroller including timers and counters,
- To produce embedded systems I/O techniques and requirements, A/D conversion, serial communications

Course Outcomes

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

CO1 - Understand about Analog to digital converting technique(K2)

- CO2 communication techniques, Real time clock and various sensor handling methods.(K2)
- CO3 Relate in different Operating systems such as Ubuntu, Rasbian OS. (K3)
- CO4 Apply programs in various platforms such as Embedded C, C++, HTML, DBMS. (K4)
- CO5 Analyze different types of analog and digital sensors. (K5)

List of Experiments

1. Voltage Measurement with display

2. Designing a voltmeter to measure voltage from0to5voltsanddisplaying the measured value using7segment displays

- 3. Design of Real Time Clock using MCS 51 using segment Displays.
- 4. Design of Water Pump Controller to sense the water level in a tank
- 5. Digital Clock with LCD display a. Temperature Measurement with 7 segment display
- 6. Implementation of UART, ADC and DAC features
- 7. Design of Single Channel Data Acquisition System
- 8. PC Communication

9. Interfacing the microcontroller to a PC through RS232 interface and displaying

themessagessentbythemicrocontrolleronthePCusingVisualBasicprogram running in PC

- 10. Remote Control through FM Link
- 11. Establishing an FM link between two microcontrollers for data transfers.
- 12. Hot Chamber Controller to maintain the temperature at the set point.
- 13. Obstacle Detector using ultrasonic transmitter-receiver
- 14. Moisture sensor and sprinkler controller design

Reference Books

- 1. KalpathiRamani "Microcontrollers And Applications With Lab Manual" Pearson Education India2010.
- 2. Manish K. Patel "The 8051 Microcontroller Based Embedded Systems" Tata McGraw-Hill Education. 2014
- Perry Xiao "Designing Embedded Systems and the Internet of Things (IoT) with the ARM mbed" John Wiley & Sons- 2018
- 4. Jonathan W. Valvano "Embedded Systems: Introduction to Robotics" Independently Published, 2019
- 5. James K. Peckol "Embedded Systems: A Contemporary Design Tool" John Wiley & Sons.- 2019

Web Resources

- 1. https://nptel.ac.in/courses/106/105/106105159/
- 2. https://www.youtube.com/watch?v=9Q-3c0gQcok
- 3. https://www.youtube.com/watch?v=G9_pQzt1sts

COs/POs/PSOs Mapping

COs				Pi	rogra	m O	utcor	nes ((POs))			Prog Outo	gram Spe comes (P	cific SOs)
	PO1	PO2	PO3	PO4	PO5	P06	P07	PO8	PO9	PO10	P011	PO12	PSO1	PSO2	PSO3
1	3	2	2	3	2	-	-	-	3	-	-	2	2	2	3
2	3	2	2	3	2	-	-	-	3	-	-	2	2	2	3
3	3	2	2	3	2	-	-	-	3	-	-	2	2	2	3
4	3	2	3	3	2	-	-	-	3	-	-	2	2	2	3
5	3	2	2	3	2	-	-	-	3	-	-	2	2	2	3

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

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		L	Т	Ρ	С	Hrs
UT9WCF02	FLUID FOWER STSTEMS LAD	0	0	2	1	30

Course Objectives

- To understand the concepts, construction and working principles of fluid power system Components
- To design and test the hydraulic and pneumatic circuits using MATLAB/LABVIEW software and simulate the circuits using Automation studio software.
- To familiarize in fluid power automation and different components of Hydraulics, pneumatics, electro hydraulic/ electro pneumatic and PLC based systems
- To Hands on experience in designing and executing of circuits for real systems.
- To build the circuit using Fluid SIM and try different loads in order to realize its effect on the system performance.

Course Outcomes

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

- CO1- Show the actuators and valves for the design of fluid power circuits. (K2)
- CO2 Identify design and simulate the fluid power circuits using software tool. (K3)
- CO3 Analyzing the fluid power circuits using suitable actuators and valves.(K4)
- CO4 Evaluate operation and maintenance of common fluid power components. (K5)
- CO5 Choose standard schematic symbols for common fluid power components (K5)

List of Experiments

Design and testing of hydraulic circuits such as

- Pressure control
- Flow control
- Direction control
- Design of circuit with programmed logic sequence, using an optional PLC in hydraulic Electro hydraulic Trainer kit.

Design and testing of pneumatic circuits such as

- Pressure control
- Flow control
- Direction control
- Circuits with logic controls
- Circuits with timers
- Circuits with multiple cylinder sequences in Pneumatic Electro pneumatic Trainer.
- Modeling and analysis of basic electrical, hydraulic, and pneumatic systems using MATLAB/LABVIEW software

Simulation of basic hydraulic, pneumatic and electrical circuits using Automation studio software.

Reference Books

- 1. BireswarMajumdar "Fluid Mechanics with Laboratory Manual" PHI Learning Pvt. Ltd 2016
- R. V. RAIKAR "LABORATORY MANUAL HYDRAULICS AND HYDRAULIC MACHINES " PHI Learning Pvt. Ltd – 2012
- Cameron Tropea, Alexander L. Yarin, John F. Foss "Springer Handbook of Experimental Fluid Mechanics" Springer Science & Business Media – 2007
- 4. Zh. Zhang "Hydraulic Transients and Computations "Springer International Publishing, 2020

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5. Gustavo Costa, NarimanSepehri "Hydrostatic Transmissions and Actuators: Operation, Modelling and Applications" John Wiley & Sons. – 2015.

Web Resources

- 1. http://fm-nitk.vlabs.ac.in/#
- 2. http://fmc-nitk.vlabs.ac.in/
- 3. http://vlabs.iitb.ac.in/vlabs-dev/labs/nitk_labs/fluid-machinarylab/index.html

COs				Р	rogra	m O	utcor	nes (POs)				Prog Outo	gram Spe comes (P	cific SOs)
	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	2	3	2	-	-	-	3	-	-	2	2	2	3
2	3	2	2	3	2	-	-	-	3	-	-	2	2	2	3
3	3	2	2	3	2	-	-	-	3	-	-	2	2	2	3
4	3	2	3	3	2	-	-	-	3	-	-	2	2	2	3
5	3	2	2	3	2	-	-	-	3	-	-	2	2	2	3

COs/POs/PSOs Mapping

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

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U91MCP63 INDUSTRIAL ROBOTICS LAB L I P 0 0 2

Course Objectives

- To learn about different types of robots and its components.
- To understanding Robot kinematics forward and reverse kinematics
- To gain the programming for the required robot motion
- To determine the robotic applications, by interfacing it with real environment.
- To provide analysis skills associated with trajectory planning and robot control.

Course Outcomes

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

- CO1 Show the type of robot and various motions.(K2)
- CO2 Build the robot forward and reverse kinematics. (K2)
- CO3 Select a suitable robot for a specific application. (K3)
- CO4 Analyzing programming Robots for performing various tasks.(K4)
- CO5 Evaluate simulate a robot which meets kinematic requirements. (K5)

List of Experiments

- 1. Study of the major components of the robot.
- 2. Study of the robotic simulation/ programming software.
- 3. Study of forward and reverse kinematics, to program the sequence of motion of a robot.
- 4. Programming an industrial robot for performing various applications involving Point-to-point motion of the manipulator arm.
- 5. Programming an industrial robot for performing various applications involving continuous path motion of the manipulator arm.
- 6. Interfacing an industrial robot with a belt conveyor.
- 7. Developing program for an industrial robot to perform pick and place operation.
- 8. Programming of Industrial Robot for material handling application
- 9. Programming of industrial robot for processing application
- 10. Simulation of various Robot work cells (SOFT WARE).
- 11. Programming an industrial robot for a sorting operation using a sensing system.

Reference Books

- 1. Rex Miller, Mark R. Miller "Robots and Robotics: Principles, Systems, and Industrial Applications "McGraw Hill Professional, 2017
- 2. Bruno Siciliano, OussamaKhatib "Springer Handbook of Robotics" Springer. 2016
- 3. Kevin M. Lynch, Frank C. Park "Modern Robotics" Cambridge University Press 2017
- 4. Thomas R. Kurfess "Robotics and Automation Handbook" CRC Press. 2018
- 5. Mark W. Spong, Seth Hutchinson, M. Vidyasagar "Robot Modeling and Control" John Wiley & Sons. 2020

COs/POs/PSOs Mapping

COs				Pi	rogra	m O	utcor	nes (POs))			Prog Outo	gram Spe comes (P	cific SOs)
	P01	PO2	PO3	PO4	PO5	P06	P07	PO8	PO9	PO10	P 11	012	PSO1	PSO2	PS 3
1	3	2	2	3	2	-	-	-	3	-	-	2	2	2	3
2	3	2	2	3	2	-	-	-	3	-	-	2	2	2	3
3	3	2	2	3	2	-	-	-	3	-	-	2	2	2	3
4	3	2	3	3	2	-	-	-	3	-	-	2	2	2	3
5	3	2	2	3	2	-	-	-	3	-	-	2	2	2	3

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

Dr.G.Balamuruga Mohan kaj M.Tech, Ph.D., 1 Professor, & Head, Dept. of Mechatronics Engineering Sri Manakula Vinayagar Engineering College, Madagadipet, Puducherry-605 107.

	L	Т	Ρ	С	Hrs
CERTIFICATION COURSE - IV	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.

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1110MCS61		L	Т	Ρ	С	Hrs
0191010301	SKILL DEVELOPMENT COOKSE - VII	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

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U19MCS62

SKILL DEVELOPMENT COURSE – VIII

L T P C 2 0 0 -

(Technical Seminar)

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 20 minutes.
- In a session of three periods per week, 8 to 10 students are expected to present the seminar.
- Each student is expected to present atleast 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. The marks attained for this course is not considered for CGPA calculation.

Dr.G.Balamuruga Mohan kay M.Tech, Ph.D., L Head, Professor, Dept. of Mechatronics Engineering Vinayagar Engineering College, agadipet, Puducherry-605 107.

Hrs

30

U19MCS63 SKILL DEVELOPMENT COURSE – IX L T P C Hrs (NPTEL / MOOC - I) 0 0 0 - 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.

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	L		Ρ	C	Hrs
FROFESSIONAL ETHICS	2	0	0	-	30

Course Objectives

The course will introduce the students to

 To enable the students to create an awareness on Engineering Ethics and Human Values, to instill Moral and 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 and rights in the society

UNIT I HUMAN VALUES

Morals, values and Ethics – Integrity – Work ethic – Service learning – Civic virtue – Respect for others – Living peacefully – 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

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

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

UNIT IV SAFETY, RESPONSIBILITIES AND RIGHTS

Safety 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

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.
- 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.
- 3. Charles E. Harris, Michael S. Pritchard and Michael J. Rabins, "Engineering Ethics –Concepts and Cases", Cengage Learning, 2009
- 4. John R Boatright, "Ethics and the Conduct of Business", Pearson Education, New Delhi, 2003
- 5. Edmund G Seebauer and Robert L Barry, "Fundametals of Ethics for Scientists and Engineers", Oxford University Press, Oxford, 2001
- Laura P. Hartman and Joe Desjardins, "Business Ethics: Decision Making for Personal Integrity and Social Responsibility" Mc Graw Hill education, India Pvt. Ltd., New Delhi2013.

(06 Hrs)

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7. World Community Service Centre, " Value Education", Vethathiri publications, Erode, 2011

Web Resources:

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

Dr.G.Balamuruga Mohan kay.M.Tech, Ph.D., 1 Professor, & Head, Dept. of Mechatronics Engineering Sri Manzkula Vinayagar Engineering College, Madagadipet, Puducherry-605 107.

U19MCT71 PLC AND DATA ACQUISITION SYSTEMS L T P C Hrs 3 0 0 3 45

Course Objectives

- To study the evolution and advantages of PLC
- To understand the various PLC instructions.
- To study the used of PLC for some specific applications
- To understand the need of computer control in automation
- To study the data acquisition systems.

Course Outcomes

After completion of the course, the students will be able to
CO1- Understand the fundamental of PLC.(K2)
CO2- Program a PLC with different logical languages(K3)
CO3- Various industrial applications of PLCs are studied (K2)
CO4- Understand the need of computer in Automation(K2)
CO5- Understand the basics of data conversion and data acquisition. (K2)

UNIT I BASICS OF PLC

Definition and History of PLC-PLC advantage and disadvantages- Over all PLC systemsCPU and Programmer/Monitors-PLC input and output models – Architecture- PLC Programming language – Relay logic – Ladder logic – Programming of Gates – Flow charting as a programming method – connecting PLC to computer - PLC Troubleshooting and Maintenance.

UNIT II PLC PROGRAMMING

Programming of Timers – Introduction - ON delay, OFF delay, Retentive Timers – PLC Timer functions – Examples of timer function Industrial application. Programming Counters – up/down counter – Combining counter - Examples of counter function Industrial application.PLC Arithmetic Functions – PLC number Comparison function

UNIT III PLC DATA HANDLING FUNCTIONS

PLC Program Control Instructions: Master Control Reset - Skip – Jump and Move Instruction. Sequencer instructions - Types of PLC Analog modules and systems, PLC analog signal processing – BCD or multi bit data processing – Case study of Tank level control system, bottle filling system and Sequential switching of motors

UNIT IV COMPUTER CONTROL – INTRODUCTION

Need of computer in a control system-Functional block diagram of a computer control system-Data loggers-Supervisory computer control- Direct digital control-Digital control interfacing-SCADA.

UNIT V DATA ACQUISITION SYSTEMS

Sampling theorem – Sampling and digitizing – Aliasing – Sample and hold circuit – Practical implementation of sampling and digitizing – Definition, design and need for data acquisition systems – Interfacing ADC and DAC with Microprocessor / Multiplexer - Multiplexed channel operation –Microprocessor/PC based acquisition systems

Text Books

- 4. Petrezeulla, "Programmable Logic Controllers", McGraw Hill, 1989.
- 5. Curtis D. Johnson," Process Control Instrumentation Technology", 8th edition Prentice Hall June 2005
- 6. D.Roy Choudhury and Shail B.Jain, Linear Integrated circuits, New age International Pvt .Ltd, 2003.

(9 Hrs)

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(9 Hrs)

Reference Books

- 6. Hughes .T, "Programmable Logic Controllers", ISA Press, 1989.
- 7. G.B.Clayton," Data Converters", The Mac Millian Press Ltd., 1982.
- John w.Webb & Ronald A.Reis., "Programmable logic controllers- principles and applications", 5th Edition PHI Learning Pvt. LTd, New Delhi -2010
- 9. Prof. Rajesh Mehra, Plcs & Scada Theory And Practice, Laxmi Publication

10. Bolton W., "Mechatronics", Pearson Education, 2009

Web Resources

- 1. https://www.youtube.com/watch?v=I_9Pwyxhe40
- 2. https://www.nielit.gov.in/calicut/content/online-course-industrial-automation-plc-scada
- 3. https://onlinecourses.nptel.ac.in/noc20_me39/preview
- 4. https://nptel.ac.in/courses/108/105/108105062/

COs				Рі	rogra	m O	utcor	nes ((POs))			Prog Outo	gram Spe comes (P	cific SOs)
	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	1	-	-	-	-	-	-	-	2	1	3	2	3
2	3	2	1	-	-	-	-	-	-	-	2	2	3	2	3
3	3	2	1	-	-	-	-	-	-	-	2	3	3	2	3
4	3	2	1	-	-	-	-	-	-	-	2	1	3	2	3
5	3	2	1	-	-	-	-	-	-	-	2	3	3	2	3

COs/POs/PSOs Mapping

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

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Hrs LT P C **U19MCT72 DESIGN OF MECHATRONICS SYSTEM** 2 2 0 3 60

Course Objectives

- To study Mechatronics system design and simulation, ergonomics and safety
- To gain knowledge on theoretical and practical aspects of computer interfacing, real time data acquisition and • control
- To study design of motion control, motion converter and temperature control ٠
- To gain knowledge on real time interfacing
- To undergo case studies on Mechatronic system •

Course Outcomes

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

CO1- Understand the basics and key elements of Mechatronics design process(K2)

- **CO2** Familiar with basic system modeling(K2)
- CO3- Realize the concepts of real time interfacing and data acquisition(K3)
- **CO4-** Realize the concepts of real time interfacing and data acquisition(K3)

CO5- Understanding the concepts of design of Mechatronic system through case studies(K2)

UNIT I INTRODUCTION TO DESIGN OF MECHATRONICS SYSTEM

Key elements – Mechatronics design process – design parameters – mechatronics and traditional design – Advanced approaches in mechatronics design - Introduction to industrial design, modelling, simulation and analysis - Ergonomics and safety.

UNIT II BASIC SYSTEM MODELLING

Basic building blocks of system modelling. Modelling of mechanical system- Modelling of mechanical and electrical systems - Simple exercises in linear, rotary motions.

UNIT III INTERFACING AND DATA ACQUISITION

Sensor selection, Real-time interfacing - Introduction - Elements of data acquisition and control and Frequency Domain- Applications.

UNIT IV ALGORITHMS FOR ADVANCED CONTROL

Advanced applications in Mechatronics: Mechatronic Control in Automated Manufacturing – Artificial intelligence in Mechatronics - Fuzzy Logic Applications in Mechatronics

UNIT V CASE STUDIES ON DESIGN OF MECHATRONICS SYSTEM

Motion control using DC Motor, AC Motor and Servomotor - Temperature control of hot/cold reservoir - Pick and place robot - Carparking barriers - Motion and temperature control of washing machine - Auto focus camera, exposure control

Text Books

- 1. S Devdas shetty, Richard A. Kolk, "Mechatronics System Design", 2nd Edition, Cengage Learning 2011
- 2. Georg pelz, "Mechatronic Systems: Modeling and simulation" with HDL's, John wiley and sons Ltd, 2003.

Reference Books

- 1. Bishop, Robert H, "Mechatronics Hand book", CRC Press, 2002.
- 2. De Silva, "Mechatronics: A Foundation Course", Taylor & Francis, Indian Reprint, 2013.
- 3. Bradley, D.Dawson, N.C. Burd and A.J. Loader, "Mechatronics: Electronics in Products and Processes", CRC Press 1991, First Indian print 2010.

(12 Hrs)

(12 Hrs)

(12 Hrs)

(12 Hrs)

(12 Hrs)

Academic Curriculum and Syllabi R-2019

4. Theory and Practice of Mechatronics System, Pearson Education, 2007.

Web Resources

- 1. https://onlinecourses.nptel.ac.in/noc21_me129/preview
- 2. https://onlinecourses.nptel.ac.in/noc21_me27/preview
- 3. https://www.edx.org/course/mechatronics
- 4. https://www.classcentral.com/course/edx-the-mechatronics-revolution-fundamentals-and-core-concepts-19083

COs/POs/PSOs Mapping

COs				Р	rogra	m O	utcor	nes (POs))			Prog Outo	gram Spe comes (PS PSO2 2 2 2 2 2 2 2 2 2	cific SOs)
	P01	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	2	2	-	-	-	-	-	-	2	1	3	2	3
2	3	2	2	2	-	-	-	-	-	-	2	2	3	2	3
3	3	2	2	2	-	-	-	-	-	-	2	3	3	2	3
4	3	2	2	2	-	-	-	-	-	-	2	1	3	2	3
5	3	2	2	2	-	-	-	-	-	-	2	3	3	2	3

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

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U19MCP71 BUSINESS BASICS FOR ENTREPRENEUR

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

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

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

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., & 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.

(6 Hrs)

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Academic Curriculum and Syllabi R-2019

- 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 Resources

- 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					Progr	ram O	utcom	es (P	Os)				Prog Outc	jram Spe omes (P	cific SOs)
	P01	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	1	2	1	2	-	-	3	3	2	3	1	2	1	2	1
2	1	2	2	2	-	-	3	3	3	2	1	2	2	2	1
3	1	2	2	1	-	-	3	3	3	3	2	3	1	2	3
4	1	3	2	2	-	-	3	3	3	3	2	3	1	2	2
5	1	3	2	2	-	-	3	3	3	2	2	3	1	3	2

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

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U19MCP72 COMPUTER AIDED ENGINEERING LAB

т Ρ С Hrs 0 2 30 0 1

Course Objectives

- To draw the models in 3Dusing Pro-E/ SOLIDWORKS
- To understand assembly process using Pro-E/ SOLIDWORKS
- To analyze the models using ANSYS

Course Outcomes

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

CO1- Explore various CAD packages and CAE tools(K4)

CO2- Interpret drawings and develop machine components using standard CAD packages (K4)

CO3- Solve the structural, contact and vibrational problems with different loadings using analysis tools(K5)

List of Experiments

- 1. Part and Assembly drawing of Couplings using Pro-E/ SOLIDWORKS.
- 2. Part and Assembly drawing of Bearings using Pro-E/ SOLIDWORKS.
- 3. Part and Assembly drawing of Valves using Pro-E/ SOLIDWORKS.
- 4. Modeling and Drafting of Machine Elements i.e. Tail Stock/ Screw Jack / Connecting Rod using Pro-E/ SOLIDWORKS
- 5. Structural analysis of a given component using ANSYS.
- 6. Thermal analysis of a given application using ANSYS.
- 7. Modal analysis of a given model using ANSYS.
- 8. Contact analysis of a model using ANSYS.
- 9. Shear Force and bending moment diagram using ANSYS.
- 10. Vibration analysis of an object using ANSYS.
- 11. Modeling and analyzing of any part models using CAD and CAE packages

Reference Books

- 1. David D. Bedworth, Mark R. Henderson, Philp M. Wolfe, "Computer Integrated Design and manufacturing", Mc Graw Hill International series, 1991
- 2. Ibrahim Zeid and R. Sivasubramanian, "CAD/CAM Theory and Practice", Revised First special Indian Edition, Tata Mc Graw Hill Publication, 2007
- 3. Ibrahim Zeid, "Mastering CAD/CAM", special Indian Edition, Tata Mc Graw Hill Publication, 2007

Web Resources

- 1. https://www.iitr.ac.in/departments/ME/pages/Computer_Aided_Engineering_Laboratory.html
- 2. https://www.odu.edu/mae/instructional-laboratories/cae
- 3. https://research.fit.edu/computer-aided-engineering-lab/

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

COs/POs/PSOs Mapping

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

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U19MCP73 INDUSTRIAL AUTOMATION LAB

Course Objectives

- To identify the differences between various PLCs
- To control some process parameters and test PID algorithm.
- To use the VFD to control the speed of AC motor.

Course Outcomes

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

- CO1- Carryout wiring connections and troubleshoot in different PLCs. (K3)
- CO2- Develop simple applications using LD, ST and FBD mode of programming. (K4)
- CO3- Develop SCADA application using open source software and Perform speed control on AC motor using VFD and PLC. (K4)

List of Experiments

- 1. Study of different PLCs and their specification
- 2. Study of installations and troubleshooting of PLC.
- 3. Development of Ladder Diagram (LD) and Structured Text (ST) programming in PLC for simple applications.
- 4. Development of an application by using timer and counter of PLC.
- 5. Solving simple problems using Functional Block Diagram (FBD) programming in PLC
- 6. Interfacing between PLC and Process loop (temperature)
- 7. Interfacing between PLC and Process loop (level)
- 8. Interfacing between PLC and Process loop (flow)
- 9. Verification and testing of PID controller in a process loop.
- 10. Develop one application using SCADA system.
- 11. AC motor speed control using PLC and VFD

Reference Books

- 1. Industrial Instrumentation and Control By. S.K. Singh The McGraw Hill Companies
- 2. Process Control Instrumentation Technology By. C.D. Johnson, PHI
- 3. Industrial control handbook, Parr, Newnem
- 4. Programmable logic controller, Dunning, Delmar

Web Resources

- 1. https://fac.ksu.edu.sa/sites/default/files/lab-manual_v3.pdf
- 2. http://iotmumbai.bharatividyapeeth.edu/media/pdf/lab_manuals/Manual_EE5I_EIA_22526.pdf
- 3. https://pdfcoffee.com/automation-lab-manual-5-pdf-free.html
Academic Curriculum and Syllabi R-2019 COs/POs/PSOs Mapping

COs				Р	rogra	m O	utcor	nes (POs)				Prog Outo	gram Spe comes (P	cific SOs)
	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	P011	PO12	PSO1	PSO2	PSO3
1	3	2	1	-	-	-	-	-	3	1	2	1	3	2	3
2	3	2	1	-	-	-	-	-	3	2	2	2	3	3	3
3	3	2	1	-	-	-	-	-	3	1	2	3	3	2	3
4	3	2	1	-	-	-	-	-	3	2	2	1	3	3	3
5	3	2	1	-	-	-	-	-	3	2	2	3	3	2	3

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

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	L	Т	Ρ	С	Hrs
UT9INICF74	0	0	2	1	30

• The objective of comprehensive viva-voce is to assess the overall knowledge of the student in the relevant field of Engineering concepts, tools, and the process of identifying and solving engineering Problems acquired over 4 years of study in the undergraduate program.

Course Outcomes

On successful completion of the course, students will be able to

- CO1 Revise the Mechatronics engineering principles postulations and other technical information in order to apply in various conditions.(K2)
- CO2 Communicate effectively and knowledge of contemporary issues.(K4)
- CO3 Collate and justify the design by the acquired comprehensive technical knowledge and skill.(K5)
- CO4 Design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health care, safety, manufacturability and sustainability.(K5)
- CO5 Explain the relevance of a technical note for a given application.(K5)

CONTENTS

- The viva shall normally cover the all subjects taught in all the semesters of B.Tech Programme.
- 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 or short questions 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 committee.

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		L	Т	Ρ	С	Hrs
	PROJECT PHASE - I	0	0	4	2	60
Course Objectives						

- To enable students to use all concepts of Mechanical engineering in creating a solution for a problem
- To offer students a glimpse into real world problems and challenges that need.
- To create awareness among the students of the characteristics of several domain areas where Mechanical engineering can be effectively used.
- To improve the team building, communication and management skills of the students.
- To introduce students to the vast array of literature available of the various research challenges in the field of Mechanical engineering.

Course Outcomes

On successful completion of the course, students will be able to CO1 -Identify an innovative or creative idea/concept/solution to a problem. (K2) CO2 -Design and Develop the working model. (K3) CO3 -Work independently to lead the project along with team members. (K3) CO4 -Interpret the results and document the report. (K4)

CO5 -Communicate effectively through presentation.(K5)

CONTENTS

- The Project is a theoretical study/analysis/prototype design/modeling and simulation or a combination of these should be done as group (preferably four students) project.
- The progress of the project is evaluated based on a minimum three reviews and final viva-voce examination.
- A project report is required to be submitted in the standard prescribed format.

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	L	I	Ρ	C	Hrs
	Δ	Λ	Δ	2	-

 An In plant training is a learning opportunity for students. Students should therefore receive feedback on their performance so that they can grow professionally. Overall professional development of diploma mechanical engineers is the need of the day for enabling them to sustain in competitive global environment

Course Outcomes

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

- **CO1** Exposure to the industrial environment and Recognize the requirement of the industry and cope up with the industrial scenario. **(K1)**
- CO2 Identify career paths taking into account their individual strengths and aptitude and Prepare a report about the work experience in industry. (K2)
- CO3 Communicate effectively through technical presentation. (K2)
- CO4 Enhancing the employability skills and start-up skills to increase his ability to engage in, life-long learning. (K4)
- CO5 Develop individual confidence to handle various engineering assignments and expose themselves to acquire life skills to meet societal challenges. (K5)

CONTENTS

- 1. The Guide allotted by the department head have liberty to select nearby organization/industry of local vicinity with prior approval of principal of the institute. Structured training to be arranged by guide and report of the same shall be submitted by the individual student, to full fill their term work.
- 2. The mechanical engineering diploma students can take in plant training in any one of the following industries.
 - a. Public sector enterprises
 - b. State government undertaking
 - c. Public limited companies
 - d. Private limited companies
 - e. Individual ownership organisations.

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ARTIFICIAL INTELLIGENCE AND MACHINE С Hrs Т Ρ L 3 3 45 LEARNING 0 0

Course Objectives

U19MCT81

- To understand the various characteristics of intelligent agents.
- To learn the different search strategies in AI. ٠
- To gain knowledge in solving AI problems.
- To introduce students to the basic concepts and techniques of Machine Learning. •
- To have a thorough understanding of the Supervised and Unsupervised learning techniques. •

Course Outcomes

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

CO1 - Familiarize on characteristics Intelligent agents(K1)

- **CO2** Interpret on various problem solving methods(K2)
- CO3 Understand AI techniques(K2)
- CO4 Understand Machine learning(K2)
- CO5 Interpret the supervised and unsupervised learning(K2)

UNIT I INTRODUCTION TO ARTIFICIAL INTELLIGENCE

Introduction - Definition - Future of Artificial Intelligence - Characteristics of Intelligent Agents -Typical Intelligent Agents - Problem Solving Approach to Typical AI problems.

UNIT II PROBLEM SOLVING METHODS

Problem solving Methods - Search Strategies- Uninformed - Informed - Heuristics - Local Search Algorithms and Optimization Problems - Searching with Partial Observations - Constraint Satisfaction Problems - Constraint Propagation - Backtracking Search - Game Playing - Optimal Decisions in Games - Alpha - Beta Pruning -Stochastic Games.

UNIT III KNOWLEDGE REPRESENTATION

First Order Predicate Logic - Prolog Programming - Unification - Forward Chaining-Backward Chaining -Resolution - Knowledge Representation - Ontological Engineering-Categories and Objects - Events - Mental Events and Mental Objects - Reasoning Systems for Categories - Reasoning with Default Information.

UNIT IV INTRODUCTION TO MACHINE LEARNING

Learning – Types of Machine Learning – Supervised Learning – The Brain and the Neuron – Design a Learning System – Perspectives and Issues in Machine Learning – Concept Learning Task – Concept Learning as Search - Finding a Maximally Specific Hypothesis - Version Spaces and the Candidate Elimination Algorithm - Linear Discriminants – Perceptron – Linear Separability – Linear Regression.

UNIT V LINEAR MODELS

Multi-layer Perceptron – Going Forwards – Going Backwards: Back Propagation Error – Multi-layer Perceptron in Practice - Examples of using the MLP - Overview - Deriving Back-Propagation - Radial Basis Functions and Splines - Concepts - RBF Network - Curse of Dimensionality - Interpolations and Basis Functions - Support Vector Machines.

Text Books

- 1. Russell S. and P. Norvig,"Artificial Intelligence: A Modern Approach", Prentice Hall, Third Edition, 2009.
- 2. Bratko, "Prolog: Programming for Artificial Intelligence", Fourth edition, Addison-Wesley Educational Publishers Inc., 2011

(9 Hrs)

(9 Hrs)

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(9 Hrs)

3. Stephen Marsland, —Machine Learning – An Algorithmic Perspective, Second Edition, Chapman and Hall/CRC Machine Learning and Pattern Recognition Series, 2015.

Reference Books

- 1. M. Tim Jones, "Artificial Intelligence: A Systems Approach(Computer Science)", Jones and Bartlett Publishers, Inc.; First Edition, 2008
- 2. Nils J. Nilsson, "The Quest for Artificial Intelligence", Cambridge University Press, 2009.
- 3. William F. Clocksin and Christopher S. Mellish," Programming in Prolog: Using the ISO Standard", Fifth Edition, Springer, 2003
- 4. Tom M Mitchell, —Machine Learningll, First Edition, McGraw Hill Education, 2013

Web Resources

- 1. https://nptel.ac.in/courses/106/105/106105077/
- 2. https://nptel.ac.in/courses/106/102/106102220/
- 3. https://nptel.ac.in/courses/106/105/106105079/
- 4. https://nptel.ac.in/courses/106/106/106106202/
- 5. https://www.greatlearning.in/great-lakes-artificial-intelligence-and-machine-learning?&utm

COs/POs/PSOs Mapping

COs				P	rogra	m O	utcor	nes ((POs))			Prog Outo	gram Spe comes (P	cific SOs)
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2	3	2	-	2	2	1	1	2	2	1	2	2	3	3	3
3	3	2	-	1	1	1	2	1	1	1	2	2	3	2	3
4	3	2	-	2	2	2	3	2	2	2	2	2	3	3	3
5	3	2	-	2	2	2	3	2	2	2	2	2	3	3	3

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

Dr.G.Balamuruga Mohan kay M.Tech, Ph.D., Professor & Head, Dept. of Mechatronics Engineering Manakula Vinayagar Engineering College, Madagadipet, Puducherry-605 107.

U19MCP81 ENTREPRENEURSHIP MANAGEMENT

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

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

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

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., & 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., & 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 & Influence People.

(6 Hrs)

(6 Hrs)

L T P C Hrs 0 0 2 1 18

(6 Hrs)

- 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 Resources

- 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					Prog	ram O	utcom	nes (P	Os)				Prog Outo	ram Spe omes (P	cific SOs)
	PO1	PO2	PO3	PO4	PO5	PO6	P07	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

Dr.G.Balamuruga Mohan ka, M.Tech, Ph.D., Professor, & Head, Dept. of Mechatronics Engineering Mauakula Vinayagar Engineering College, Madagadipet, Puducherry-605 107.

PRO IECT PHASE - II	L	Т	Ρ	С	Hrs
	0	0	16	C 8	45

- To develop students ability to apply Mechanical Engineering knowledge to transfer ideas to solve real life problems in industries as an individual or as a team.
- To develop effective communication skills and financial management for presentation of project related activities.
- To apply and integrate knowledge and understanding of other engineering disciplines to overcome technical uncertainty and to prepare project proposals.

Course Outcomes

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

- CO1 Demonstrate and practice the concepts of basics sciences and mechanical engineering principles in addressing a real time and real life situation. (K6)
- CO2 Enhance the financial management skills to achieve project goal in a stipulated time by working as a Team. (K5)
- CO3 Familiarize in technical writing skills and create a project proposal and report on completion. (K5)
- CO4 Develop a model comprising of real time application in the industry. (K6)

CO5 - Design a system under the domain of mechanical engineering also Evaluate for simulation design, analysis

and manufacturing facts of the system. (K6)

Guidelines For Carrying Out Project Work

- Create a model/fabricate a model/conduct experiment/simulate mechanical system/implement improved ideas for the project work.
- Analyze data, evaluate the results and conclude the appropriate solution, suggestion for feature work.
- The continuous assessment shall be made as prescribed in the regulations.
- The review committee may be constituted by the Head of the Department.
- The progress of the project is evaluated based on a minimum of three reviews.
- Each student shall finally produce a comprehensive report covering background information, literature survey, problem statement, project work details and conclusion.
- This final report shall be typewritten form as specified in the guidelines.

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U19MCS81

SKILL DEVELOPMENT COURSE - XL T P C Hrs(NPTEL / MOOC - II)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

an harm.Tech.Ph.D., Dr.G.Balamuruga Professor & Head, Dept. of Mechatronics Engineering Sri Mauakula Vinayagar Engineering College, Madagadipet, Puducherry-605 107.

PROFESSIONAL ELECTIVES

		L		Р	C	Hrs
UT9WICE41	ADDITIVE MANOFACTORING	3	0	0	3	45

- To know the principle methods, areas of usage, possibilities and limitations as well as environmental effects of the Additive Manufacturing technologies
- To usage of CAD & Reverse Engineering concept in Additive Manufacturing
- To be familiar with the characteristics of the different materials those are used in Additive Manufacturing.
- To be familiar with various rapid prototyping and additive Manufacturing Techniques
- To usage of Additive Manufacturing in Bio Products.

Course Outcomes

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

- CO1 Compare various methods of Additive Manufacturing technologies(K2)
- CO2 Use apply latest technologies like CAD Modeling and Simulation tools and do computer assisted Additive Manufacturing(K3)
- CO3 Analyze the characteristics of the different materials in Additive Manufacturing.(K4)
- **CO4** Will learn the latest trends and opportunities in 3D printing, localize services, production parts(K2)
- **CO5** Understand the latest trends and business opportunities in Additive Manufacturing, distributed manufacturing and mass customization.(K2)

UNIT I INTRODUCTION

Overview – History – Need-Classification -Additive Manufacturing Technology in product development-Materials for Additive Manufacturing Technology – Tooling – Applications.

UNIT II CAD & REVERSE ENGINEERING

Basic Concept – Digitization techniques – Model Reconstruction – Data Processing for Additive Manufacturing Technology: CAD model preparation – Part Orientation and support generation – Model Slicing–Tool path Generation – Software for Additive Manufacturing Technology: MIMICS, MAGICS.

UNIT III LIQUID AND SOLID BASED ADDITIVE MANUFACTURING

Classification – Liquid based system – Stereo-lithography Apparatus (SLA)- Principle, process, advantages and applications – Solid based system –Fused Deposition Modeling – Principle, process, advantages and applications, Laminated Object Manufacturing

UNIT IV POWDER BASED ADDITIVE MANUFACTURING SYSTEMS

Selective Laser Sintering – Principles of SLS process – Process, advantages and applications, Three Dimensional Printing – Principle, process, advantages and applications-Laser Engineered Net Shaping (LENS), Electron Beam Melting

UNIT V BIO-ADDITIVE MANUFACTURING & SOFTWARES

Customized implants and prosthesis: Design and production. Bio-Additive Manufacturing- Computer Aided Tissue Engineering (CATE) – Case studies Preparation of Drawings for Parts and Assembly of the following by using Drafting software. Designing for Additive Manufacturing (DfAM), Software Tools vs. Requirements

(9 Hrs)

(9 Hrs)

(9 Hrs)

(9 Hrs)

Text Books

- 1. John O. Milewski" Additive Manufacturing of Metals:" Springer, 2017
- 2. Li Yang, Keng Hsu, Brian Baughman, Donald Godfrey, Francisco Medina, "Additive Manufacturing of Metals: The Technology, Materials, Design and Production" Springer, 2017
- **3.** Ian Gibson, David Rosen, Brent Stucker, "Additive Manufacturing Technologies: 3D Printing, Rapid Prototyping, and Direct Digital Manufacturing", Springer Nature; 2nd ed., 2015.

References Books

- 1. Manu Srivastava, Sandeep Rathee, Sachin Maheshwari" Additive Manufacturing: Fundamentals and Advancements" CRC Press2019
- 2. Rupinder Singh, J. Paulo Davim, "Additive Manufacturing: Applications and Innovations Manufacturing Design and Technology" CRC Press / Taylor & Francis Group 2018
- 3. Amit Bandyopadhyay, Susmita Bose, "Additive Manufacturing" CRC Press/Taylor & Francis Second Edition 2019
- 4. Martin Leary, " Design for Additive Manufacturing", Elsevier2019.
- 5. David J. Fisher, "Additive Manufacturing of Metals", Materials Research Forum LLC2020.

Web Resources

- 1. http://www.digimat.in/nptel/courses/video/112104204/L47.html
- 2. https://www.coursera.org/lecture/digital-thread-implementation/additive-manufacturing-Ah2w6
- 3. https://nptel.ac.in/courses/110/106/110106146/
- 4. https://learn-xpro.mit.edu/additive-manufacturing
- 5. https://www.youtube.com/watch?v=BdyQSC0tbqU

COs Mapping with POs and PSOs

со					Prog	ram O	utcom	es (PO	s)				Prog Outce	ram Spe omes (P	ecific SOs)
S	PO	PO	PO	PO	PO	PO	PO	PO	PO	P01	PO1	P01	PSO	PSO	PSO
	1	2	3	4	5	6	7	8	9	0	1	2	1	2	3
CO 1	2	2	2	2	3	-	-	-	-	-	-	3	2	2	2
CO 2	3	2	3	2	3	-	-	-	-	-	-	3	3	3	2
CO 3	3	3	3	3	3	-	-	-	-	-	-	3	2	2	3
CO 4	3	2	3	2	3	-	-	-	-	-	-	3	3	3	2
CO 5	2	2	2	2	3	-	-	-	-	-	-	3	2	3	2

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U19MCE42

HEATING VENTILATION AND AIR L CONDITIONING 3

Course Objectives

- Understand the thermodynamic concepts to be used for HVAC applications
- Understand and describe the major concepts of the psychrometric chart.
- Define heating, ventilating and air conditioning.
- Define the heating and cooling loads to be considered in designing a HVAC system.
- Explain how a HVAC system can be controlled for better performance.

Course Outcomes

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

- **CO1** Apply the law of thermodynamics for simple HVAC systems(K3)
- CO2 Solve problems using refrigerant table / charts and psychrometric charts(K3)
- CO3 Recognizing various components needed for HVAC systems(K2)
- CO4 Able to estimate the heating and cooling loads to design HVAC units. (K3)
- CO5 Developing control systems for controlling the performance of HVAC units. (K3)

UNIT I INTRODUCTION

Fundamentals of Thermodynamics - Conservation of Mass, Laws of Thermodynamics, Thermodynamic Cycles, Fundamentals of Heat Transfer, Conduction, Convection, Thermal Radiation. HVAC - Scope of HVAC, Air-Conditioning Processes, Environment for Human Comfort.

UNIT II PSYCHROMETRY

Psychrometrics, Ideal Gas Approximation, Fundamental Parameters, Equation of State, Humidity, Degree of Saturation, Wet Bulb Temperature, Partial Pressure of Water Vapor, Dew Point Temperature, Saturation, Enthalpy, Thermodynamic Wet Bulb Temperature, Properties of Moist Air, Psychrometric Chart, simple exercises using psychrometry

UNIT III AIR CONDITIONING PROCESSES AND VENTILATION

Introduction, Basic processes - Heating and Cooling Process, Cooling with Dehumidification, Heating with Humidification, Adiabatic Mixing of Two Air Streams, Evaporative Cooling, Heating and Air Conditioning System Cycles. Basic air-conditioning system and zoned air-conditioning system. Indoor air quality and ventilation - Indoor Air Quality, Ventilation Procedure, Concentration of Air Pollutants, Indoor Air Quality Procedure, Filters – Types, Ozone, Ultraviolet Light

UNIT IV HEATING AND COOLING LOAD CALCULATIONS

Emissivities of Materials, Heat Transfer Coefficient, Coefficient of Transmission, Thermal Conductivities of Materials, Thermal Resistances of Materials, Outdoor Air Load Components – introduction, Basic Concepts and Terminologies. Heating load calculations – Introduction, Calculating Design Heating Loads. Cooling load calculations - Basic Definitions, Transfer Function Method (TFM), Heat Sources and heat gains, CLTD / SCL / CLF Calculation Procedure, Cooling Load by CLTD/SCL/CLF Method

UNIT V DIGITAL CONTROLS FOR HVAC SYSTEMS

Introduction, control types, Basic Control – open and closed loop controls, Typical Control Loops, Direct Digital Control – Introduction, control schemes, Direct Digital Control of an Air-Handler – Introduction, Schemes, Architecture and Advantages of Direct Digital Controls.

(9 Hrs)

(9 Hrs)

(9 Hrs)

(9 Hrs)

Text Books

- 1. R.K.Rajput, "A Text Book Of Engineering Thermodynamics ",Fifth Edition,2017.
- 2. Joseph Wagner, Kirk VanGelder "Automotive Heating, Ventilation, and Air Conditioning" Jones & Bartlett Learning, 2018.
- 3. A. Vedavarz, S. Kumar, M. Hussain, "Heating, Ventilation and Air Conditioning Handbook", Industrial Press Inc., 2006

Reference Books

- 1. Red-Hot Careers "Heating, Ventilation, and Air Conditioning (HVAC) "CreateSpace Independent Publishing Platform, 2018–2018
- 2. Jan F. Kreider, "Handbook of Heating, Ventilation, and Air Conditioning", Taylor & Francis Limited, 2019.
- 3. Amrutha Rao MALLI, "A Practical Approach on Heating Ventilation and Air Conditioning Technology", Independently Published, 2017.
- 4. Russell E. Smith, "Electricity for Refrigeration, Heating, and Air Conditioning", Cengage Learning- 2018
- 5. David W. Bearg, "Indoor Air Quality and HVAC Systems", Routledge, 2019.

Web Resources

- 1. https://nptel.ac.in/courses/112/105/112105129/
- 2. https://swayam.gov.in/nd1_noc19_me58/preview
- 3. https://drive.google.com/open?id=0B7JWdKw_4Q07VWNrLVNkRXpyUmM
- 4. https://www.google.com/url?sa=t&source=web&rct=j&url=https://ocw.mit.edu/courses/architecture/4-401-environmental-technologies-in-buildings-fall-2018/lecture-slides-lec17.pdf&ved=&usg=AOvVaw3XYdn
- 5. https://www.epa.gov/iaq-schools/heating-ventilation-and-air-conditioning-systems-part-indoor-air-quality-design-tools

со	Prog	ram Ou	utcome	es (PO	s)								Prog Outco	ram Spe omes (P	ecific SOs)
S	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO1	PO1	PO1	PSO	PSO	PSO
	1	2	3	4	5	6	7	8	9	0	1	2	1	2	3
CO 1	3	3	2	3	3	1	2	2	1	1	2	3	3	2	2
CO 2	3	3	3	3	3	2	2	1	1	2	2	3	3	3	3
CO 3	3	3	3	3	3	1	1	1	2	1	1	3	3	3	3
CO 4	3	3	3	3	3	2	2	2	3	2	2	3	3	3	3
CO 5	3	3	2	3	3	2	2	2	3	2	2	3	3	3	3

COs Mapping with POs and PSOs

Dr.G.Balamuruga Mohan karm.Tech.Ph.D., Professor & Head, Dept. of Mechatronics Engineering Sri Mauakula Vinayagar Engineering College Madagadipet, Puducherry-605 107.

COMPUTER INTEGRATED MANUFACTURING **U19MCE43**

Course Objectives

- To discuss the basic concepts of CIM and Communication.
- To deal with the information related to Database management system and Product design
- To learn the principles of Concurrent engineering and Process planning
- To discuss about basic principles of Automatic Data Collection and Quality inspection
- To introduce various concepts of FMS, AGV and Industrial robotics

Course Outcomes

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

- CO1 Apply the knowledge of computer integrated manufacturing and communication.(K3)
- CO2 Identify the required DBMS architecture and product design details for various systems.(K2)
- CO3 Apply the knowledge of Concurrent engineering and process planning in manufacturing planning.(K3)
- CO4 Identify the methods for Automated Data Collection and Quality inspection, as required.(K2)
- **CO**5 Determine the required Flexible manufacturing system components along with the required AGV and Robotics.(K3)

UNIT I INTRODUCTION TO CIM AND COMMUNICATION

Introduction to CIM, Evolution, Benefits, Computers in Manufacturing: Factory tasks for Computer Integration, CIM Hardware and Software.

Fundamentals of Communication: Representation of data, Coding, Transmission, Medium, Types of Communication Lines and Hardware, Network Architectures.

UNIT II DATABASE MANAGEMENT SYSTEMAND PRODUCT DESIGN

Data base: Introduction, Manufacturing data, Data base models, Data base Management, Data base required for a shop floor control (Fundamentals only)

Product Design: Design Process, CAD – areas of Application, Benefits, Fundamentals of CAD. CAM, CAE.

UNIT III CONCURRENT ENGINEERING AND PROCESS PLANNING

Concurrent / Simultaneous engineering: Introduction, Design for manufacturing and assembly, and other product design objectives. Advanced Manufacturing Planning. Introduction to Reverse Engineering. Process Planning: CAPP, Retrieval and Generative Model.

UNIT IV DATA COLLECTION AND QUALITY INSPECTION

Automated Data Collection - Bar Codes, OCR, Image Processing, Computer vision, RF Identification, Magnetic Identification, Voice Technology, Comparison.

CAQC, Contact & Non-Contact type inspection, Introduction to CMM, Application of Various Techniques and Equipments in inspection, interfacing inspection with CAD/CAM.

UNIT V FLEXIBLE MANUFACTURING SYSTEM

Types of Flexibility - FMS – FMS Components – FMS Application & Benefits. Automated Guided Vehicle System– AGVS Application – Vehicle Guidance technology – Vehicle Management & Safety. Industrial robotics: Robot Anatomy, Classification of Robots - End Effectors - Sensors in Robotics- Industrial Robot Applications.

160

Hrs

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(9 Hrs)

(9 Hrs)

(9 Hrs)

(9 Hrs)

Text Books

- 1. Mikell. P. Groover, 'Automation, Production Systems and computer integrated manufacturing', Prentice Hall of India, New Delhi, 2007.
- 2. P. Radhakrishnan , S. Subramanyan, V. Raju, 'CAD/CAM/CIM', New Age International (P) Ltd., New Delhi, 2000.
- 3. Bedworth, Henderson & Wolfe, 'Computer Integrated Design and Manufacturing', McGraw Hill
- 4. William. W. Luggen, 'Flexible Manufacturing Cells and System', Prentice Hall, New jersy
- 5. Rao. P, N Tewari & T. K. Kundra, "Computer Aided Manufacturing", Tata McGraw Hill Publishing Company, 2000.

References Books

- 1. S. Kant Vajpayee, 'Principles of Computer Integrated Manufacturing', Prentice Hall of India, 2003.
- 2. Teicholtz, Orr, 'CIM Handbook', McGraw Hill publishing.
- 3. Roger Hanman, 'Computer Intergrated Manufacturing', Addison Wesley, 1995.
- 4. Gideon Halevi and Roland Weill, "Principles of Process Planning A Logical Approach"
- 5. James A. Rehg, H. W. Kraebber, "Computer Integrated Manufacturing, 2nd edition, Pearson Education

Web Resources

- 1. www.cimlearningzone.co.uk/
- 2. http://nptel.ac.in/courses/112102101/
- 3. http://nptel.ac.in/courses/112102103/
- 4. http://elearning.vtu.ac.in/06ME72.html
- 5. https://ocw.mit.edu/courses/mechanical-engineering/2-008-design-and-manufacturing-ii-spring-2004/lecturenotes/

COs	Progr	am Ou	tcomes	s (POs)									Pro Outo	gram Spec comes (PS	cific SOs)
•••	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	2	3	-	1	2	-	3	-	3	3	3	2
CO2	3	3	3	2	3	-	2	2	-	-	-	3	3	3	2
CO3	3	3	2	2	3	-	1	1	-	-	-	3	3	3	2
CO4	3	3	2	2	3	-	2	2	-	-	-	3	3	3	3
CO5	3	3	2	2	3	-	2	2	-	-	-	3	3	1	2

COs Mapping with POs and PSOs

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U19MCE44

INSTRUMENTATION FOR AUTOMOTIVE С Ρ L Т 3 3 **INDUSTRIES** 0 0

Course Objectives

- 1. To provide knowledge about various techniques used for the measurement of industrial parameters
- 2. To provide knowledge on measurement of velocity, displacement, viscosity, temperature using various types of sensors and related circuits
- 3. To introduce Force & Torque Measuring Instruments
- 4. To introduce Pressure & flow Measuring Instruments
- 5. To impart knowledge on measuring of process variables, analytical instrumentation, automatic process controls

Course Outcomes

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

- CO1 Capable to select and use strain measuring instruments(K2)
- CO2 Check various available techniques available and select appropriate to obtain satisfactory task for the parameter to be measured like displacement, Force & Torque(K3)
- CO3 Be acquainted with measurement of Pressure & flows. (K2)
- CO4 Be acquainted with measurement of Level & Temperature of a system(K2)
- CO5 Acquire and Interpret the measurement results and cause of any possible error(K4)

UNIT I INTRODUCTION AND STRAIN MEASUREMENT

Introduction to instrumentation system, static and dynamic characteristics of an instrumentation system. Strain Gauge and Strain Measurement: Factors affecting strain measurements, Types of strain gauges, theory of operation of resistive strain gauge, gauge factor, types of electrical strain gauges, strain gauge materials, gauging techniques and other factors, strain gauge circuits and temperature compensation, applications of strain gauges

UNIT II DISPLACEMENT, FORCES AND TORQUE MEASUREMENT

Resistive potentiometer (Linear, circular and helical), LVDT, RVDT and their characteristics, variable inductance and capacitance transducers, Piezo electrical transducers-output equations and equivalent circuit, Hall effect devices and Proximity sensors, Large displacement measurement using synchros and resolvers, Shaft encoders. Load cells and their applications, various methods for torque measurement. Use of torque wrenches.

UNIT III PRESSURE AND FLOW MEASUREMENT

Mechanical devices like Diaphragm, Bellows, and Bourdon tube for pressure measurement, Variable inductance and capacitance transducers, Piezo electric transducers, LVDT for measurement of pressure, Low pressure and vacuum pressure measurement using Pirani gauge, McLeod gauge, Ionization gauge, Pressure gauge calibration. Differential pressure meter like Orifice plate, Venturi tube, flow nozzle, Pitot tube, Rotameter, Turbine flow meter, Electromagnetic flow meter, hot wire anemometer, Ultrasonic flow meter.

UNIT IV LEVEL AND TEMPERATURE MEASUREMENT

Resistive, inductive and capacitive techniques for level measurement, Ultrasonic and radiation methods, Air purge system (Bubbler method). Resistance type temperature sensors - RTD & Thermistor, Thermocouples & Thermopiles, Laws of thermocouple - Fabrication of industrial thermocouples - Signal conditioning of thermocouples output - Radiation methods of temperature measurement - Radiation fundamentals - Total radiation & selective radiation pyrometers – Optical pyrometer – Two colour radiation pyrometers

UNIT V DIGITAL DATA ACQUISITION SYSTEMS & CONTROL

(9 Hrs)

(9 Hrs)

162

Hrs

45

(9 Hrs)

(9 Hrs)

Use of signal conditioners, scanners, signal converters, recorders, display devices, A/D & D/A circuits in digital data acquisition. Instrumentation systems. Types of Instrumentation systems. Components of an analog Instrumentation Data – Acquisition system. Multiplexing systems. Uses of Data Acquisition systems. Use of Recorders in Digital systems. Digital Recording systems. Modern Digital Data Acquisition system. Analog Multiplexed operation, operation of sample Hold circuits.

Text Books

- 1. Salah H. R. Ali, "Automotive Engine Metrology", CRC Press, 2017.
- 2. Tom Denton, "Automotive Technician Training: Theory", Routledge, 2014.
- 3. S Sheeba Rani, P Subha Hency Jose, P Rajalakshmy, "Automotive Electrics and Instrumentation", Educreation Publishing, 2019

Reference Books

- 1. Frank Lamb, "Industrial Automation: Hands On", McGraw Hill Professional, 2013
- 2. Jerker Delsing, "IoT Automation: Arrowhead Framework", CRC Press, 2017.
- 3. Gregory K. McMillan, P. Hunter Vegas, "Process / Industrial Instruments and Controls Handbook", McGraw-Hill Education, 2019.
- 4. Bela G. Liptak, Kriszta Venczel, "Instrument and Automation Engineers' Handbook: Process Measurement and Analysis", Taylor & Francis, 2016.
- **5.** Ronald L Krutz, "Industrial Automation and Control System Security Principles", International Society of Automation

Web Resources

- 1. https://nptel.ac.in/course.html
- 2. https://nptel.ac.in/courses/108/105/108105062/
- 3. https://swayam.gov.in/nd1_noc20_me39/preview
- 4. https://www.aimil.com/blog/role-of-instrumentation-in-automobile-industry/
- 5. https://sites.google.com/site/sjredu/subje/instru-auto

CO5	Progr	am Ou	tcomes	s (POs)									Prog Outc	ram Spe omes (P	ecific SOs)
003	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	3	1	2	2	1	1	-	3	3	3	3
CO2	3	3	3	3	3	2	2	1	1	2	-	3	3	2	3
CO3	3	3	3	3	3	1	1	1	2	1	-	3	3	2	3
CO4	3	3	3	3	3	2	2	2	3	2	-	3	3	2	3
CO5	3	3	2	3	3	2	2	2	3	2	-	3	3	3	3

COs Mapping with POs and PSOs

Dr.G.Balamuruga Mohan kay M.Tech, Ph.D., Professor & Head, , of Mechatronics Engineering Mauakula Vinayagar Engineering College, Madagadipet, Puducherry-605 107.

L DATA COMMUNICATION AND NETWORKING U190MCE45

С Hrs т Ρ 3 3 45 Λ Λ

Course Objectives

- To introduce the fundamental various types of computer networks.
- To demonstrate the TCP/IP and OSI models with merits and demerits. •
- To explore the various layers of OSI Model.
- To introduce UDP and TCP Models.
- To develop an understanding of computer networking basics

Course Outcomes

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

- CO1 Students should be understanding and explore the basics of Computer Networks and Various Protocols. He / She will be in a position to understand the World Wide Web concepts.(K2)
- CO₂ Students will be in a position to administrate a network and flow of information further he/she can understand easily the concepts of network security, Mobile and adhoc networks.(K3)
- CO3 Recognize the technological trends of Computer Networking. (K2)
- CO4 Discuss the key technological components of the Network. (K2)
- CO5 Evaluate the challenges in building networks and solutions to those. (K4)

UNIT I DATA COMMUNICATIONS

Components - Direction of Data flow - Networks - Components and Categories - Types of Connections -Topologies – Protocols and Standards – ISO / OSI model, Example Networks such as ATM, Frame Relay, ISDN Physical layer: Transmission modes, Multiplexing, Transmission Media, Switching, Circuit Switched Networks, Datagram Networks, Virtual Circuit Networks.

UNIT II DATA LINK LAYER

Introduction, Framing, and Error - Detection and Correction - Parity - LRC - CRC Hamming code, Flow and Error Control, Noiseless Channels, Noisy Channels, HDLC, Point to Point Protocols. 111 Medium Access sub layer: ALOHA, CSMA/CD, LAN - Ethernet IEEE 802.3, IEEE 802.5 - IEEE 802.11, Random access, Controlled access, Channelization.

UNIT III NETWORK LAYER

Logical Addressing, Internetworking, Tunneling, Address mapping, ICMP, IGMP, Forwarding, Uni-Cast Routing Protocols, Multicast Routing Protocols.

UNIT IV TRANSPORT LAYER

Process to Process Delivery, UDP and TCP protocols, Data Traffic, Congestion, Congestion Control, QoS, Integrated Services, Differentiated Services, QoS in Switched Networks

UNIT V APPLICATION LAYER

Domain name space, DNS in internet, electronic mail, SMTP, FTP, WWW, HTTP, SNMP.

(9 Hrs)

(9 Hrs)

(9 Hrs)

(9 Hrs)

Text Books

- 1. Lakhmi C. Jain, George A. Tsihrintzis, Valentina E. Balas, Dilip Kumar Sharma, "Data Communication and Networks: Proceedings of GUCON 2019", Springer Nature, 2019.
- 2. Dr M. P. Vani, "Data Communication and Computer Network: Easy to Learn and Simple to Develop", Notion Press, 2019.
- 3. Forouzan, "Data Communications and Networking", McGraw Hill Education; Fifth edition, 2017.

References Books

- 1. Oliver C. Ibe, "Fundamentals of Data Communication Networks", John Wiley & Sons, 2017.
- 2. Shashi Banzal, "Data and Computer Network Communication", Laxmi Publications Pvt. Limited, 2015
- 3. R. K. Ghosh, "Wireless Networking and Mobile Data Management", Springer, 2017.
- 4. Thiagarajan, Viswanathan, Manav Bhatnagar, "Telecommunication Switching Systems And Networks", PHI Learning Pvt. Ltd, 2015.
- 5. Adamu, Murtala Zungeru, S Subashini, P Vetrivelan, "Wireless Communication Networks and Internet of Things: Select Proceedings", Springer, 2018.

Web Resources

- 6. https://nptel.ac.in/courses/106/105/106105082/
- 7. https://nptel.ac.in/courses/106/105/106105080/
- 8. https://swayam.gov.in/nd2_cec19_cs07/preview
- 9. https://nptel.ac.in/courses/117/105/117105076/
- 10.https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-263j-data-communicationnetworks-fall-2002/lecture-notes/

		<u> </u>													
COs	Progr	ram Ou	tcome	s (POs)									Pro: Oute	gram Spe comes (P\$	cific SOs)
	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	2	3	1	2	2	1	1	2	3	2	3	2
CO2	3	2	3	2	3	2	2	1	1	2	2	3	3	2	3
CO3	3	3	3	3	3	1	1	1	2	1	1	3	2	3	2
CO4	3	2	3	2	3	2	2	2	3	2	2	3	3	2	2
CO5	2	2	2	2	3	2	2	2	3	2	2	3	2	2	2

COs Mapping with POs and PSOs

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U20MCE501

MEMS AND NANO TECHNOLOGY

С Ρ Hrs

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Course Objectives

- · To impart knowledge about the latest trends in manufacturing micro components and measuring systems to Nano scale.
- To provide knowledge on processing techniques of micro-electro mechanical systems
- To enumerate the concepts on applications of micro devices
- To gain knowledge on the properties of nano materials
- To perform characterization study on nano materials

Course Outcomes

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

CO1 - Familiarize on MEMS and Microsystems (K2)

CO2 - Recognize the processing techniques of MEMS(K2)

- **CO3** Comprehend the need for smart materials(K3)
- CO4 Value the science of nano materials(K4)

C05 – Analyze on various characterization tests for nano materials(K4)

Unit I OVERVIEW OF MEMS AND MICROSYSTEMS

Definition - historical development - fundamentals - properties, micro fluidics, design and fabrication of microsystem, microelectronics, working principle and applications of micro system

Unit II MATERIALS, FABRICATION PROCESSES AND MICRO SYSTEM (9 Hrs) PACKAGING

Substrates and wafers, silicon as substrate material, mechanical properties of Si, Silicon Compounds silicon pies resistors, Gallium arsenide, quartz, polymers for MEMS, conductive polymers. Photolithography, photo resist applications, light sources, in implantation, diffusion process exudation - thermal oxidation, silicon diode, chemical vapor deposition, sputtering - deposition by epitaxy - etching - bulk and surface machining - LIGA process Micro system packaging - considerations packaging - levels of micro system packaging die level, device level and system level.

Unit III MICRO DEVICES AND MATERIALS

Sensors - classification - signal conversion ideal characterization of sensors micro actuators, mechanical sensors - measured displacement sensors, pressure and flow sensors, and micro actuators - smart materials applications.

Unit IV SCIENCE OF NANO MATERIALS

Classification of Nano structures - effect of the nanometer length scale effects of Nanoscale dimensions on various properties - structural, thermal, chemical, mechanical, magnetic, optical and electronic properties - effect of Nanoscale dimensions on biological systems. Fabrication methods - Top down processes - bottom up process.

Unit V CHARACTERIZATION OF NANO MATERIALS

Nano-processing systems – Nano measuring systems – characterization – analytical imaging techniques – microscopy techniques, electron microscopy scanning electron microscopy, transmission electron microscopy, transmission electron microscopy, scanning tunneling microscopy, atomic force microscopy, diffraction techniques -spectroscopy techniques - Raman spectroscopy, 3D surface analysis - Mechanical, Magnetic and thermal properties - Nano positioning systems.

(9 Hrs)

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Text Books

- 1. Zhaoying Zhou, Zhonglin Wang, Liwei Lin, "Microsystems and Nanotechnology", Springer-Verlag Berlin Heidelberg 2012
- 2. Amretashis Sengupta, Chandan Kumar Sarkar "Introduction to Nano: Basics to Nanoscience and Nanotechnology" Springer.– 2015

Reference Books

- 1. Jeremy Ramsden "Nanotechnology: An Introduction" William Andrew.- 2016
- 2. Vikas Choudhary, Krzysztof Iniewski "MEMS: Fundamental Technology and ApplicationsCRC Press.- 2017
- Sunipa Roy, Chandan Kumar Ghosh, Chandan Kumar Sarkar "Nanotechnology: Synthesis to Applications"-CRC Press.2017
- 4. Patrick M. Boucher" Nanotechnology: Legal Aspects" CRC Press 2018
- **5.** Nandita Dasgupta, Shivendu Ranjan, Eric Lichtfouse "Environmental Nanotechnology: Volume 2Springer. 2018

Web Resources

- 1. https://nptel.ac.in/courses/117/105/117105082/
- 2. https://swayam.gov.in/nd1_noc20_ee52/preview
- 3. https://www.edx.org/course/nanotechnology-fundamentals-of-nanotransistors
- 4. https://www.my-mooc.com/en/mooc/micro-nanofabrication-mems-epflx-memsx/

COs				Pi	rogra	m O	utcor	nes (POs)			Prog Outo	gram Spe comes (P	cific SOs)
	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	3	3	-	-	-	-	3	-	-	3	1	2	2
2	3	3	3	3	-	-	-	-	3	-	-	3	1	2	2
3	3	3	3	3	-	-	-	-	3	-	-	3	1	2	2
4	3	2	2	3	-	-	-	-	3	-	-	3	1	2	2
5	3	2	2	3	-	-	-	-	3	-	-	3	1	2	2

COs/POs/PSOs Mapping

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

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		L		Р	C	Hrs
UT9WICE52	IOT FOR MECHATRONICS	3	0	0	3	45

- To impart necessary and practical knowledge of components ofInternet of Things
- To understand about the smart objects and how to connect these smart objects.
- To develop skills required to build real-life IoT based projects.
- · Gateway installations and cloud analytics
- Understand Security, privacy and Trust in IoT

Course Outcomes

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

- CO1 Understand the fundamentals of Internet of Things (K2)
- CO2 Analyze the hardware and software components used in IoT. (K3)
- CO3 Assortment of sensors & networking protocols. (K3)
- CO4 Progress of application on IoT and securing the IoT framework. (K4)
- **CO5** Evaluate life IoT based projects(K5)

UNIT I INTRODUCTION TO IOT

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

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 SMART OBJECTS: THE "THINGS" IN IOT

Sensors, Actuators, and Smart Objects – Sensors, Actuators, Micro-Electro-Mechanical Systems (MEMS), Smart Objects: Smart Objects: A Definition, Trends in Smart Objects. Sensor Networks: Wireless Sensor Networks (WSNs), Communication Protocols for Wireless Sensor Networks. Connecting Smart Objects: Communications Criteria – Range, Frequency Bands, Power Consumption, Topology, Constrained Devices, Constrained-Node Networks, IoT Access Technologies: IEEE 802.15.4, LoRaWAN.

UNIT IV IOT APPLICATION DEVELOPMENT AND SECURING IOT

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. Securing IoT: A Brief History of OT Security, Common Challenges in OT Security:

Erosion of Network Architecture, Pervasive Legacy Systems, Insecure Operational Protocols

UNIT V IOT IN INDUSTRY

IoT Strategy for Connected Manufacturing, Connected Factory: Industrial Automation and Control Systems Reference Model and Control Protocols, Connected Factory Security. Smart and Connected Cities: IoT Strategy and architecture for Smarter Cities and Security Architecture for Smarter Cities, IoT Use Cases for Transportation: Connected Cars, Connected Fleets, Infrastructure and Mass Transit, IoT Architecture for Transportation: IoT Technologies for Roadways.

(9 Hrs)

(9 Hrs)

(9 Hrs)

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(9 Hrs)

IoT case studies and mini projects based on Industrial automation, Transportation, Home Automation.

Text Books

- 1. Ismail Butun "Industrial IoT: Challenges, Design Principles, Applications, and Security" Springer International Publishing, 2020
- 2. Dr. Rajesh Singh, Dr. Anita Gehlot, Dr. Lovi Raj Gupta "Internet of Things with Raspberry Pi and Arduino "CRC Press. – 2020
- 3. Ruben Oliva Ramos" Internet of Things Programming with JavaScript" Packt Publishing Ltd 2017.

Reference Books

- 1. Nilanjan Dey, Parikshit N. Mahalle, Pathan Mohd Shafi "Internet of Things, Smart Computing and Technology: A Roadmap Ahead" Springer Nature. 2020
- Dr. Rajesh Singh, Dr. Anita Gehlot, Dr. Lovi Raj Gupta, Ms. Navjot Rathour, Mahendra Swain, Bhupendra Singh "IoT based Projects: Realization with Raspberry Pi, NodeMCU and Arduino" BPB Publications. 2020
- 3. Peter Waher "Learning Internet of Things" Packt Publishing Ltd.- 2015
- 4. Sheng-Lung Peng, Souvik Pal, Lianfen Huang "Principles of Internet of Things (IoT) Ecosystem: Insight Paradigm" Springer Nature- 2019
- 5. Eric M. H. Goh " Learn By Examples A Quick Guide To Internet of Things With Arduino and Data" SVBook. 2020

Web Resources

- 1. https://nptel.ac.in/courses/112/103/112103174/
- 2. https://www.iiitnr.ac.in/content/internet-things-and-sensor
- 3. https://www.captechu.edu/blog/internet-of-things-and-mechatronics

COs/POs/PSOs Mapping

COs				P	rogra	m O	utcor	nes (POs)			Pro Outo	gram Spe comes (P	cific SOs)
	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	P011	PO12	PSO1	PSO2	PSO3
1	3	3	3	3	-	1	2	2	1	1	2	3	1	2	3
2	3	3	3	3	-	2	2	1	1	2	2	3	1	2	3
3	3	3	3	3	-	1	1	1	2	1	1	3	1	2	3
4	3	2	2	3	-	2	2	2	3	2	2	3	1	2	3
5	3	2	2	3	-	2	2	2	3	2	2	3	1	2	3

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

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U	19MCE53 OPERATIONS RESEARCH	L 2	1		2	ПГЭ 4E
С	ourse Objectives	ა	U	U	ა	40
•	To understand the role of operation research in decision making.					
•	To provide knowledge and training in using optimization techniques.					
•	To impart the various operation research models for effective problem solving.					

- To know the basics and the methods of solving inventory theory and problems. •
- To acquire knowledge in principles of Queuing theory.

Course Outcomes

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

CO1 - Understand the characteristics of different types of decision making environments.(K2)

CO2 - Solve Transportation Models and Assignment Models.(K3)

CO3- Design new simple models by using critical path method.(K3)

CO4- Function of inventory and replacement concepts.(K4)

C05- Apply Queuing theory and solve problems related to it.(K5)

UNIT I LINEAR PROGRAMMING

Stages of Development of Operations Research - Applications of Operations Research - Limitations of Operations – Introduction to Linear Programming – Graphical Method – Simplex Method – Duality.

UNIT II TRANSPORTATION PROBLEMS

Basic feasible solution by different methods - Fixing optimal solutions - Stepping stone method - MODI method -Assignment problem – Formulation – Optimal solution.

UNIT III NETWORKS MODELS

Shortest Path Problem – Floyd's Algorithm – Minimum Spanning Tree Problem – CPM/PERT – Crashing of a Project network

UNIT IV INVENTORY ANALYSIS AND REPLACEMENT MODELS

Inventory cost - Classification of Fixed first order Quantity Inventory Models- Inventory models with Deterministic Demand- Inventory models with probabilistic Demand. Replacement Models -types of failures- Replacement of items that deteriorate

UNIT V QUEUING THEORY

Basic Waiting Line Models: $(M/M/1):(GD/\alpha/\alpha) - (M/M/1):(GD/N/\alpha) - (M/M/C):(GD/\alpha/\alpha) - M/M/C):(GD/N/\alpha).$

Text Books

- 1. Michael W.Carter, Camille C.Price, GhaithRabadi, "Operation Research A Practical Introduction", Chapman and Hall/CRC, 2nd Edition 2018.
- 2. Jiongmin Yong, "Optimization Theory: A Concise Introduction", World scientific publishing company, 2018.
- 3. John F. Shortle, James M. Thompson, Donald Gross, Carl M. Harris, "Fundamentals of Queuing Theory", 5th Edition,2018.

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Reference Books

- 1. A.RaviRavindran, "Operations Research Methodologies", Taylor and Francis, 2019.
- 2. Hastings, Kevin J. "Introduction to the Mathematics of Operations Research with Mathematics", Taylor and Francis, 2019.
- 3. Er.Prem Kumar Gupta,Dr.D.S.Hira," Operations Research" S.chand& Company Pvt.Ltd, **7**th Edition,2014.
- 4. J. K. Sharma. "Operations Research Theory and Applications", Macmillan India Ltd, 5th Edition, 2013.

Web Resources

- 1. https://www.researchgate.net/publication/313880623
- 2. https://nptel.ac.in/courses/117/103/117103017
- 3. https://nptel.ac.in/courses/111/107/111107128/

COs/POs/PSOs Mapping

COs				Pi	rogra	ım O	utcor	nes ((POs))			Pro Outo	gram Spe comes (P	cific SOs)
	P01	PO2	PO3	PO4	PO5	P06	P07	PO8	PO9	PO10	P011	PO12	PSO1	PSO2	PSO3
1	2	1	3	3	-	-	-	-	-	-	-	1	3	2	2
2	3	2	3	3	-	-	-	-	-	-	-	1	3	2	2
3	3	2	3	3	-	-	-	-	-	-	2	1	3	2	2
4	2	1	3	3	-	-	-	-	-	-	2	1	3	2	2
5	3	2	3	3	-	-	-	-	-	-	2	1	3	2	2

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

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U19MCE54	BIOMEDICAL INSTRUMENTATION	L 3	Т 0	P 0	C 3	Hrs 45
 Course Objectives To Illustrate origin of b To understand the different to design bio amplifier To learn the different to To Summarize different 	nio potentials and its propagations erent types of electrodes and its placement for various reco r for various physiological recordings measurement techniques for non-physiological parameters. nt biochemical measurements.	[.] dings				
Course Outcomes After completion of the o CO1 - Differentiate differen CO2 - Illustrate different el CO3 - Design bio amplifier CO4 - Explain various tech CO5 - Demonstrate differen	course, the students will be able to nt bio potentials and its propagations (K2). lectrode placement for various physiological recordings (K2) r for various physiological recordings (K3). nnique for non-electrical physiogical measurements(K4). ent biochemical measurement techniques. (K5).					
UNIT I INTRODUCTION Basic concept of biomedic Biopotential amplifiers. Bio	N TO BIO-MEDICAL INSTRUMENTATION al instrumentation. Electrodes, transducers, biosensors and otelemetry.	their	char	actei	ristics	(9 Hrs)
UNIT II ELECTRICAL F Recording of ECG, EEG, respiratory system.	PARAMETERS ACQUISITION AND ANALYSIS EMG, ERG, evoked potentials etc. Cardiovascular measure	ement	s. M	easu	ireme	(9 Hrs) ent of the

UNIT III MEASUREMENT AND DIAGNOSTIC

Cardiovascular measurements. Cardiac pacemakers - internal and external pacemakers, defibrillators. Electro encephalogram -neuronal communication, Measurement of the respiratory system.

UNIT IV IMAGING MODALITIES AND ANALYSIS

Analytical instruments in Biomedical Engineering; oximeter, spectrophotmeter, colorimeter, blood gas analyzer, blood cell counter.

UNIT V LIFE ASSISTING, THERAPEUTIC DEVICES

Therapeutic & assist devices for cardiovascular system and respiratory system. Physiotherapy devices. Electrosurgical units. Safety aspects of biomedical equipment.

Text Books

- 1. Leslie Cromwell, Biomedical Instrumentation and measurement, 2nd edition, Prentice hall of India, New Delhi, 2015.
- 2. R. S. Khandpur, Handbook of Biomedical Instrumentation, Tata Mc Graw Hill, 2005
- 3. J. J. Carr and J. M. Brown, Introduction to Biomedical Equipment Technology, Pearson Education. 2004

Reference Books

1. John G. Webster, Medical Instrumentation Application and Design, 4th edition, Wiley India Pvt Ltd, New Delhi, 2015.

(9 Hrs)

(9 Hrs)

- 2. Myer Kutz, Standard Handbook of Biomedical Engineering and Design, McGraw Hill Publisher, 2003.
- 3. Khandpur R.S, Handbook of Biomedical Instrumentation, 3rd edition, Tata McGraw-Hill New Delhi, 2014

Web Resources

- 1. https://nptel.ac.in/courses/108/105/108105101/
- 2. https://onlinecourses.nptel.ac.in/noc21_ee17/preview
- 3. https://nptel.ac.in/courses/102/101/102101068/

COs				P	rogra	im Oi	utcor	nes (POs))			Prog Outo	gram Spe comes (P	cific SOs)
	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	P011	PO12	PSO1	PSO2	PSO3
1	2	1	3	3	-	-	-	-	-	-	-	2	2	1	3
2	3	2	3	3	-	-	-	-	-	-	-	2	3	2	3
3	2	1	3	3	-	-	-	-	-	-	-	2	2	1	3
4	3	2	3	3	-	-	-	-	-	-	-	2	3	2	3
5	3	2	3	3	-	-	-	-	-	-	-	2	3	2	3

COs/POs/PSOs Mapping

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

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	DATA BASE MANAGEMENT SVSTEM	L		Ρ	C	Hrs
UT9INICE35	DATA BASE MANAGEMENT STSTEM	3	0	0	3	45

- To Understand the basic concepts and the applications of database systems
- To Master the basics of SQL and construct queries using SQL
- To understand the relational database design principles
- To become familiar with the basic issues of transaction processing and concurrency control
- To become familiar with database storage structures and access techniques

Course Outcomes

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

- CO1 Demonstrate the basic elements of a relational database management system (K2)
- CO2 Identify the data models for relevant problems(K3)
- CO3 Design entity relationship and convert entity relationship diagrams into RDBMS (K3)
- CO4 Formulate SQL queries on the respect data (K4)
- **CO5** Apply normalization for the development of application software's(K5)

UNIT I INTRODUCTORY CONCEPTS OF DBMS

Introduction and applications of DBMS, Purpose of data base, Data, Independence, Database System architecture- levels, Mappings, Database, users and DBA.

Relational Model : Structure of relational databases, Domains, Relations, Relational algebra – fundamental operators and syntax, relational algebra queries, tuple relational calculus

UNIT II ENTITY-RELATIONSHIP MODEL

Basic concepts, Design process, constraints, Keys, Design issues, E-R diagrams, weak entity sets, extended E-R features – generalization, specialization, aggregation, reduction to E-R database schema

Relational Database design : Functional Dependency – definition, trivial and non-trivial FD, closure of FD set, closure of attributes, irreducible set of FD, Normalization – 1Nf, 2NF, 3NF, Decomposition using FD- dependency preservation, BCNF, Multivalued dependency, 4NF, Join dependency and 5NF

UNIT III QUERY PROCESSING & QUERY OPTIMIZATION

Overview, measures of query cost, selection operation, sorting, join, evaluation of expressions, transformation of relational expressions, estimating statistics of expression results, evaluation plans, materialized views

Transaction Management : Transaction concepts, properties of transactions, serializability of transactions, testing for serializability, System recovery, Two- Phase Commit protocol, Recovery and Atomicity, Log-based recovery, concurrent executions of transactions and related problems, Locking mechanism, solution to concurrency related problems, deadlock, , two-phase locking protocol, Isolation, Intent locking

UNIT IV SECURITY

Introduction Discretionary access control, Mandatory Access Control, Data Encryption.SQL Concepts : Basics of SQL, DDL,DML,DCL, structure – creation, alteration, defining constraints – Primary key, foreign key, unique, not null, check, IN operator

UNIT V FUNCTIONS

Aggregate functions, Built-in functions – numeric, date, string functions, set operations, sub-queries, correlated sub-queries, Use of group by, having, order by, join and its types, Exist, Any, All, view and its types. transaction control commands – Commit, Rollback, Savepoint, PL/SQL Concepts : Cursors, Stored Procedures, Stored Function, Database Triggers

(9 Hrs)

(9 Hrs)

(9 Hrs)

(9 Hrs)

174

Text Books

- 1. Data base Management Systems, Raghurama Krishnan, Johannes Gehrke, McGrawHill Education, 3rd Edition, 2003.
- 2. Data base System Concepts, A.Silberschatz, H.F. Korth, S.Sudarshan, McGraw Hill, VI edition, 2006.
- 3. Mukesh Neg, Fundamentals of Database Management System, Learn Essential Concepts of Database Systems, BPB PUBN, 2019.

Reference Books

- 1. Panneerselvam, R, Data Base Management Systems, PHI Learning Pvt. Ltd. 2018
- 2. Michael M. Gorman, Database Management Systems Understanding and Applying Database Technology, Elsevier Science 2014
- 3. Rajesh Narang, Database Management Systems, Prentice Hall India Pvt., Limited, 2018
- 4. P.S. Gill, Database Management Systems, I.K. International Publishing House Pvt. Limited , 2010
- 5. Dr. Rajni Sharma, Dr. Sarita Kaushik, Database Management System, Horizon Books (A Division of Ignited Minds Edutech P Ltd) 2015

Web Resources

- 1. https://nptel.ac.in/noc/courses/noc20/SEM1/noc20-cs09/
- 2. https://nptel.ac.in/courses/106/106/106106093/
- 3. https://nptel.ac.in/noc/courses/noc18/SEM1/noc18-cs15/

COs				Pi	rogra	m O	utcor	nes (POs)			Prog Outo	gram Spe comes (P	cific SOs)
	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	1	3	3	-	1	2	-	-	-	-	2	2	1	3
2	3	2	3	3	-	2	2	-	-	-	-	2	3	2	3
3	2	1	3	3	-	1	1	-	-	-	-	2	2	1	3
4	3	2	3	3	-	2	2	-	-	-	-	2	3	2	3
5	3	2	3	3	-	2	2	-	-	-	-	2	3	2	3

COs/POs/PSOs Mapping

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

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U19MCE61 INTRODUCTION TO FINITE ELEMENT ANALYSIS L T P C Hrs 3 0 0 3 45

Course Objectives

- To learn the basic principles of finite element analysis procedure.
- To understand the concepts of discretization
- To learn the theory and characteristics of finite elements that represent engineering structures.
- To understand the nature of iso-parametric and iso-perimetric elements
- To learn and apply finite element solutions to structural, thermal, dynamic problem to develop the knowledge and skills needed to effectively evaluate finite element analyses performed by others.

Course Outcomes

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

- CO1 Understand the concepts behind various methods and weighted residual methods in FEM.(K2)
- CO2 Understand the discretization concepts.(K2)
- CO3 Identify the application and characteristics of FEA elements such as bars, beams, plane and isoperimetric elements, and 3-D element.(K3,K4)
- CO4 Differentiate the iso-parametric and iso-perimetric elements. (K3,K4)
- CO5 Identify how the finite element method expands beyond the structural domain, for problems involving dynamics, heat transfer, and fluid flow.(K3,K4)

UNIT I INTRODUCTION

Finite element method, stress and equilibrium, strain – displacement relations, stress – strain relations, plane stress and plane strain conditions, various and weighted residual methods, concept of potential energy, one dimensional problems.

UNIT II DISCRETIZATION

Element shapes, discretization procedures, assembly of stiffness matrix, bandwidth, node numbering, mesh generation, interpolation functions, and local and global coordinates, convergence requirements, and treatment of boundary conditions.

UNIT III ANALYSIS OF TRUSSES

Finite element modeling coordinates and shape functions, assembly of global stiffness matrix and load vector, finite element equations, treatment of boundary conditions, stress, strain and support reaction calculations. Analysis of Beams: Element stiffness matrix for Hermit beam element, derivation of load vector for concentrated and UDL, simple problems on beams. Modeling of two dimensional stress analysis with constant strain triangles and treatment of boundary conditions, formulation of axisymmetric problems.

UNIT IV HIGHER ORDER AND ISOPARAMETRIC ELEMENTS

One dimensional quadratic and cubic elements in natural coordinates, two dimensional four nodded isoperimetric elements and numerical integration.

UNIT V STEADY STATE HEAT TRANSFER ANALYSIS

One-dimensional analysis of a fin and two dimensional analysis of thin plate, analysis of a uniform shaft subjected to torsion. Dynamic Analysis: Formulation of finite element model, element consistent and lumped mass matrices, evaluation of Eigen values and Eigen vectors, free vibration analysis.

Text Books

1. Tirupathi R. Chandrupatla, Ashok D. Belegundu, Introduction to Finite Elements in Engineering,4th Edition, Prentice Hall, 2012.

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- Singiresu S Rao, The Finite Element Methods in Engineering, 6th Edition, Elsevier Butterworth–Heinemann, 2017.
- 3. Reddy. J.N., "An Introduction to the Finite Element Method", 3rd Edition, Tata McGraw-Hill, 2005.

Reference Books

- 1. Seshu, P, "Text Book of Finite Element Analysis", 3rd Edition, Prentice-Hall of India Pvt. Ltd., New Delhi, 2007.
- 2. G.Ramamurthy, "Applied Finite Element Analysis", 2nd Edition, Wiley Publication, 2010
- 3. Siddu S. AnupGoel, ParmeshwarPatil, N. I. Jamader, "Finite Element Analysis", Technical publications, 2019.
- 4. Krishnamurthy, C.S., "Finite Element Analysis", Tata McGraw-Hill, 2000.
- 5. Robert D Cook, David S Malkus, Michael E Plesha, "Concepts and Applications of Finite Element Analysis", 4th edition, John Wiley and Sons, Inc., 2003.

Web Resources

- 1. https://nptel.ac.in/courses/112104193/
- 2. https://www.coursera.org
- 3. https://www.featutorials.com
- 4. https://www.sciencedirect.com/topics/engineering/finite-element-analysis
- 5. https://www.comsol.co.in/multiphysics/finite-element-method

COs/POs/PSOs Mapping

COs					Prog	am O	utcom	nes (P	Os)				Prog Outc	jram Spe omes (P	cific SOs)
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2	PSO3
1	3	2	2	3	-	-	-	-	-	-	-	-	2	2	3
2	3	2	2	3	-	-	-	-	-	-	-	-	2	2	3
3	3	2	2	3	-	-	-	-	-	-	-	-	2	2	3
4	3	2	3	3	-	-	-	-	-	-	-	-	2	2	3
5	3	2	2	3	-	-	-	-	-	-	-	-	2	2	3

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

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		L	Т	Ρ	С	Hrs
UT9WICE02	AUTOMOTIVE ELECTRONICS	3	0	0	3	45

- The intention and purpose of this course is to study the basics of electronics, emission controls and its Importance in automobiles.
- To study the various sensors and actuators used in automobiles for improving fuel economy and emission control.
- To study the various blocks of control units used for control of fuel, ignition and exhaust systems.
- To explore practically about the components present in an Automotive electrical and electronics system.
- To know the concepts and develop basic skills necessary to diagnose automotive electrical problems

Course Outcomes

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

- CO1 Know the importance of emission standards in automobiles.(K2)
- CO2 Understand the electronic fuel injection/ignition components and their function.(K2)
- **CO3 -** Choose and use sensors and equipment for measuring mechanical quantities, temperature and appropriate actuators.(K3)
- CO4 Analyze electronic engine control systems problems with appropriate diagnostic tools.(K4)
- CO5 Design the chassis and vehicle safety system.(K4)

UNIT I INTRODUCTION

 Equivalent Bharat Standards. Charging systems: Working and design of charging circuit diagram – Alternators – Requirements of starting system - Starter motors and starter circuits

UNIT II IGNITION AND INJECTION SYSTEMS

Approach to Control and Instrumentation: Concept of a system, Analog and digital systems, Basic measurement systems, Analog and digital signal processing, Sensors, Sensor characteristics, Sensor response, Sensor error, Redundancy of sensors in ECUs, Avoiding redundancy, Sensor modeling, Smart Nodes.

UNIT III SENSOR AND ACTUATORS IN AUTOMOTIVES

Working principle and characteristics of Airflow rate, Engine crankshaft angular position, Hall effect, Throttle angle, temperature, exhaust gas oxygen sensors – study of fuel injector, exhaust gas recirculation actuators, stepper motor actuator, vacuum operated actuator.

UNIT IV ENGINE CONTROL SYSTEMS

Control modes for fuel control-engine control subsystems – ignition control methodologies – different ECU's used in the engine management – block diagram of the engine management system. In vehicle networks: CAN standard, format of CAN standard – diagnostics systems in modern automobiles.

UNIT V CHASSIS AND SAFETY SYSTEMS

Traction control system – Cruise control system – electronic control of automatic transmission – antilock braking system – electronic suspension system – working of airbag and role of MEMS in airbag systems – centralized door locking system – climate control of cars.

Text Books

1. Williams. B. Ribbens: "Understanding Automotive Electronics", 6th Edition, Elsevier Science, Newnes

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Publication, 2003.

- 2. Robert Bosch: "Automotive Electronics Handbook", John Wiley and Sons, 2004.
- 3. David Alciatore & Michael Histand: "Introduction to Mechatronics and Measurement Systems (SIE)", TMH, 2007.

Reference Books

- 1. Ronald K Jurgen: "Automotive Electronics Handbook", 2nd Edition, McGraw-Hill, 1999.
- 2. James D. Halderman: "Automotive Electricity and Electronics", PHI Publication.
- 3. Terence Rybak & Mark Stefika: "Automotive Electromagnetic Compatibility (EMC)", Springer, 2004.
- 4. Allan Bonnick: "Automotive Computer Controlled Systems, Diagnostic Tools and Techniques", Elsevier Science, 2001.
- 5. Uwe Kieneke and Lars Nielsen: "Automotive Control Systems: Engine, Driveline and Vehicle", 2nd Edition, Springer Verlag, 2005

Web Resources

- 1. https://onlinecourses.nptel.ac.in/noc20_ee18/preview
- 2. https://nptel.ac.in/courses/108/106/108106170/
- 3. https://nptel.ac.in/courses/107/106/107106080/

COs	Program Outcomes (POs)											Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	P011	PO12	PSO1	PSO2	PSO3
1	3	2	2	1	2	2	1	1	2	2	1	1	2	2	3
2	3	2	2	2	2	1	1	2	2	1	1	2	2	2	3
3	3	2	2	1	1	1	2	1	1	1	2	1	2	2	3
4	3	2	3	2	2	2	3	2	2	2	3	2	2	2	3
5	3	2	2	2	2	2	3	2	2	2	3	2	2	2	3

COs/POs/PSOs Mapping

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

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		L		Р	C	Hrs
U I 9IVICE03	VLSI DESIGN	2	Δ	Δ	3	45

- To study the fundamentals of CMOS circuits and its characteristics
- To Learn the design and realization of combinational & sequential digital circuits
- To acquire knowledge about Architectural choices
- To study the performance trade-offs involved in designing and realizing the circuits in CMOS technology
- Learn the different FPGA architectures and testability of VLSI circuits

Course Outcomes

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

- CO1- Infer the fundamentals of CMOS circuits and its characteristics (K2)
- CO2- Illustrate the design and realization of combinational digital circuits (K3)
- CO3- Demonstrate the design and realization of sequential digital circuits (K3)
- CO4- Explain the performance trade-offs involved in designing and realizing the circuits in CMOS technology (K4)
- CO5- Classify FPGA architectures and testability of VLSI circuits (K4)

UNIT I INTRODUCTION TO MOS TRANSISTOR

MOS Transistor, CMOS logic, Inverter, Pass Transistor, Transmission gate, Layout Design Rules, Gate Layouts, Stick Diagrams, Long-Channel I-V Charters tics, C-V Charters tics, Non ideal I-V Effects, DC Transfer characteristics, RC Delay Model, Elmore Delay, Linear Delay Model, Logical effort, Parasitic Delay, Delay in Logic Gate, Scaling.

UNIT II COMBINATIONAL MOS LOGIC CIRCUITS

Circuit Families: Static CMOS, Ratioed Circuits, Cascode Voltage Switch Logic, Dynamic Circuits, Pass Transistor Logic, Transmission Gates, Domino, Dual Rail Domino, CPL, DCVSPG, DPL, Circuit Pitfalls. Power: Dynamic Power, Static Power, Low Power Architecture.

UNIT III SEQUENTIAL CIRCUIT DESIGN

Static latches and Registers, Dynamic latches and Registers, Pulse Registers, Sense Amplifier Based Register, Pipelining, Schmitt Trigger, Monostable Sequential Circuits, Astable Sequential Circuits. Timing Issues : Timing Classification Of Digital System, Synchronous Design.

UNIT IV DESIGN OF ARITHMETIC BUILDING BLOCKS AND SUBSYSTEM

Arithmetic Building Blocks: Data Paths, Adders, Multipliers, Shifters, ALUs, power and speed tradeoffs, Case Study: Design as a trade off. Designing Memory and Array structures: Memory Architectures and Building Blocks, Memory Core, Memory Peripheral Circuitry.

UNIT V IMPLEMENTATION STRATEGIES AND TESTING

FPGA Building Block Architectures, FPGA Interconnect Routing Procedures. Design for Testability: Ad- Hoc Testing, Scan Design, BIST, IDDQ Testing, Design for Manufacturability, Boundary Scan.

Text Books

- 1. Jan Rabaey, Anantha Chandrakasan, B.Nikolic, "Digital Integrated Circuits: A Design Perspective", Second Edition, Prentice Hall of India, 2003.
- 2. M.J. Smith, "Application Specific Integrated Circuits", Addisson Wesley, 1997

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3. A.Pucknell, Kamran Eshraghian, "BASIC VLSI Design", Third Edition, Prentice Hall of India, 2007.

Reference Books

- 1. N.Weste, K.Eshraghian, "Principles of CMOS VLSI Design", Second Edition, Addision Wesley 1993
- R.Jacob Baker, Harry W.LI., David E.Boyee, "CMOS Circuit Design, Layout and Simulation", Prentice Hall of India 2005
- 3. Wayne wolf, --Modern VLSI Design: System on Chip Design, Prentice Hall of India, 2012
- 4. DebaPrasad Das, -VLSI Design, Oxford University Press, 2012.
- 5. Neil He Weste, David Harris and Ayan Banerjee, —CMOS VLSI design-A circuits and Systems Perspective, IIDorling Kindersley (india) Pvt Ltd, 2009.

Web Resources

- 1. https://www3.nd.edu/~kogge/courses/cse40462-VLSI-fa18/www/links.html
- 2. https://www.tutorialspoint.com/vlsi_design/index.htm
- 3. http://www.cmosvlsi.com/
- 4. http://www.csit-sun.pub.ro/courses/vlsi/Modern_VLSI_Design.pdf
- 5. https://www.maven-silicon.com/online-vlsi-design-course

COs/POs/PSOs Mapping

COs				Pr	ograr	n Ou	tcon	nes (I	POs)				Prog Outo	gram Spe comes (P	cific SOs)
	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	P011	PO12	PSO1	PSO2	PSO3
1	3	1	1	-	2	1	2	2	1	1	2	2	2	1	2
2	3	1	1	-	2	2	2	1	1	2	2	1	2	1	2
3	2	1	1	-	2	1	1	1	2	1	1	1	2	1	2
4	2	1	1	-	2	2	2	2	3	2	2	2	2	1	2
5	3	1	1	-	2	2	2	2	3	2	2	2	2	1	2

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		L		Р	C	Hrs
UT9MCE04	VIRTUAL INSTRUMENTATION	3	0	0	3	45

Course Objectives

- To understand the basics of data acquisition are introduced in mechatronics systems.
- To provide knowledge on design of process control by using virtual instrumentation techniques ٠
- To give knowledge in process analysis by VI tools.
- To provide basic knowledge in describing function analysis.
- To get adequate knowledge VI tool sets •

Course Outcomes

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

CO1 - Identify about virtual instrumentation tools. (K2)

- CO2 Frame adequate knowledge VI tool sets (K2)
- **CO3** Apply various filed of VI data acquisition (K3)
- CO4 Develop VI conventional programming techniques (K4)
- CO5 Create VI programming techniques for various fields. (K5)

UNIT I PREVIEW OF VIRTUAL INSTRUMENTATION

Historical perspectives, advantages, block diagram and architecture of a virtual instrument, dataflow techniques, graphical programming in data flow, comparison with conventional programming. Current loop, RS.232C/RS.485, GPIB, System buses, interface buses: USB, PCMCIA, VXI, SCXI,

UNIT II PROGRAMMINGTECHNIQUES

VIS and sub-VIS loops and charts, arrays, clusters and graphs, case and sequence structures, formula nodes, local and global variables, string and file I/O.

UNIT III DATA ACQUISITION BASICS

AOC.OAC. 010. Counters & timers. PC Hardware structure, timing. Interrupts OMA, software and hardware installation

UNIT IV COMMON INSTRUMENT INTERFACES

PXI, etc., networking basics for office &Industrial applications, Visa and IVI, image acquisition and processing. Motion control.

UNIT V USE OF ANALYSIS TOOLS

Fourier transforms, power spectrum correlation methods, windowing & filtering, VI application in various fields.

Text Books

- 1.I.Bratko, "Prolog: Programming for Artificial Intelligence", Fourth edition, Addison-Wesley Educational Publishers Inc., 2011
- 2.S. Russell and P. Norvig, "Artificial Intelligence: A Modern Approach", Prentice Hall, Third Edition, 2009.
- 3. Norbert Meyer, Roberto Pugliese, Sandro Zappatore Remote Instrumentation and Virtual Laboratories, Service Architecture and Networking, Springer US, 2010

Reference Books

- 1. Gerhard Weiss, "Multi Agent Systems", Second Edition, MIT Press, 2013
- 2. M. Tim Jones, "Artificial Intelligence: A Systems Approach(Computer Science)", Jones and Bartlett Publishers,

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- Inc.; First Edition, 2008
- 3. Nils J. Nilsson, "The Quest for Artificial Intelligence", Cambridge University Press, 2009Alan S. Morris, Reza Langari "Measurement and Instrumentation: Theory and Application" Academic Press - 2015
- 4. JOVITHA JEROME "VIRTUAL INSTRUMENTATION USING LABVIEW" PHI Learning Pvt. Ltd 2010
- 5. Gupta" Virtual Instrumentation Using Labview 2E" Tata McGraw-Hill Education 2010

Web Resources

- 1. https://swayam.gov.in/nd1_noc19_ee44/preview
- 2. https://nptel.ac.in/courses/106/104/106104122/
- 3. https://www.mooc-list.com/tags/electrical-instruments

COs/POs/PSOs Mapping

COs				P	rogra	am O	utcor	nes (POs))			Proç Outo	gram Spe comes (P	cific SOs)
	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	P011	PO12	PSO1	PSO2	PSO3
1	3	2	2	-	1	2	-	-	-	-	-	-	2	1	2
2	3	2	2	-	2	2	-	-	-	-	-	-	2	1	2
3	2	2	2	-	1	1	-	-	-	-	-	-	2	1	2
4	2	2	2	-	2	2	-	-	-	-	-	-	2	1	2
5	3	2	2	-	2	2	-	-	-	-	-	-	2	1	2

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

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	INTELLIGENT CONTROL SYSTEM	L I	P	C	nrs
019MICE05		3 0	0	3	45

Course Objectives

- To understand the structure of Neural Networks and learning algorithms.
- To Implement ANN based Intelligent system for real time engineering application.
- To recognize and implement the structure of a fuzzy PID controller and its components.
- To be value how the concepts of Fuzzification and Defuzzification are used in a fuzzy PID controller.
- To identify with how to create a PID controller using genetic algorithms concepts.

Course Outcomes

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

- CO1 Plan and implementation of intelligent system for industrial process control and Industrial drives control application. (K2)
- CO2 Propose and implementation of intelligent system for Research Activity in Medicine and Biological Sciences. (K3)
- CO3 Devise and implementation of intelligent system in Cancer Research (K4)
- CO4 Produce and implementation of intelligent system for Biosignal Detection, processing Correction. (K5)
- CO5 Create and developing Simple Models from a Relay Feedback. (K6)

UNIT I INTRODUCTION

Motivation, Neural Networks, Rationale for Using NN in Engineering, Fuzzy Logic Control, Rationale for Using FL in Engineering, Evolutionary Computation, Hybrid Systems

UNIT II FUNDAMENTALS OF NEURAL NETWORKS

Introduction, Basic Structure of a Neuron, Model of Biological Neurons, Elements of Neural Networks, Weighting Factors, Threshold, Activation Function, ADALINE, Linear Separable Patterns, Single Layer Perceptron, General Architecture, Linear Classification. Perceptron Algorithm, Multi-Layer Perceptron, General Architecture, Input-Output Mapping, XOR Realization

UNIT III INTRODUCTION TO FUZZY SETS

Basic definitions and relations Introduction, Classical Sets, Classical Set Operations, Properties of Classical Sets, Fuzzy Sets, Fuzzy Membership Functions, Fuzzy Set Operations, Properties of Fuzzy Sets, Alpha-Cut Fuzzy Sets, Extension Principle, Classical Relations vs. Fuzzy Relations

UNIT IV INTELLIGENT AUTO TUNING OF PID CONTROLLLER

Process Reaction Curve and Relay Methods Identification and PID Tuning, Introduction, Developing Simple Models from the Process Reaction, Identification Algorithm for Oscillatory Step Responses, Identification Algorithm for Non-Oscillatory Responses Without Overshoot, Developing Simple Models from a Relay Feedback.

UNIT V FUZZY LOGIC AND GENETIC ALGORITHM METHODS IN PID TUNING

Introduction, Fuzzy PID Controller Design, Fuzzy PI Controller Design, Fuzzy D Controller Design, Fuzzy PID Controller Design, Fuzzification, Fuzzy Control Rules, Defuzzification, A Control Example, Multi-Objective Optimised Genetic Algorithm Fuzzy PID Control, Genetic Algorithm Methods Explained.

Text Books

 Vojislav Kecman, Learning and Soft Computing: Support Vector Machines, Neural Networks, and Fuzzy Logic Models, The MIT Press, 2001

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- 2. Amit Konar, Computational Intelligence: Principles, Techniques and Applications, Springer, 2005
- T. Nanayakkara, F. Sahin, and M. Jamshidi, Intelligent Control Systems with an Introduction to Systems of Systems, CRC Press, 2008

Reference Books

- Sankar K. Pal and Sushmita Mitra, Neuro-Fuzzy Pattern Recognition: Methods in Soft Computing, John Wiley & Sons, 1999
- Antonio Ruano, Intelligent Control Systems Using Computational Intelligence Techniques, Institution of Engineering and Technology, 2005
- 3. Y. Sin and C. Xu, Intelligent Systems: Modeling, Optimization, and Control, CRC Press, 2008
- 4. Dr. K.P. Mohandas, "Modern Control Engineering", revised edition, Sanguine Publishers, Bangalore, 2006.
- 5. Norman S. Nise, "Control System Engineering", John Wiley & Sons, Inc, Sixth Edition, 2010.

Web Resources

- 1. https://nptel.ac.in/courses/108/104/108104049/
- 2. https://nptel.ac.in/courses/108/107/108107115/
- 3. https://nptel.ac.in/courses/107/106/107106081/

COs				Pi	rogra	m O	utcor	nes ((POs))			Prog Outo	gram Spe comes (P	cific SOs)
	P01	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	P011	PO12	PSO1	PSO2	PSO3
1	3	2	2	-	-	-	-	-	-	-	-	-	2	1	2
2	3	2	2	-	-	-	-	-	-	-	-	-	2	1	2
3	2	2	2	-	-	-	-	-	-	-	-	-	2	1	2
4	2	2	2	-	-	-	-	-	-	-	-	-	2	1	2
5	3	2	2	-	-	-	-	-	-	-	-	-	2	1	2

COs/POs/PSOs Mapping

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

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Sri Mauatula Vinayagar Engineering College, Madagadipet, Puducherry-605 107.

Hrs Т Ρ С NON-DESTRUCTIVE TESTING METHODS **U19MCE71** 3 0 0 3

Course Objectives

- To study various Non-Destructive Evaluation and Testing methods, theory and their industrial applications.
- To impart knowledge in various methods of Non Destructive Testing.
- To overview the concepts, principles, and methods employed for NDT of structures and materials.
- To evolve eddy current testing methods. •
- To characterization of ultrasonic testing and acoustic emission systems

Course Outcomes

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

CO1- Observe various Non-Destructive Testing and characterization of industrial components.(K1)

CO2- Interpret basic principles of various NDT methods.(K2)

CO3- Estimate various NDT and industrial applications.(K3)

- CO4- Distinguish NDT methods and other techniques tools.(K4)
- **C05** Understand specifications related to non-destructive testing technology.(K2)

UNIT I INTRODUCTION OF NDT

NDT Versus Mechanical testing, Overview of the Non-Destructive Testing Methods for the detection of manufacturing defects as well as material characterization. Relative merits and limitations, Various physical characteristics of materials and their applications in NDT, Visual inspection – Unaided and aided.

UNIT II SURFACE NDE METHODS

Liquid Penetrant Testing – Principles, types and properties of liquid penetrants, developers, advantages and limitations of various methods, Testing Procedure, Interpretation of results. Magnetic Particle Testing- Theory of magnetism, inspection materials Magnetisation methods, Interpretation and evaluation of test indications, Principles and methods of demagnetization, Residual magnetism. (Image Processing)

UNIT III THERMOGRAPHY AND EDDY CURRENT TESTING

Thermography- Principles, Contact and non-contact inspection methods, Techniques for applying liquid crystals, Advantages and limitation – infrared radiation and infrared detectors, Instrumentations and methods, applications. Eddy Current Testing-Generation of eddy currents, Properties of eddy currents, Eddy current sensing elements, Probes, Instrumentation, Types of arrangement, Applications, advantages, Limitations, Interpretation/Evaluation

UNIT IV ULTRASONIC TESTING AND ACOUSTIC EMISSION

Ultrasonic Testing-Principle, Transducers, transmission and pulse-echo method, straight beam and angle beam, instrumentation, data representation, A-scan, B-scan, C-scan(Conversion). Phased Array Ultrasound, Time of Flight Diffraction. Acoustic Emission Technique – Principle, AE parameters, Applications

UNIT V RADIOGRAPHY

Principle, interaction of X-Ray with matter, imaging, film and film less techniques, types and use of filters and screens, geometric factors, Inverse square, law, characteristics of films - graininess, density, speed, contrast, characteristic curves, Penetrameters, Exposure charts, Radiographic equivalence. Fluoroscopy- Xero-Radiography, Computed Radiography, Computed

Text Books

1. Mayorkinos Papaelias, Fausto Pedro Garcia Marquez, Alexander Karyotakis "Non-Destructive Testing and Condition Monitoring Techniques for Renewable "Butterworth-Heinemann - 2019

45

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- 2. Jean-Paul Balayssac, Vincent Garnier "Non-destructive Testing and Evaluation of Civil Engineering Structures" Elsevier. - 2017.
- 3. Baldev Raj, T. Jayakumar, M. Thavasimuthu Practical Non-destructive Testing, Woodhead 2002

Reference Books

- 1. J. B. Hull, Vernon John "Non-Destructive Testing" Macmillan International Higher Education. 2015
- 2. Nathan Ida, Norbert Meyendorf "Handbook of Advanced Nondestructive Evaluation Springer International Publishing, 2019
- 3. Gerhard Huebschen, Iris Altpeter, Ralf Tschuncky "Materials Characterization Using Nondestructive Evaluation (NDE) Methods" Woodhead Publishing. - 2016
- 4. Songling Huang, Shen Wang "New Technologies in Electromagnetic Non-destructive Testing" Springer. -2016
- 5. Raman Singh, Baldev Raj, U. Kamachi Mudali "Non-Destructive Evaluation of Corrosion and Corrosionassisted Cracking" John Wiley & Sons. - 2019

Web Resources

- 1. https://nptel.ac.in/courses/113/106/113106070/
- 2. https://swayam.gov.in/nd1_noc20_mm07/preview
- 3. https://www.classcentral.com/course/swayam-theory-and-practice-of-non-destructive-testing-9872.
- 4. https://onlinecourses.nptel.ac.in/noc20_mm07/preview.
- 5. https://www.youtube.com/watch?v=oqMXbxk4RHI

COs				Pi	rogra	ım O	utcor	nes ((POs))			Prog Outo	gram Spe comes (P	cific SOs)
	P01	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	1	1	2	2	1	1	2	2	2	1	3	2	3
2	3	2	1	2	2	1	1	2	2	1	2	2	3	2	3
3	3	2	1	1	1	1	2	1	1	1	2	3	3	2	3
4	3	2	1	2	2	2	3	2	2	2	2	1	3	2	3
5	3	2	1	2	2	2	3	2	2	2	2	3	3	2	3

COs/POs/PSOs Mapping

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

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U19MCE72 PRODUCT DESIGN AND DEVELOPMENT L T P C 3 0 0 3

Course Objectives

- To goal of the course is to give an introduction to multidisciplinary aspects of product development and innovation.
- To familiarize basic methodology and tools that can be used in product development projects.
- To Practical problems will be considered in cooperation with companies in order to simulate real product development situations.
- To development of product design architecture.
- To design the innovation of new product methods.

Course Outcomes

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

CO1- Remembering the technical and business aspects of the product development process (K1)

- **CO2**-Summarizing skilled in implementation of gathering data from customers and establish technical specification (K2)
- CO3- Determining product functional decomposition engineering problem solving.(K3)
- **CO4-** Distinguishing the principles behind product modularization.(K2)
- **CO5**-Predicting intellectual property issues in product development and ethical issues in product development.(K3)

UNIT I INTRODUCTION

Need for IPPD – Strategic importance of Product development – integration of customer, designer, material supplier and process planner, Competitor and customer – Behaviour analysis. Understanding customer – prompting customer understanding – involve customer in development and managing requirements – Organization – process management and improvement – Plan and establish product specifications.

UNIT II CONCEPT GENERATION AND SELECTION

Task – Structured approaches – clarification – search – externally and internally – explore systematically – reflect on the solutions and processes – concept selection – methodology – benefits.

UNIT III PRODUCT ARCHITECTURE

Implications – Product change – variety – component standardization – product performance – manufacturability – product development management – establishing the architecture – creation – clustering – geometric layout development – fundamental and incidental interactions – related system level design issues – secondary systems – architecture of the chunks – creating detailed interface specifications.

UNIT IV INDUSTRIAL DESIGN

Integrate process design – Managing costs – Robust design – Integrating CAE, CAD, CAM tools – Simulating product performance and manufacturing processes electronically – Need for industrial design – impact – design process – investigation of for industrial design – impact – design process – investigation of customer needs – conceptualization – refinement – management of the industrial design process – technology driven products – user – driven products – assessing the quality of industrial design.

UNIT V DESIGN FOR MANUFACTURING AND PRODUCT DEVELOPMENT

Definition – Estimation of Manufacturing cost – reducing the component costs and assembly costs – Minimize system complexity – Prototype basics – principles of prototyping – planning for prototypes – Economic Analysis – Understanding and representing tasks – baseline project planning – accelerating the project – project execution.

(9 Hrs)

(9 Hrs)

(9 Hrs)

(9 Hrs)

188

Hrs

45

Text Books

- 1. Dr. Ali Jamnia "Introduction to Product Design and Development for Engineers" CRC Press-2018
- Vivek D. Bhise "Automotive Product Development: A Systems Engineering Implementation" CRC Press-2017
- 3. Karl T. Ulrich, Steven D. Eppinger Product Design and Development McGraw Hill Education, McGraw Hill Education (India) Private Limited. 2016

Reference Books

- 1. Bjarki Hallgrimsson "Prototyping and Modelmaking for Product Design "Laurence King Publishing, 2019
- 2. Peter N. Golder, Debanjan Mitra "Handbook of Research on New Product Development" Edward Elgar Publishing. 2018
- 3. Regine M. Gilbert "Inclusive Design for a Digital World: Designing with Accessibility in Mind" Apress. 2019
- Omera Khan "Product Design and the Supply Chain: Competing Through Design "Kogan Page, 2018 Steven Eppinger, Karl Ulrich, Maria C. Yang "Loose Leaf for Product Design and Development "McGraw-Hill Education, 2019

Web Resources

- 1. https://swayam.gov.in/nd1_noc20_me12/preview
- 2. https://nptel.ac.in/courses/112/107/112107217/
- 3. https://www.mooc-list.com/course/medtech-trends-and-product-design-futurelearn.
- 4. https://nptel.ac.in/noc/courses/noc17/SEM1/noc17-me16/
- 5. https://www.youtube.com/watch?v=HN9GtL21rb4

COs				Pi	rogra	ım O	utcor	nes (POs)			Prog Outo	gram Spe comes (P	cific SOs)
	P01	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	1	-	-	-	-	-	-	-	2	1	3	2	3
2	3	2	1	-	-	-	-	-	-	-	2	2	3	2	3
3	3	2	1	-	-	-	-	-	-	-	2	3	3	2	3
4	3	2	1	-	-	-	-	-	-	-	2	1	3	2	3
5	3	2	1	-	-	-	-	-	-	-	2	3	3	2	3

COs/POs/PSOs Mapping

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Hrs Т Ρ С L **U19MCE73** AUTOMATED MATERIAL HANDLING SYSTEMS 3 0 0 3 45

Course Objectives

- To study about the fundamentals of automation in material handling
- To provide knowledge on common material handling systems
- To impart knowledge on automated material handling systems like RGVS, AGVS, AS/RS, etc.
- To provide knowledge on transfer mechanisms, conveyors, part feeding devices, robots in material handling ٠
- To discuss various case studies related to automated material handling •

Course Outcomes

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

CO1- Acquire knowledge on automation in material handling systems (K1)

CO2- Acquire knowledge on RGVS, AGVS, AS/RS (K2)

- **CO3** Familiarize on robots in material handling (K2)
- **CO4-** Recognize the automated systems with real time applications (K2)

CO5- Understand the Principles of work holding devices and apply in real time Applications (K2)

UNIT I INTRODUCTION

Introduction to work handling concepts in manufacturing - configuration, symbolic representation, workpiece characteristics and their significance, Facilities planning process, Facilities design and diagrams, Storage facilities planning, Materials flow, Activity relationship, Space requirements, Facility lay out -computerized lay outs, Evaluation and selection of alternatives, Defined materials handling, Storage –open and closed storage systems, Bulk loading, Unloading, Shipping and Receiving systems and operations.

UNIT II COMMON MATERIAL HANDLING EQUIPMENT'S

Concepts of Unit Loads, Material handling and Storage equipment's operation and selection, Containers, Pallets, Conveyor systems, Industrial trucks, Wagon tipplers, Transporters, Stackers, Reclaimers, Silos & hoppers and their accessories, Ropeways, Ship loaders, Cable cranes, Container handling systems, Electric lifts & Hoists, EOT cranes, Elevators, Material handling equipment's in Steel mills, Power plants, Mines, Automobile and Transport 27 CIM-2013 SRM(E&T) Industries, Large scale Constructions etc.,

UNIT III AUTOMATION OF MATERIAL HANDLING

Automated feeding arrangements for discrete parts, their design based in work piece requirements, orienting methods, one by one feeding, agonizing, stapling etc., - Feeding continuous material liquids, granules etc.,-Automated assembly system, elements, configuration design, details and control – Special feeding mechanisms – Automated inspection and their design

UNIT IV CLASSIFICATION OF AUTOMATED SYSTEMS

Concepts of Unit Built Machines (UBM) - classification and elements, Power Units, self-contained and separate feed type, Change over UBMs, Transfer lines - classification and their components, Automated systems for handling and transfer of prismatic, axis symmetric parts and asymmetric parts in transfer lines, Case studies on transfer lines – interlocked, palletized and flexible inter linkage transfer lines, control systems – SWARF handling and disposal systems.

UNIT V AUTOMATED MATERIAL HANDLING EQUIPMENT'S

Automated handling and storage systems in manufacturing environment, Rail Guided Vehicles (RGVs), Automated Guided Vehicles (AGVs), Applications of RGVs and AGVs, Automated Storage a Retrieval Systems

(9 Hrs)

(9 Hrs)

(9 Hrs)

(9 Hrs)

(AS / RS), AS / RS in the Automated factory, Considerations for planning an AS /RS system, Applications of AS / RS, Principles of work holding devices – Modular fixturing, Flexible fixturing systems – Fixturing for FMS, Robots and their applications in handling and storage.

Text Books

- 1. Bandyopadhyay, Susmita "Intelligent Vehicles and Materials Transportation in the Manufacturing" IGI Global.-2017
- 2. Hamed Fazlollahtabar, Mohammad Saidi-Mehrabad "Autonomous Guided Vehicles: Methods and Models for Optimal Path Planning" Springer.– 2015

Reference Books

- 1. K. C. Arora "Aspects of Materials Handling" Laxmi Publications, 2011
- Eugene L. Magad "Total Materials Management: Achieving Maximum Profits Through Materials" Springer Science & Business Media. - 2013
- 3. J.M. Tanchoco" Material Flow Systems in Manufacturing" Springer Science & Business Media- 2012
- Robert J. Graves, Leon F. McGinnis, Mickey R. Wilhelm "Material Handling '90" f Springer Science & Business Media. – 2012
- 5. P.J. O'Grady "Controlling Automated Manufacturing Systems" Springer Science & Business Media.- 2012

Web Resources

- 1. https://nptel.ac.in/courses/112/102/112102011/
- 2. https://swayam.gov.in/nd1_noc20_me44/preview
- 3. https://www.youtube.com/watch?v=iVPbB8YRM_E

COs/POs/PSOs Mapping

COs				P	rogra	m O	utcor	nes (POs)			Prog Outo	gram Spe comes (P	cific SOs)
	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	P011	PO12	PSO1	PSO2	PSO3
1	3	2	1	-	-	-	-	-	-	-	2	1	3	2	3
2	3	2	1	-	-	-	-	-	-	-	2	2	3	2	3
3	3	2	1	-	-	-	-	-	-	-	2	3	3	2	3
4	3	2	1	-	-	-	-	-	-	-	2	1	3	2	3
5	3	2	1	-	-	-	-	-	-	-	2	3	3	2	3

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		L		Р	C	Hrs
UTSINICE/4	AUTONOMOUS MOBILE ROBOTS	3	0	0	3	45

Course Objectives

- 1. To students will learn about basics and applications in robots
- 2. To discuss technical definitions, laws, concept and theories.
- 3. To study technical terminology and conventions.
- 4. To understand localization of mobile robot.
- 5. To train path planning and navigation architectures

Course Outcomes

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

- CO1- Discuss about the basics of robot cognition and perception (K2)
- CO2- Understand the kinematic motions calculations and its functions. (K2)
- CO3- Apply the machine vision and motion concept of image processing (K3)
- CO4- Develop knowledge about simultaneous localization and mapping based techniques and paradigms. (K3)
- **CO5** Analyze the various path planning techniques by briefing about the robot's environment and explaining about the programs used (K3)

UNIT I INTRODUCTION

Introduction, Locomotion: Key issues for locomotion, legged Mobile Robots-Leg configurations and stability-Examples of legged robot locomotion, Wheeled Mobile Robots-Wheeled locomotion-case studies

UNIT II MOBILE ROBOT KINEMATICS AND WORKSPACE

Introduction, Kinematic Models and Constraints-Representing robot position-Forward kinematic models-Wheel kinematic, Examples: robot kinematic models and constraints, Mobile Robot Manoeuvrability. Mobile Robot Workspace-Degrees of freedom-Path and trajectory considerations, Motion Control - Open loop control-Feedback control

UNIT III PERCEPTION AND LOCALIZATION

Sensors for Mobile Robots: Sensor classification - Characterizing sensor performance – Wheel/motor sensors - Heading sensors – Ground based beacons - Active ranging – Motion/speed sensors - Vision-based sensors, Representing Uncertainty, Feature Extraction: Feature extraction based on range data (laser, ultrasonic, vision-based ranging) - Visual appearance-based feature extraction,

UNIT IV MOBILE ROBOT LOCALIZATION

Introduction - The Challenge of Localization: Noise and Aliasing, Localization-Based Navigation versus Programmed Solutions Map Representation, Probabilistic Map-Based Localization, Other Examples of Localization Systems, Autonomous Map Building.

UNIT V PLANNING AND NAVIGATION

Introduction, Competences for Navigation: Planning and Reacting - Path planning Obstacle avoidance, Navigation Architectures: Modularity for code reuse and sharing - Control localization - Techniques for decomposition - Case studies: tiered robot architectures

Text Books

- 1. Roland Siegwart, IllahR. Nourbakhsh, "Autonomous Mobile Robots, The MIT Press, 2014.
- 2. John.J.Craig, "Introduction to Robotics: Mechanics &control", Pearson Publication, Fourth edition, 2018
- 3. Eugene Kagan, Irad Ben-Gal, Nir Shvalb, Autonomous Mobile Robots and Multi-Robot Systems, Wiley, 2019

(9 Hrs)

(9 Hrs)

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Reference Books

- 1. Sathya Ranjan Deb, "Robotics Technology & flexible Automation", Second edition, Tata McGraw-Hill Publication, (2nd edition) 2017.
- 2. Xiaorui Zhu, Youngshik Kim, Mark A. Minor "Autonomous Mobile Robots in Unknown Outdoor Environments" CRC Press. 2017
- 3. Ingemar J. Cox, Gordon T. Wilfong "Autonomous Robot Vehicles" Springer Science & Business Media 2012
- Nikolaus Correll" Introduction to Autonomous Robots: Kinematics, Perception, Localization and Planning" Magellan Scientific, 2016
- 5. Shawn M. Walsh, Michael S. Strano "Robotic Systems and Autonomous Platforms: Advances in Materials and Manufacturing "Elsevier Science, 2018

Web Resources

- 1. https://swayam.gov.in/nd1_noc19_me74/preview
- 2. https://nptel.ac.in/courses/112/105/112105249/
- 3. https://www.mooc-list.com/course/autonomous-mobile-robots-edx
- 4. http://www.mobilerobots.org.
- 5. https://www.youtube.com/watch?v=Za49iugVQWg

COs/POs/PSOs Mapping

COs				Pi	rogra	ım O	utcor	nes ((POs))			Prog Outo	gram Spe comes (P	cific SOs)
	PO1	PO2	PO3	PO4	PO5	P06	P07	PO8	PO9	PO10	P011	PO12	PSO1	PSO2	PSO3
1	3	2	1	1	2	2	1	1	2	2	2	1	3	2	3
2	3	2	1	2	2	1	1	2	2	1	2	2	3	2	3
3	3	2	1	1	1	1	2	1	1	1	2	3	3	2	3
4	3	2	1	2	2	2	3	2	2	2	2	1	3	2	3
5	3	2	1	2	2	2	3	2	2	2	2	3	3	2	3

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

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U19MCE75 DIGITAL IMAGE PROCESSING AND MACHINE L T P C Hrs VISION 3 0 0 3 45

Course Objectives

- To introduce the fundamentals of Digital Image Processing, including image acquisition.
- To discuss simple image enhancement techniques in various domains.
- To study various image segmentation and representation techniques
- To understand the fundamentals of machine vision system.
- To familiarize the Industrial applications of machine vision.

Course Outcomes

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

CO1- interpret image in its numeric and graphical form and Understand geometric relationship of pixels (K1)

CO2- Write simple codes for improving image quality (K2)

CO3- Extracting useful information from image contents through processing (K3)

CO4- Analysis the needs of a machine vision system (K3)

CO5- Developing machine vision system based on the application. (K3)

UNIT I INTRODUCTION

Definition, Digital image representation, fundamental steps in image processing, elements of digital image processing systems, image acquisition, storage, processing, communication and display. Digital Image Fundamentals - Structure of the human eye, image formation, a simple image model, some basic relationships between pixels, neighbours of a pixel, connectivity, Labelling, distance measures, imaging geometry

UNIT II IMAGE ENHANCEMENT

Image enhancement in the spatial domain - Basic gray level transformations, histogram processing, Enhancement using arithmetic/ logic operations, Basics of spatial filtering-comparison between smoothing and sharpening spatial filters. Image Enhancement in the frequency domain - 1D Fourier transform, 2D Fourier transform and its Inverse-Smoothing & sharpening frequency domain filters (Ideal, Butterworth, Gaussian)-homo-morphic filtering.

UNIT III IMAGE SEGMENTATION

Edge detection, Edge linking via Hough transforms – Thresholding - Region based segmentation – Region growing – Region splitting and merging – Morphological processing- erosion and dilation, Segmentation by morphological watersheds – basic concepts – dam construction - Watershed segmentation algorithm.

UNIT IV MACHINE VISION

Introduction, definition, Machine vision components, hardware and algorithms, image function and characteristics, segmentation, data reduction, feature extraction, edge detection, image recognition and decisions, machine learning, CCD line scan and area scan sensor, Videcon and other cameras, Triangulation geometry, resolution passive and active stereo imaging, laser scanner, data processing.

UNIT V INDUSTRIAL APPLICATIONS OF MACHINE VISION

Application of machine vision such as inspection of parts, identification, industrial robot control. Industrial machine vision in production and services, structure of industrial machine vision, rules of thumb, illumination, optics, image processing, interfacing machine vision system, vision system calibration.

Text Books

1. Rafael C. Gonzalez and Richard E. Woods, "Digital Image Processing", Pearson Education India, 2018.

(9 Hrs)

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- 2. Milan Sonka, Vaclav Hlavac, Roger Boyle, "Image Processing, Analysis, and Machine Vision", 2015.
- 3. Gerardus Blokdyk, "Machine Vision A Complete Guide 2019 Edition", 5STARCooks, 2019.

Reference Books

- 1. Alan V. Oppenheim, Ronald W. Schafer, "Discrete-Time Signal Processing", Pearson Education, 2014.
- 2. Anil K. Jain, "Fundamentals of Digital Image Processing", Prentice Hall of India, Digitized 2007.
- 3. Borko Furht, Esad Akar, Whitney Angelica Andrews, "Digital Image Processing: Practical Approach", Springer International Publishing, 2018.
- 4. Poonam Yadav, Abhishek Yadav, "Digital Image Processing" Kindle Edition, Laxmi Publisher, 2009.
- 5. Jürgen Beyerer, Fernando Puente León, Christian Frese, "Machine Vision Automated Visual Inspection: Theory, Practice and Applications", Springer Berlin Heidelberg, 2015.

WEB RESOURCES

- 1. https://swayam.gov.in/nd1_noc19_ee55/preview
- 2. https://nptel.ac.in/courses/117/105/117105079/
- 3. https://www.coursera.org/learn/digital
- 4. https://www.mooc-list.com/tags/image-processing
- 5. https://www.youtube.com/watch?v=1I6kfkY4GyQ

COs/POs/PSOs Mapping

COs				Р	rogra	m O	utcor	nes (POs))			Prog Outo	gram Spe comes (P	cific SOs)
	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	P011	PO12	PSO1	PSO2	PSO3
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2	3	2	1	-	-	-	-	-	-	-	2	2	3	2	3
3	3	2	1	-	-	-	-	-	-	-	2	3	3	2	3
4	3	2	1	-	-	-	-	-	-	-	2	1	3	2	3
5	3	2	1	-	-	-	-	-	-	-	2	3	3	2	3

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

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		L	1	Р	C	Hrs
UT9WICE80	RELIABILITY ENGINEERING	3	0	0	3	45

Course Objectives

- To apply engineering knowledge and specialist techniques to prevent or to reduce the failures
- To identify and correct the causes of failures that occur despite the efforts to prevent them
- To determine ways of coping with failures that occur, if their causes have not been fixed
- To apply methods for estimating the likely reliability of new software and for analyzing reliability data.
- To calculate the machine maintenance and of service of the equipment.

Course Outcomes

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

CO1 – Understand major concepts of reliability prediction. (K2)

- CO2 Analyze statistical experiments leading to reliability modeling.(K2)
- CO3 Identify reliability testing components.(K3)
- CO4 Apply reliability theory to assessment of reliability in engineering design.(K3)
- CO5 Evaluate reliability standard systems.(K4)

UNIT I INTRODUCTION

Concept of reliability, reliability indices, component reliability –Introduction, non repairable component, hazard models, components with preventive maintenance, repairable components.

UNIT II SYSTEM RELIABILITY

Network methods, Introduction; series configuration parallel configuration, mixed configuration, the r out of n configuration d composition method minimal-tie and minimal –cut methods logic diagrams.

UNIT III REDUNDANCY TECHNIQUES

Element redundancy, Unit redundancy, Standby redundancies. Markov analysis. System Reliability Analysis – Enumeration method, Cut-set method, Success Path method.

UNIT IV FAILURE MODES

System reliability state space method system representation basic concepts state probability state frequency and duration system of two independent component two components with dependent failures combining states failure effect analysis state enumeration methods

UNIT V RELIABILITY EVALUATION

System reliability evaluation using probability distribution series system parallel system partially redundant system mean time to failure stand by system

Text Books

- 1. Mangey Ram , Reliability Engineering Methods and Applications, CRC Press/Taylor and Francis Group, 2018.
- 2. K. Gupta, Reliability, Maintenance and Safety Engineering, University Science Press · 2009
- 3. Charles E. Ebeling ,An Introduction to Reliability and Maintainability Engineering, Waveland Press, Third Edition, 2019

Reference Books

- 1. Alessandro Birolini, Reliability Engineering Theory and Practice, Springer Berlin Heidelberg · 2013
- 2. Edgar Bradley, Reliability Engineering A Life Cycle Approach, CRC Press, 2016
- 3. Kailash C. Kapur, Michael Pecht, Reliability Engineering, Wiley, 2014

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- 4. Pethuru Raj Chelliah, Shreyash Naithani, Shailender Singh, Practical Site Reliability Engineering, Packt Publishing, 2018
- 5. Singiresu S. Rao, Reliability Engineering, Pearson Education, 2014

Web Resources

- 1. https://onlinecourses.nptel.ac.in/noc20_mg43/preview
- 2. https://nptel.ac.in/courses/114/106/114106041/
- 3. https://onlinecourses.nptel.ac.in/noc20_mg18/preview
- 4. https://onlinecourses.nptel.ac.in/noc20_mg18/preview
- 5. https://onlinecourses.nptel.ac.in/noc20_me26/preview

COs				U	Progr	am O	utcon	nes (P	Os)				Prog Outco	ram Sp omes (F	ecific PSOs)
	P01	PO1 PO2 PO3 PO4 PO5 PO6 PO7 PO8 PO9 PO10 PO11 PO												PSO2	PSO3
1	3	3	3	3	-	-	-	-	2	-	2	3	2	3	1
2	3	3	2	2	-	-	-	-	-	-	1	3	2	2	3
3	3	3	2	2	-	-	-	-	2	-	2	3	2	1	3
4	3	3	3	2	-	-	-	-	1	-	1	3	1	2	3
5	3	3	3	2	-	-	-	-	1	-	2	3	2	2	3

COs/POs/PSOs Mapping

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

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U19MCE81 AUTOMATION IN MANUFACTURING SYSTEMS

Course Objectives

- To impart knowledge in the field of Automated Manufacturing system.
- To illustrate the basic concepts of automation in production lines.
- To understand the fundamentals of automation in multi station assembly machines
- To describe the importance of automated material handling and storage systems.
- To understand automated inspection principles and strategies in manufacturing.

Course Outcomes

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

- CO1 Understand the basic types, levels, strategies of automation. (K1)
- CO2 Understand basic components and their functions of automated production line system.(K2)
- CO3 Apply the quantitative analysis and assembly systems.(K2)
- CO4 Examine various storage system and transportation requirements of automated systems.(K2)
- CO5 Evaluate the process control strategy to an automated system.(K3)

UNIT I INTRODUCTION

Facilities - Manual work systems, worker - machine systems and automated systems. Manufacturing support systems, Automation in Production systems - Automated Manufacturing systems, Computerized manufacturing support systems, Manual labour in Production systems, Automation principles and strategies.

UNIT II AUTOMATED PRODUCTION LINES

Fundamentals - System configurations, work part transfer mechanisms, Storage buffers, and Control of the production line. Applications - Machining systems and System Design Considerations. Analysis of Transfer lines - Transfer lines with No internal parts storage, Transfer lines with internal storage buffers.

UNIT III AUTOMATED ASSEMBLY SYSTEMS

System configurations, Parts delivery at workstations and applications, quantitative analysis of assembly systems - Parts Delivery System at Workstations, Multi - Station Assembly Machines, Single Station Assembly Machines, Partial Automation.

UNIT IV AUTOMATED MATERIAL TRANSPORT & STORAGE SYSTEMS

Automated Material Transport & Storage systems: Automated Guided Vehicle (AGV) Systems, Types and applications, Vehicle Guidance Technology, Vehicle Management and Vehicle safety. Automated Storage and Retrieval Systems (ASRS) and Carousel Storage Systems.

UNIT V AUTOMATEDINSPECTIONSYSTEMS

Quality in Design and manufacturing, inspection principles and strategies, automated inspection, contact Visoncontact, CMM. Manufacturing support systems. Quality function deployment, computer aided process planning, concurrent engineering, shop floor control, just in time and lean production.

Text Books

- 1. Beno Benhabib Manufacturing: Design, Production, Automation, and Integration, CRC Press, 2009.
- 2. R. Thomas Wright, Mich+ael Berkeihiser, 'Manufacturing and Automation Technology', 2011.
- 3. Mikell P. Groover, 'Automation, Production Systems and Computer-Integrated Manufacturing', Pearson Publisher, Fourth Edition, 2016.

Hrs

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(9 Hrs)

(9 Hrs)

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(9 Hrs)

Reference Books

- 1. P. Radhakrishnan, S. Subramanyan and V. Raju, 'CAD/CAM/CIM', New Age International (P) Ltd., New Delhi, 2009.
- 2. S.R.Deband Sankha Deb, 'Robotics Technology and Flexible Automation', TataMcGrawHill, Second Edition, NewDelhi, 2010.
- 3. Peter Corke, 'Robotics, Vision and Control:Fundamental Algorithms in MATLAB', Springer, 2011.
- 4. Nicholas Odrey, Mikell P Groover, Roger Nagel, Ashish Dutta, 'Industrial Robotics(SIE): Technology, Programming and Applications',McGraw Hill, 2012.
- 5. Caustic Kumar (Editor), Divya Zindani (Editor), J. Paulo Davim,' Digital Manufacturing and Assembly Systems in Industry 4.0', CRC Press, 2021

Web Resources

1.https://nptel.ac.in/courses/108/105/108105063/

2.https://www.automationmag.com/

3.https://www.springer.com/gp/book/9783319771786.

4.https://library.automationdirect.com/industrial-automation-top-10-trends/

5. https://nptel.ac.in/courses/112/102/112102011/

COs/POs/PSOs Mapping

COs				P	rogra	im O	utcor	nes (POs)			Prog Outo	gram Spe comes (P	cific SOs)
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3	3	2	1	1	1	1	2	1	1	1	3	2	3	1	3
4	3	2	1	2	2	2	3	2	2	2	3	2	3	2	3
5	3	2	1	2	2	2	3	2	2	2	3	2	3	2	3

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U19MCE82	MECHATRONICS SYSTEM APPLICATIONS	L 3	Т 0	P 0	C 3	Hrs 45
Course Objectiv	ves	· ·	•	•	•	
• To impart know	vledge in the field of modern mechatronics components					
• To illustrate th	e basic concepts of mechatronics systems design					
• To understand	the fundamentals and elements of mechatronics systems					
• To describe th	e importance of mechatronics system for various applications.					
To understand	the implementation of mechatronics systems in manufacturing.					
Course Outcom	nes					
After completion	of the course, the students will be able to					
CO1 - understand	the modern mechatronics components.					
CO2 - understand	the principles and alternatives for mechatronics systems design (K	2)				
CO3 - understand	the elements of mechatronics systems (K3)					
CO4 - familiarise r	nechatronics system for various applications. (K3)					
CO5 - Understand	I the various applications, justification and implementation of mecha	tronics	s sys	tems	s. (K2	2)
	JCTION					(9 Hrs)
Introduction to bas	sics mechatronics components - Sensors, Actuators, Micro-controlle	ers. PL	C's			

UNIT II BIOMIMICRY USING MECHATRONICS

Biomimicry – Introduction, Concept, Advantages. Bio-Inspired Robots – Mechanisms, Controls, Actuations. Case Studies - Wall-Climbing Caterpillar Robot, Hexapedal robot inspired by cockroach locomotion.

UNIT III MEDICAL APPLICATIONS

Introduction to mechatronics for medical applications, Importance of Mechatronics in Medical Applications, Applications of Mechatronics in Medicine - Robotics in Medicine, Smart Instruments and Probes. Case Studies -Handheld Snake-Like Robots, 3D Printed Skull.

UNIT IV SAFETY, SECURITY AND DEFENCE APPLICATIONS

Industrial safety systems, Smart security systems, Mechatronics in defence, Artificial Intelligence in security systems. Case Studies: Cobots (Collaborative Robots), Smart Doors, Heat-seeking missiles.

UNIT V MANUFACTURING APPLICATIONS

Introduction to manufacturing systems, Retrofitting, CNC machines, Rapid Prototyping, Industrial Robots. Case Studies – Laser cutting, Quality inspecting robots.

Text Books

- 1. W Bolton, Mechatronics, Pearson Education, Fourth Edition, 2011.
- 2. Siamak Najarian, Javad Dargahi, Ph.D.,, Goldis Darbemamieh, Siamak Hajizadeh Farkoush, Mechatronics in Medicine: A Biomedical Engineering Approach, 2012 McGraw-Hill Education, ISBN: 9780071768962

Reference Books

- 1. David G. Alciatore & Michael B Histand., Introduction to Mechatronics and Measurement systems, Tata McGraw Hill, 2003
- 2. Mechatronic Systems, Applications Edited by Annalisa Milella, Donato Di Paola and Grazia Cicirelli, 2010 Inthe. www.intechweb.org, ISBN 978-953-307-040-7

(9 Hrs)

(9 Hrs)

(9 Hrs)

Academic Curriculum and Syllabi R-2019 Web Resources

- 1. http://controlmanuals.com/files/Automation/Mechatronics-p1.html
- 2. www.mooc-list.com/course/me209x-thermodynamics-edx
- 3. http://www.springer.com/in/book/9783642175305

COs/POs/PSOs Mapping

COs				Pi	rogra	im O	utcor	nes ((POs))			Prog Outo	gram Spe comes (P	cific SOs)
	PO1	PO2	PO3	PO4	PO5	P06	P07	PO8	PO9	PO10	P011	PO12	PSO1	PSO2	PSO3
1	3	2	2	1	1	2	2	1	1	2	3	2	3	2	3
2	3	2	2	1	2	2	1	1	2	2	3	2	3	2	3
3	3	2	2	1	1	1	1	2	1	1	3	2	3	1	3
4	3	2	2	1	2	2	2	3	2	2	3	2	3	2	3
5	3	2	2	1	2	2	2	3	2	2	3	2	3	2	3

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U19MCE83	ROBOTICS AND MACHINE VISION	L 3	T 0	P 0	C 3	Hrs 45
Course Objectives		5	U	U	5	73
To learn kinematics	equation for robots.					
• To introduce the des	ign philosophy for grippers for various robotic applications					
• To analyze the sense	ors and actuators for different robotic applications.					
To apply performance	e criteria in the design of basic amplifier circuits and verify that	t the cr	iteria	a we	re me	t.
To learn operations of	on digital images.					
To analyze and evaluation	uate performance of images and work with multiple images.					
Course Outcomes						
After completion of the	he course, the students will be able to					
CO1 - Derive kinemation	cs equation for robots (K2)					
CO2 - Design appropri	ate grippers for various robotic applications.(K2)					
CO3 - Select appropria	ate sensors and actuators for different robotic applications.(K3)				
CO4 - Perform operati	ions on digital images.(K3)					
CO5 – Extract features	s from images and work with multiple images.(K4)					
UNIT I INTRODUC	TION					(9 Hrs)
Introduction to robotic Representation. Basics	cs, Robot Transformations – Rotation Matrix – Forward ar s of Trajectory planning	ıd Inve	erse	Kine	ematio	xs – DH
UNIT II END EFFEC	CTORS					(9 Hrs)

Types of end effectors –Mechanical grippers –Types of Gripper mechanisms–Grippers force analysis –Other types of Grippers –Vacuum cups –Magnetic Grippers –Adhesive Grippers –Robot end effector interface.

UNIT III SENSORS & ACTUATORS

Functions of Drive Systems - AC, DC Motors - Pneumatic and Hydraulic Actuators - Selection of Sensors -Classification of Sensors - Data Acquisition

UNIT IV IMAGE PROCESSING

Image Acquisition – Operation on images: Mondic – Diadic – Spatial – Morphology – Boundary detection – Hit and miss transform - Shape changing: Cropping - resizing - pyramids - warping

UNIT V USING MULTIPLE IMAGES

Region Features: Classification – Representation – Description. Line Features – Point features - Feature correspondence - Geometry of multiple views - Stereo vision - Structure and motion, interfacing with industrial robots

Text Books

- 1. Peter Corke, Robotics, Vision and Control: Fundamental Algorithms in MATLAB, 2nd edition, Springer, 2017
- 2. John Billingsley and Robin Bradbeer, Mechatronics and Machine Vision in Practice, Springer, 2007

Reference Books

- 1. González, Rafael C. and Woods, Richard Eugene, Digital Image Processing, 3rd Edition, Prentice Hall, 2008.
- 2. Davies, E.R., Machine Vision: Theory, Algorithms, Practicalities , Academic Press, London, 2012

(9 Hrs)

(9 Hrs)

Academic Curriculum and Syllabi R-2019 **Web Resources**

- 1. http://zums.ac.ir/files/research/site/ebooks/Robotics/Robot%20Vision.pdf
- 2. https://www.mooc-list.com/course/robotic-vision-qut

COs/POs/PSOs Mapping

COs				P	rogra	m O	utcor	nes (POs))			Prog Outo	gram Spe comes (P	cific SOs)
	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	P011	PO12	PSO1	PSO2	PSO3
1	3	2	1	1	2	2	1	1	2	2	3	2	3	2	3
2	3	2	1	2	2	1	1	2	2	1	3	2	3	2	3
3	3	2	1	1	1	1	2	1	1	1	3	2	3	3	3
4	3	2	1	2	2	2	3	2	2	2	3	2	3	2	3
5	3	2	1	2	2	2	3	2	2	2	3	2	3	2	3

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		L		Ρ	C	nrs
UT9WICE04	PROJECT MANAGEMENT	3	0	0	3	45
Course Objectives						

Course Objectives

- To understand the concepts of Project Management for planning to execution of projects.
- To understand the time needed to successfully complete a project, considering factors such as task dependencies and task lengths
- To understand the feasibility analysis in Project Management and network analysis tools for time estimation.
- To comprehend the fundamentals of Contract Administration, Costing and Budgeting.
- To make them capable to analyze, apply and appreciate contemporary project management tools and methodologies in Indian context.

Course Outcomes

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

CO1 - Explain project, project management, life cycle and influencing factors (k1)

- CO2 Analyze and manage project formulation in projects parametrics (K2)
- CO3 Manage time in projects through Gantt charts, CPM and PERT techniques, (K3)
- **CO4** Optimize resources of projects using scheduling, fast tracking and re-estimation techniques (K3)

CO5 - Identify risk management in projects with emerging trends in project management (K2)

UNIT I PROJECT AND ITS PROCESS

Define project and process, boundaries of project, Objectives and functions of Project management, characteristics and types of projects, organization structure / styles, roles of project management group, project management office and its role, project knowledge area, project integration- process group interaction. Project flow, project life cycle- influencing factors.

UNIT II PROJECT FORMULATION

Generation and Screening of PM ideas- Triple Constraint - Time, Cost and Scope. TOR/ Project Charter/ SOW (Statement of Work) - Creation of project Charter. Preliminary planning and estimate. Types of estimate- Ball park, Parametric and Bottom up estimates. Project Presentation & Approval - Detailed Project Report & Approval (Technical and Budget Sanction).

UNIT III TIME MANAGEMENT

Project Scope Management - Work break down structure- Activity/ Task- Events- Case study. Project planning tools Rolling wave planning. Gantt Charts, Milestone chart, Program Progress chart- Creating milestone plan. Project Network- Fulkerson's rules - Activity-On-Arrow and Activity- On - Node networks. Analyze project time-Critical path method.

UNIT IV RESOURCE MANAGEMENT AND OPTIMIZATION

Types of resource - Balancing of resource - Resource Smoothing technique - Time constraint. Resource leveling technique- Resource constraint- Case study.

Resource optimization, Types of cost - Direct, Indirect and Total Cost. Variation of Cost with time. Schedule Compression Techniques- Crashing, Fast Tracking & Re-estimation- Crash time and crash cost. Optimize project cost for time and resource. CPM Cost model.

UNIT V RISK MANAGEMENT

Risk management - meaning and process, Risk identification and analysis techniques- FMEA and SWOT analysis- Risk reporting and monitoring- Case study.

(9 Hrs)

(9 Hrs)

(9 Hrs)

(9 Hrs)

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Text Books

1. Dennis Lock, Project Management, Taylor & Francis, 2017

2. Albert Lester Project Management, Planning and Control Managing Engineering, Construction and Manufacturing Projects to PMI, APM and BSI Standards, Elsevier/Butterworth-Heinemann 2007

Reference Books

- 1. Terry Schmidt Strategic Project Management Made Simple Practical Tools for Leaders and Teams, Wiley, 2009.
- 2. R. B. Khanna Project Management, PHI Learning 2011
- 3. Garth G.F. Ward Effective Project Management Guidance and Checklists for Engineering and Construction, Wiley, 2018.

Web Resources

- 1. https://nptel.ac.in/courses/110/104/110104073/
- 2. https://nptel.ac.in/courses/110/107/110107081/
- 3. https://www.youtube.com/watch?v=5pwc2DYIKQU
- 4. https://www.youtube.com/watch?v=wJ8HZ7hqUs8

COs/POs/PSOs Mapping

COs				Pi	rogra	im O	utcor	nes ((POs))			Prog Outo	gram Spe comes (P	cific SOs)
	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	1	-	-	-	-	-	-	-	3	2	3	2	3
2	3	2	1	-	-	-	-	-	-	-	3	2	3	2	3
3	3	2	1	-	-	-	-	-	-	-	3	2	3	1	3
4	3	2	1	-	-	-	-	-	-	-	3	2	3	2	3
5	3	2	1	-	-	-	-	-	-	-	3	2	3	2	3

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U19MCE85 POWER PLANT INSTRUMENTATION AND CONTROL L T P C Hrs 3 0 0 3 45

Course Objectives

- To provide an overview of different methods of power generation with a particular stress on thermal power generation.
- To bring out the various processes involved in power generation plants.
- To provide knowledge about the controlling combustion and draught.
- To impart knowledge about the different types of controls for feed water and steam.
- To familiarize the student with the methods of monitoring different parameters and their control.

Course Outcomes

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

CO1 - Demonstrate knowledge of power plants and instrumentations for controlling.(K1)

- CO2 Identify various elements involved in steam generation for power plants.(K2)
- CO3 Control the combustion to vary the steam generation.(K3)
- CO4 Control the quantity of steam generation and power generation.(K3)

CO5 - Design proper control system with required instrumentation for controlling the power generation.(K3)

UNIT I OVERVIEW OF POWER GENERATING STATIONS AND STEAM GENERATION (9 Hrs)

Brief survey of different methods of conventional power generation (hydro, thermal and nuclear)-Importance of instrumentation in power generating stations.

Steam generation in thermal power plants: Process of power generation in coal-fired and oil fired in thermal power plants-Nature of steam-Thermal efficiency-Gas turbine and combined cycle plants-Steam turbine and use-Steam turbine.

UNIT II CIRCUITS IN STEAM GENERATION AND DEMAND FOR STEAM GENERATION (9 Hrs)

Water, fuel, air and flue gas circuits: The condensate and feed water system - Feed pumps and valves-The water and steam circuits

Setting the demand for the steam generator: nature of the demand-Setting the demand in power stations applications-Master demand in power station applications-Load demand in combined heat and power plants-Waste to energy plants

UNIT III COMBUSTION AND DRAUGHT CONTROL

Principles of combustion control, Working with multiple fuels, control of coal mills, Draught control, Binary control of the combustion system

UNIT IV FEED WATER CONTROL AND STEAM-TEMPERATURE CONTROL

Feed-water control: principles of feed-water control - One, two and three-element control, Measuring and displaying the drum level, mechanisms used for feed-water control, Pumps, De-aerator control

Steam-temperature control: need of steam-temperature control, spray-water attemperator, Temperature control with tilting burners, Controlling the temperature of reheated steam, Gas recycling

UNIT V CONTROL EQUIPMENT PRACTICE

DCS configuration in power plant-A Typical DCS configuration-Interconnections between systems-Equipment selection and environment-Mechanical factors and ergonomics-Electrical Actuators-Hydraulic Actuators-Cabling - Electromagnetic Compatibility-Reliability of systems

(9 Hrs)

(9 Hrs)

Text Books

- 1. Swapan Basu, Ajay Kumar Debnath "Power Plant Instrumentation and Control Handbook" Academic Press. -2019.
- 2. Hegde "Power Plant Engineering" Pearson Education India. 2015

Reference Books

- 1. Swapan Basu "Plant Hazard Analysis and Safety Instrumentation Systems" Academic Press. 2016
- 2. Philip Kiameh "Power Plant Equipment Operation and Maintenance Guide" McGraw Hill Professional, 2011.
- 3. Gregory K. McMillan, P. Hunter Vegas "Process / Industrial Instruments and Controls Handbook, Sixth Edition" McGraw-Hill Education, 2019
- 4. K. Krishnaswamy, M. Ponni bala "power plant instrumentation" PHI learning Pvt. ltd. 2013
- 5. Mallick, Amiya ranjan "practical boiler operation engineering and power plant, PHI learning pvt. ltd.. 2015

Web Resources

- 1. https://nptel.ac.in/courses/112/107/112107291/
- 2. https://swayam.gov.in/nd1_noc20_me10/preview
- 3. http://www.powerplantinstrumentationcontrol.yolasite.com/upcomming-lecture.php

COs				Рі	rogra	im O	utcor	nes (POs))			Prog Outo	gram Spe comes (P	cific SOs)
	PO1	PO2	PO3	PO4	PO5	P06	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	1	2	-	-	-	-	-	-	3	2	3	2	3
2	3	2	1	2	-	-	-	-	-	-	3	2	3	2	3
3	3	2	1	2	-	-	-	-	-	-	3	2	3	1	3
4	3	2	1	2	-	-	-	-	-	-	3	2	3	2	3
5	3	2	1	2	-	-	-	-	-	-	3	2	3	2	3

COs/POs/PSOs Mapping

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U19MCE86 UNCONVENTIONAL MACHINING PROCESSES L T P C Hrs 3 0 0 3 45

Course Objectives

- To differentiation between convention and unconventional machining process and need of unconventional machining in the current scenario.
- To know about the surface finish of different materials using mechanical energy-based processes.
- To know about the surface finish of different materials using electrical energy-based processes.
- To know about the surface finish of different materials using chemical energy-based processes.
- To know about the surface finish of different materials using thermal energy-based processes

Course Outcomes

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

- CO1 Understand the basic principle of conventional machining process(K1)
- CO2 Interpret the mechanical energy-based processes(K2)
- CO3 Familiarize on the various electrical energy-based processes(K3)
- CO4 Interpret the chemical energy-based processes(K3)
- CO5 Familiarize on the various thermal energy-based processes(K2)

UNIT I INTRODUCTION

Introduction to Non-traditional machining, Need for Non-traditional machining process, Comparison between traditional and non-traditional machining, general classification Non-traditional machining processes, classification based on nature of energy employed in machining, selection of non-traditional machining processes, Specific advantages, limitations and applications of non-traditional machining processes.

UNIT II MECHANICAL ENERGY BASED PROCESSES

Abrasive Jet Machining - Water Jet Machining - Abrasive Water Jet Machining - Ultrasonic Machining. Working Principles - equipment used - Process parameters - MRR – Applications.

UNIT III ELECTRICAL ENERGY BASED PROCESSES

Electric Discharge Machining (EDM) - working Principle - equipments - Process Parameters - Surface Finish and MRR - electrode / Tool - Power and control Circuits - Tool Wear - Dielectric - Flushing - Wire cut EDM – Applications.

UNIT IV CHEMICAL AND ELECTRO-CHEMICAL ENERGY BASED PROCESSES

Chemical machining and Electro-Chemical machining (CHM and ECM)-Etchants – Maskant - techniques of applying maskants - Process Parameters – Surface finish and MRR-Applications. Principles of ECM- equipments-Surface Roughness and MRR Electrical Circuit-Process Parameters- ECG and ECH - Applications.

UNIT V THERMAL ENERGY BASED PROCESSES

Laser Beam machining and drilling (LBM), plasma Arc machining (PAM) and Electron Beam Machining (EBM). Principles – Equipment –Types - Beam control techniques – Applications

Text Books

- 1. T. Jagadeesha "Unconventional Machining Processes "I.K. International Publishing House Pvt. Limited, 2016.
- Hassan El-Hofy "Fundamentals of Machining Processes: Conventional and Nonconventional Processes "CRC Press/Taylor & Francis Group, 2018.

(9 Hrs)

(9 Hrs)

(9 Hrs)

(9 Hrs)

Reference Books

1. Kumar, Kaushik, Kumari, Nisha, Davim, J. Paulo "Non-Conventional Machining in Modern Manufacturing Systems" IGI Global. – 2018

2. Golam Kibria, B. Bhattacharyya, J. Paulo Davim "Non-traditional Micromachining Processes: Fundamentals and Applications" Springer. – 2017

- 3. Kaushik Kumar, J. Paulo Davim "Modern Manufacturing Processes" Elsevier Science & Technology, 2020
- 4. Kapil Gupta "Advanced Manufacturing Technologies" Springer 2017
- 5. M. S. Shunmugam, M. Kanthababu "Advances in Micro and Nano Manufacturing and Surface Engineering "Springer Nature 2019

Web Resources

- 1. https://nptel.ac.in/courses/112/105/112105126/
- 2. https://swayam.gov.in/nd1_noc20_me17/preview
- 3. https://www.youtube.com/watch?v=gFB2PCULf0s

COs				Pi	rogra	im O	utcor	nes (POs)			Prog Outo	gram Spe comes (P	cific SOs)
	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
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3	3	2	2	1	-	-	-	-	-	-	3	2	3	1	3
4	3	2	2	1	-	-	-	-	-	-	3	2	3	2	3
5	3	2	2	1	-	-	-	-	-	-	3	2	3	2	3

COs/POs/PSOs Mapping

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U19MCE87	UNMANNED AERIAL VEHICLES	L 3	1 0	Р 0	C 3	Hrs 45
Course Objectives	i					
• Briefing on overview	v and background of the development of UAV					
• Introducing differen	t components of Unmanned Aerial System (UAS)					
• Describing the cond	epts behind the flight of aerial vehicle systems.					
• Explaining the navig	gation of UAV					
D' ' ' ' ' ' ' ' ' ' ' ' ' ' ' ' ' ' '						

Discussion on UAV launch systems and safety regulations

Course Outcomes

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

CO1 - Understand the development and need for UAV (K1)

- CO2 Design of Unmanned aerial system components (K2)
- **CO3** Exhibiting the knowledge of concepts of flight(K3)
- **CO4** Analysis navigate UAV by different methods(K3)
- CO5 Experiment proper launching system for UAS(K3)

UNIT I OVERVIEW AND BACKGROUND

Definitions, History of unmanned air vehicle (UAV) development, classifications of UAVs: scale, lift generation method, contemporary applications: military, government, civil, societal impact and future outlook, operational considerations: liability / legal issues, insurance, ethical implications, human factors

UNIT II UNMANNED AERIAL SYSTEM (UAS) COMPONENTS

Platforms: configurations, characteristics, applications, propulsion: internal combustion engines, turbine engines, electric systems, on-board flight control, payloads: sensing / surveillance, weaponized, delivery, communications: command/control, telemetry. launch / recovery systems. ground control stations

UNIT III CONCEPTS OF FLIGHT

Aerodynamics: lift, weight, thrust, drag, flight performance: climbing vs. gliding flight, range / endurance, stability and control: flight axes, flight controls, Autopilots - lateral and longitudinal autopilots, Sensor, Controller, Actuator, Airframe Control, Inner and Outer Loops, Flight-Control Classification, Overall Modes of Operation, Sensors Supporting the Autopilot

UNIT IV UAV NAVIGATION

Accelerometers, gyros, GPS, Path planning algorithms: Dubin's curves, way-points, Voronoi partitions. Path following and guidance: Straight line and curve following, vision-based guidance.

UNIT V UAV LAUNCH SYSTEMS AND SAFETY REGULATIONS

Launch Systems: Basic Considerations, UAV Launch Methods for Fixed-Wing Vehicles, Rail Launchers, Pneumatic Launchers, Hydraulic/Pneumatic Launchers, Zero Length RATO Launch of UAVs, Vertical Take-off and Landing UAV Launch, Safety considerations, Regulations in India, Future directions and the road ahead.

Text Books

- 1. Kimon P. Valavanis, George J. Vachtsevanos, "Handbook of Unmanned Aerial Vehicles", Springer Reference, 2015
- 2. Paul GerinFahlstrom, Thomas James Gleason, "Introduction to UAV Systems", A John Wiley & Sons, Ltd. Publication, 2012.

(9 Hrs)

(9 Hrs)

(9 Hrs)

(9 Hrs)

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3. Victor Becerra "Autonomous Control of Unmanned Aerial Vehicles" MDPI. Copyright. - 2019

Reference Books

- 1. Randal W. Beard and Timothy W. McLain: Small Unmanned Aircraft: Theory and Practice, Princeton University Press, 2012
- Kimon P. Valavanis: Advances in Unmanned Aerial Vehicles: State of the Art and the Road to Autonomy, Springer, 2007
- 3. Landen Rosen "Unmanned Aerial Vehicle" Alpha Editions, 2015 "
- 4. A.R. Jha, Ph.D." Theory, Design, and Applications of Unmanned Aerial Vehicles" CRC Press-2016
- 5. Management Association, Information Resources" Unmanned Aerial Vehicles: Breakthroughs in Research and Practice" IGI Global 2019

Web Resources

- 1.https://nptel.ac.in/courses/101/104/101104073/
- 2.https://swayam.gov.in/nd1_noc19_ae06/preview
- 3.https://www.youtube.com/watch?v=_RCF2Do4IVY

COs				P	rogra	m O	utcor	nes ((POs))			Prog Outo	gram Spe comes (P	cific SOs)
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3	3	2	1	1	1	1	2	1	1	1	3	2	3	1	3
4	3	2	1	2	2	2	3	2	2	2	3	2	3	2	3
5	3	2	1	2	2	2	3	2	2	2	3	2	3	2	3

COs/POs/PSOs Mapping

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		L	Т	Ρ	С	Hrs
0 ISMICE88	BOILDING AUTOMATION	3	0	0	3	45

Course Objectives

- Gain knowledge on Building Management System (BMS) and Automation.
- · Be familiarized with various transducers and sensors in BMS.
- Be exposed on Control panel and Communication.
- Learn Fire Alarm System (FAS) and security system such as CCTV.
- Gain knowledge on Energy Management in Building Automation.

Course Outcomes

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

CO1 - Remembering current philosophy, technology, terminology, and practices used in building automation(K1)

- CO2 Understand different fire standards, FAS Components, FAS loops, Architectures.(K2)
- CO3 Apply hardware and software for HVAC system (K3)
- **CO4** Evaluate energy management system(K3)
- **CO5** Design the new concepts materials of building automation(K4)

UNIT I INTRODUCTION TO BMS AND AUTOMATION

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 FAS AND SECURITY SYSTEMS

Fire, Fire modes – Fire Alarm Systems components: Field components, panel components – FAS Architectures – Access Components, Access control system Design - CCTV camera types and operation -camera selection criteria - CCTV Applications.

Security Systems Fundamentals: Introduction to Security Systems, Concepts. Perimeter Intrusion: Concept, Components, Technology. Security Design:Concept of automation in access control system for safety, Physical security system with components, RFID enabled access control with components, Computer system access control - DAC, MAC, RBAC.

UNIT III HVAC SYSTEM

Fundamentals: HVAC Fundamentals, Basic Processes (Heating, Cooling etc) Basic Science: Air Properties, Psychometric Chart, Heat Transfer mechanisms. Human Comfort: Human comfort zones, Effect of Heat, Humidity, Heatloss. Processes: Heating Processes (Boiler, Heater), Cooling Process (Chiller), Ventilation Process(Central Fan System, AHU, Exhaust Fans), Unitary Systems(VAV, FCU).Control Theory: Instrumentation Basics, Field components & use, DDC & applications. Control Panel: HVAC Control Panel, MCC Basics, Panel Components.

UNIT IV ENERGY MANAGEMENT SYSTEM

ASHRAE Symbols Energy Management: Energy Savings concept & methods, lighting control, Building Efficiency improvement, Green Building (LEED) Concept & Examples

UNIT V BUILDING MANAGEMENT SYSTEM

IBMS (HVAC, Fire & Security) project cycle, Project steps BMS.Verticals: Advantages & Applications of BMS, Examples Integration: IBMS Architecture, Normal & Emergency operation. Advantages of BMS

(9 Hrs)

(9 Hrs)

(9 Hrs)

(9 Hrs)

Text Books

- 1. Gerardus Blokdyk "Intelligent Building Automation Systems The Ultimate Step-By-Step Guide "5STARCooks, 2018.
- 2. Phil Zito "Building Automation Systems a to Z: How to Survive in a World Full of Bas "CreateSpace Independent Publishing Platform, 2016

Reference Books

- 1. Jim Sinopoli "Smart Buildings", Butterworth-Heinemann imprint of Elsevier, 2nd ed., 2010.
- 2. Albert Ting-Pat So, WaiLok Chan, Kluwer "Intelligent Building Systems" Academicpublisher, 3rd ed., 2012.
- 3. James Sinopoli "Advanced Technology for Smart Buildings" Artech House. 2016
- Sibanjan Das, Umit Mert Cakmak "Hands-On Automated Machine Learning: A beginner's guide to building" Packt Publishing Ltd. – 2018
- 5.Gerard Blokdyk "Building Automation: Quickstart Administration" CreateSpace Independent Publishing Platform, 2017

Web Resources

- 1. https://www.youtube.com/watch?v=wNeYPfNV8QI
- 2. https://nptel.ac.in/courses/108/105/108105063/
- 3. https://swayam.gov.in/nd1_noc20_me39/preview

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)													Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	P011	PO12	PSO1	PSO2	PSO3		
1	3	2	1	1	2	2	1	1	2	2	3	2	3	2	3		
2	3	2	1	2	2	1	1	2	2	1	3	2	3	2	3		
3	3	2	1	1	1	1	2	1	1	1	3	2	3	1	3		
4	3	2	1	2	2	2	3	2	2	2	3	2	3	2	3		
5	3	2	1	2	2	2	3	2	2	2	3	2	3	2	3		

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		L		Ρ	· C	Hrs
U I 9IVICE09	INDUSTRIAL ENGINEERING	3	0	0	3	45

Course Objectives

- To introduce the concepts, principles and framework of contents of Industrial Engineering
- To design and develop algorithms for solving industrial engineering related problems.
- To introduce the concepts of cost accounting and financial management practices as applied in industries.
- To acquaint the students with different aspects of Human Resource activities and Industrial Safety rules.
- To acquaint the students with different aspects of Production Planning and Control and Facility Design.

Course Outcomes

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

CO1 - Describe the scope, objectives, application, methods and tools of Industrial Engineering systems. (K1)

- CO2 Apply the various methods of Method study to Improve productivity (K2)
- CO3 Apply the various techniques of work measurement to Improve productivity (K3)
- CO4 Demonstrate the knowledge of designing plants and controlling production.(K3)
- CO5 Explain the decision support system methods to select the right solution to the concerned problems(K2)

UNIT I INDUSTRIAL ORGANISATION

Introduction to Industrial Engineering – Concepts - History and Development of Industrial engineering – Roles of Industrial Engineer – Applications – Productivity – Factors affecting productivity – Increasing productivity of resources – Kinds of productivity measures

UNIT II WORK DESIGN

Introduction to work study – Method study – Time study – stopwatch time study – Standard data - Method Time Measurement (M-T-M) – Work sampling – Ergonomics

UNIT III DEMAND FORECASTING AND ELEMENTS OF COST

Demand Forecasting and Elements of Cost Macro and micro economics - Demand and supply – Factors influencing demand – Elasticity of demand – Demand forecasting – Time series - Exponential smoothing casual forecast - Delphi method – Correlation and Regression - Barometric method – Long run and Short run forecast. Elements of cost – Determination of Material cost - Labour cost - Expenses – Types of cost.

UNIT IV PLANT LAYOUT AND GROUP TECHNOLOGY

Plant location - Factors - Plant layout - Types - Layout design process – Computerized Layout Planning – Construction and Improvement algorithms -ALDEP - CORELAP and CRAFT. Group technologyProblem definition - Production flow analysis - Heuristic methods of grouping by machine matrices – Flexible Manufacturing System - FMS work stationsMaterial handling and Storage system-Cellular Manufacturing System

UNIT V PRODUCTION PLANNING AND CONTROL

Types of productions, Production cycle-Process planning, Forecasting, Loading, Scheduling, Dispatching, Routing- Simple problems. Materials Planning – ABC analysis – Incoming materials control – Kanban system – Just in time. MRP systems- Master Production Schedule – Bill of Materials – MRP calculations

Text Books

- 1. O.P. Khanna, "Industrial engineering and management", Dhanpat Rai Publications, 2018.
- 2. Martand T. Telsang, "Industrial Engineering and Production Management", S. Chand Publishing, 2018.
- 3. Buffa E.S., Modern Production / Operational Management, John Wiley & Sons, 2009

(9 Hrs)

(9 Hrs)

(9 Hrs)

(9 Hrs)

214

Reference Books

- 1. Ravi, V. Industrial Engineering And Management" PHI Learning Pvt. Ltd 2015
- 2. Pravin Kumar "Industrial Engineering and Management" Pearson Education India 2015
- 3. Adedeji B. Badiru "Introduction to Industrial Engineering" CRC Press 2018
- 4. Mr. Ashok Keshav Karande "The Story of Industrial Engineering: The Rise from Shop-Floor Management"-2019
- 5. Panneerselvam. R., Production/Operations Management, Prentice Hall of India, 2006

Web Resources

- 1. https://online.engineering.arizona.edu/online-programs/industrial-engineering/master-ofscience-in-industrial-engineering/
- 2. https://nptel.ac.in/courses/112/107/112107142/
- 3. https://swayam.gov.in/nd1_noc20_me43/preview
- 4. https://www.youtube.com/watch?v=aYcKw5q6JB4

COs	Program Outcomes (POs)													Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3		
1	3	2	3	-	-	-	-	-	-	-	3	2	3	2	3		
2	3	2	3	-	-	-	-	-	-	-	3	2	3	2	3		
3	3	2	3	-	-	-	-	-	-	-	3	2	3	1	3		
4	3	2	3	-	-	-	-	-	-	-	3	2	3	2	3		
5	3	2	3	-	-	-	-	-	-	-	3	2	3	2	3		

COs/POs/PSOs Mapping

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OPEN ELECTIVES
U19EEO41

SOLAR PHOTOVOLTAIC FUNDAMENTALS AND L T P C Hrs

APPLICATIONS

(Common to ECE, ICE, MECH, CIVIL, Mechatronics)

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

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

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

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

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

UNIT V COST BENEFIT ANALYSIS FOR SOLAR PV INSTALLATIONS

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.
- 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.

(9 Hrs)

(9 Hrs)

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(9 Hrs)

(9 Hrs)

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- 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 Resources

- 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					Progr	am O	utcon	nes (F	'Os)				Progi Outco	ram Sp omes (F	ecific PSOs)
	PO 1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
1	3	3	3	3	2	-	3	-	-	-	-	3	2	2	2
2	3	3	3	3	2	-	3	-	-	-	-	3	2	2	2
3	3	3	3	3	2	-	3	-	-	-	-	3	2	2	2
4	3	3	3	3	2	-	3	-	-	-	-	3	2	2	2
5	3	3	3	3	2	-	3	-	-	-	-	3	2	2	2

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

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ELECTRICAL SAFETY

U19EEO42

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

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

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

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

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

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.

(9 Hrs)

(9 Hrs)

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Hrs

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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 Resources

- 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					Progr	am O	utcon	nes (P	Os)				Progr Outco	am Spe omes (P	ecific PSOs)
	PO1	PO1 PO2 PO3 PO4 PO5 PO6 PO7 PO8 PO9 PO10 PO11 PO1:											PSO1	PSO2	PSO3
1	3	3	3	2	-	2	-	-	-	-	-	-	1	1	1
2	3	3	3	2	-	2	-	-	-	-	-	-	2	2	2
3	3	3	3	2	-	2	-	-	-	-	-	-	2	2	2
4	3	3	3	2	-	2	-	-	-	-	-	-	2	2	2
5	3	3	3	2	-	2	-	-	-	-	-	-	1	1	1

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

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С Т Ρ Hours L **U19ECO41** ENGINEERING COMPUTATION WITH MATLAB 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 1 INTRODUCTION TO MATLAB

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 2 LOOPS& CONTROL STATEMENTS

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

UNIT 3 PLOTS IN MATLAB & GUI

Basic 2D plots, Labels, Line style, Markers, plot, subplot, LOG, LOG, SEMILOG-POLARCOMET, Grid axis, labeling, fplot, ezplot, ezplot, 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 4 MISCELLANEOUS TOPICS

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 5 SIMULINK & APPLICATIONS

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.

(9 Hrs)

(9Hrs)

(9Hrs)

(9Hrs)

(9Hrs)

221

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 Resources

- 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					Prog	ram O	utcon	nes (P	Os)				Prog Oute	gram Spe comes (P\$	cific SOs)
	P01	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	-	2	3	-	-	-	-	-	-	-	1	3	3
CO2	2	2	-	2	3	-	-	-	-	-	-	-	1 3		3
CO3	2	2	-	2	3	-	-	-	-	-	-	-	1	1 3	
CO4	2	2	-	2	3	-	-	-	-	-	-	-	1 3		3
CO5	2	2	-	2	3	-	-	-	-	-	-	-	1	3	3

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

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		L	Т	Ρ	С	Hours
01920042	CONSOMER ELECTRONICS	3	0	0	3	45

- To enable thetroubleshoot of different types of microphones and loudspeakers
- To make the students to analyse 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

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

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

UNIT -III TELEVISION SYSTEMS

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

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

Microwave Oven: Types, Etechnical 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

(9Hrs)

(9Hrs)

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(9Hrs)

- 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 Resources

- 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					Progr	am O	utcon	nes (P	Os)				Prog Oute	gram Spe comes (P\$	cific SOs)
	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	-	2	1	-	1	-	-	-	-	-	-	2	-	1
CO2	2	-	2	1	-	1	-	-	-	-	-	-	2 -		1
CO3	2	-	2	1	-	1	-	-	-	-	-	-	2	-	1
CO4	2	-	2	1	-	1	-	-	-	-	-	-	2	-	1
CO5	2	-	2	1	-	1	-	-	-	-	-	-	2	-	1

COs Mapping with POs and PSOs

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

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								225	
Academic Curriculum a	ind Syllabi R-2019					т	Р	C	Hrs
U19CSO41	(Common to EEE	WEB DEVE	LOPMENT CH, CIVIL, BME,	, Mechatronics)	3	0	0	3	45
 Course Objectives To study the fundation To understand the To learn the concet To study about ad To understand the 	amentals of web a design compone epts JavaScript a vance scripting a working procedu	application dev ents and tools on nd programmir nd Ajax applica ure of XML	relopment using CSS ng fundamental ations.	ls.					
Course Outcomes After the completion CO1 - Develop basic w CO2 - Design the web CO3 - Validate the web CO4 - Demonstrate the CO5 - Update the know	of the course, the eb applications. (K applications using (pages using javas web 2.0 application vledge of XML Data	e students will I 5) CSS. (K5) scripts functions. on to advance so a. (K4)	be able to . (K5) cripts. (K3)						
UNIT I INTRODUCTI Protocols – Secure Co IP. Web Design: Web tags and simple HTML UNIT II STYLE SHEE Introduction to CSS: N properties – Manipulat	ON TO WWW & onnections – Applic site design princip forms – Web site ETS leed for CSS – E ting texts using fo	HTML cation and deve les – Planning structure. Basic syntax an nts, borders an	lopment tools – the site and nav nd structure usin nd boxes – Mar	Web browser – So rigation. HTML: De ng CSS – Backgro gins, padding lists,	erver d velopm und im , positi	efiniti ent p lages oning	on – roces – Co usinę	(9 H Dynai s – H (9 H olors a g CSS	I rs) mic Itml Itml rs) and S –
CSS2. UNIT III JAVASCRIP Client side scripting: Ba	P TS asic JavaScript – \	/ariables – Fun	ctions – Conditio	ons – Loops. Appli	cations	: Pag	je Val	(9 H lidatio	I rs) n −
UNIT IV ADVANCE S JavaScript and objects – Web applications – A	SCRIPT – DOM and Web I Alternatives of AJA)	browser environ X.	ments – Forms a	and Validations – D	HTML	. AJA	X: Int	(9 Hi roduct	r s) tion
UNIT V XML Introduction to XML – document – Application	Uses of XML – Sir ns of XML – XSL a	mple XML – XM nd XSLT.	IL key compone	nts – DTD and Scł	nemas	– We	ell-forr	(9 H ned X	rs) IML
 Keith Wald, Jason Semmy Purewal, " P.J. Deitel ANE Education, 2009 	Lengstorf," Pro PH 'Learning Web App D H.M. Deitel,"	IP and jQuery", Development", Internet and	Paperback, 201 O'Reilly Media, World Wide V	6. 2014. Web - How to I	Progra	m",	Pear	son	

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 Resources

- 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

					Progr	am O	utcon	nos (P	00e)				Prog	ram Sp	ecific
COs					Flogi		utcon	169 (1	03)				Outco	omes (F	PSOs)
	PO1	PO1 PO2 PO3 PO4 PO5 PO6 PO7 PO8 PO9 PO10 PO11 PO1													PSO3
1	3	3	3	3	3	3	3	3	-	-	3	-	1	2	3
2	2	2	2	2	-	2	-	2	-	2	-	2	1	2	3
3	3	3	3	3	3	3	3	3	-	-	3	-	1	2	3
4	2	2	2	2	-	2	-	2	-	2	-	2	1	2	3
5	2	2	2	2	-	2	-	2	-	2	-	2	1	2	3

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

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111006042	ANALYSIS OF ALGORITHMS	L	Т	Ρ	С	Hrs
01903042	(Common to EEE, ECE, ICE, MECH, CIVIL, BME, Mechatronics)	3	0	0	3	45

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

Course Outcomes

Upon completion of the course, students shall have ability to

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

UNIT I INTRODUCTION

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

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

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

UNIT IV BACKTRACKING

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

UNIT V BRANCH AND BOUND

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

Text Books

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

(9 Hrs)

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Academic Curriculum and Syllabi R-2019 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 Resources

- 1. https://swayam.gov.in/nd1_noc20_cs71/preview
- 2. https://www.tutorialspoint.com/design_and_analysis_of_algorithms/
- 3. https://www.javatpoint.com/daa-tutorial
- 4. https://www.guru99.com/design-analysis-algorithms-tutorial.html
- 5. https://www.geeksforgeeks.org/fundamentals-of-algorithms/

COs/POs/PSOs Mapping

COs					Progr	am O	utcon	nes (P	Os)				Prog Outco	ram Sp omes (F	ecific PSOs)
	P01	PO1 PO2 PO3 PO4 PO5 PO6 PO7 PO8 PO9 PO10 PO11 PO1												PSO2	PSO3
1	3	3	2	3	2	2	1	-	-	-	-	-	2	2	3
2	3	2	3	3	2	2	1	-	-	-	-	-	2	2	3
3	3	3	3	3	2	2	2	-	2	-	-	-	2	2	3
4	3	2	3	3	3	2	2	-	-	-	3	-	2	2	3
5	3	3	3	3	2	2	2	-	-	-	3	2	2	2	3

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

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Academic Curriculum and Syll	abi R-2019					
U19CS043	PROGRAMMING IN JAVA	L	Т	Ρ	С	
	(Common to ECE, MECH.	3	0	0	3	

- To gain and explore the knowledge of Java programming.
- To know the principles of inheritances and packages.
- To learn about the usage of interfaces in Java.
- To gain and explore the event handling in Java.
- To get familiarized to the interfaces generic programming, multithreading concepts.

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 and package in relevant applications. (K3)
- CO3 Construct Java programs using interfaces. (K3)
- CO4 Build Java applications using Event Handling. (K3)
- CO5 Create Java applications using multithreading and generic programming. (K3)

UNIT I INTRODUCTION TO JAVA PROGRAMMING

The History and Evolution of Java - Byte code - Java buzzwords - Data types – Variables – Arrays – Operators - Control statements - Type conversion and casting – Objects and classes in Java – Defining classes – Methods - Access specifiers – Static members – Constructors – Finalize method.

UNIT II INHERITANCE AND PACKAGES

Arrays – Strings - Packages – Java-Doc comments – Inheritance – Class hierarchy – Polymorphism – Dynamic binding – Final keyword – Abstract classes

UNIT III INTERFACES

The Object class – Reflection – Interfaces – Object cloning – Inner classes – Proxies - I/O Streams - Graphics programming – Frame – Components – Working with 2D shapes.

UNIT IV EVENT HANDLING

Basics of event handling – Event handlers – Adapter classes – Actions – Mouse events – AWT event hierarchy – Introduction to Swing – Model-View-Controller design pattern – Buttons – Layout Management – Swing Components – Exception handling – Exception hierarchy – Throwing And catching exceptions.

UNIT V GENERIC PROGRAMMING AND MULTITHREADING

Motivation for generic programming – Generic classes – Generic methods – Generic code and virtual machine – Inheritance and generics – Reflection and generics - Multi-threaded programming – Interrupting threads – Thread States – Thread properties – Thread synchronization – Executors – Synchronizers. Enumeration – Autoboxing – Generics.

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. Cay S. Horstmann and Gary Cornell, "Core Java: Volume I Fundamentals", Sun Microsystems Press, Eighth Edition, 2008.
- 4. Herbert Schildt, "The Complete Reference JAVA 2", TMH, Seventh Edition, 2006.

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Hrs 45

Reference Books

- 1. Cay S. Horstmann, Gary cornell, "Core Java Volume –I Fundamentals", 9th Edition, Prentice Hall, 2013.
- 2. H.M.Dietel and P.J.Dietel, "Java How to Program", Pearson Education/PHI, 11th Edition, 2017.
- 3. Cay.S.Horstmann and Gary Cornell, "Core Java 2", Vol 2, Advanced Features, Pearson Education,8th Edition, 2008.
- Java for Programmers, P.J. Dietel and H.M Dietel, Pearson Education (OR) JAVA: 4.
- 5. Programming in Java, S.Malhotra and S.Choudary, Oxford Univ. Press.

Web Resources

- 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					Prog	ram O	utcom	es (PC	Ds)				Prog Outco	ram Spo omes (P	ecific PSOs)
	P01	O1 PO2 PO3 PO4 PO5 PO6 PO7 PO8 PO9 PO10 PO11 PO1												PSO2	PSO3
1	2	1	-	-	2	-	-	-	-	-	-	-	2	2	3
2	3	2	1	1	3	-	-	-	-	-	-	-	2	2	3
3	3	2	1	1	3	-	-	-	-	-	-	-	2	2	3
4	3	2	1	1	3	-	-	-	-	-	-	-	2	2	3
5	3	2	1	1	3	-	-	-	-	-	-	-	2	2	3

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

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		L	Т	Ρ	С	Hrs
01311042	R FROGRAMMING	3	0	0	3	45

- 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

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

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

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

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

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 &

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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 Resources

1. https://www.coursera.org/learn/r-programming

2. https://www.r-project.org/

CO-POs/PSOs Mapping

COs	5				Progr	am O	utcon	nes (F	Os)				Prog Outco	ram Sp omes (F	ecific PSOs)
	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	1	-	-	-	-	-	-	-	-	-	-	-	2	2	2
2	3	2	1	1	-	-	-	-	-	-	-	-	2	2	2
3	3	2	1	1	-	-	-	-	-	-	-	-	2	2	2
4	3	2	1	1	-	-	-	-	-	-	-	-	3	2	2
5	2	1	-	-	-	-	-	-	-	-	-	-	3	-	-

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

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U19MEO42

MATERIAL HANDLING SYSTEM

(Common to EEE, ICE, CIVIL, Mechatronics)

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

On successful 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 the ergonomics related to material handling equipment. (K1)

UNIT I MATERIAL HANDLING EQUIPMENTS

Types of intra plant 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

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

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

Basic Material Handling systems - Selection, Material Handling method - path, Equipment - function oriented systems.

UNIT V METHODS TO MINIMIZE COST OF MATERIAL HANDLING

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

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L T P C Hrs

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Reference Books

- 1. K.C, Arora Vikas, 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 Resources

- 1.https://nptel.ac.in/courses/112/102/112102011/
- 2. https://nptel.ac.in/courses/112/107/112107142/
- 3. https://nptel.ac.in/courses/112/107/112107143/
- 4. https://www.youtube.com/watch?v=WXmIdbVDJqE
- 5. https://www.youtube.com/watch?v=BBWPIByOEfI

COs Mapping with POs and PSOs

COs				F	Progra	am O	utcon	nes (F	POs)				Prog Outc	ram Spe omes (P	cific SOs)
	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	P011	PO12	PSO1	PSO2	PSO3
1	3	3	3	3	-	-	-	-	-	-	-	1	3	-	-
2	3	3	3	3	-	-	-	-	-	-	-	1	3	-	-
3	3	3	3	3	-	-	-	-	-	-	-	1	3	-	-
4	3	3	3	3	-	-	-	-	-	-	-	1	3	-	-
5	3	3	3	3	-	-	-	-	-	-	-	1	3	-	-

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

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U19CEO41

ENERGY AND ENVIRONMENT L T P

(Common to ECE, ECE, MECH, BME, IT, FT, Mechatronics)

Course Objectives

- Explain the importance of energy, classifications of energy sources and energy demand scenario
- Analyze the impacts of energy on environment & sustainability energy options
- Outline the harness of hydropower and geothermal energy sources
- Discuss the aspects of solar and wind energy
- To study the importance of biomass energy and its applications

Course Outcomes

At the end of Course students will be able to.

CO1 - Apply the knowledge of science & engineering to the contemporary issues of Energy for better humankind & environment (K3)

CO2 - Identify, review & analyze the complex problems of Energy crises in environment (K4)

CO3 - Designing solutions for the energy crises in the form of renewable energy systems to meet the needs by understanding the limitations **(K4)**

CO4 - Understanding the impact of energy on environment and providing solutions for sustainable development. (K5)

CO5 – Apply biomass energy under relevant technologies (K3)

UNIT I ENERGY

Introduction, Importance of energy, role of energy consumption in economic and social transformation, Energy needs and crisis. Energy production and utilization. Types and classification of energy sources, Conventional & unconventional energy, Renewable sources & Nonrenewable sources of energy advantages, limitations, comparisons

UNIT II ENVIRONMENT

Impact of energy on economy & environment. Regional impacts of temperature change - Global warming, Greenhouse effect, Acid rain, Ozone layer depletion. Indian environment degradation, Environmental laws - Water Act-1974 (Prevention & control of pollution), The environment protection act 1986, Air act.

UNIT III HYDROPOWER & GEOTHERMAL ENERGY

Hydropower Energy – Introduction, Site selection, layout of hydro power plant, components & working, classifications, power station, structure and control. Geothermal Energy - Introduction, Site selection, layout of power plant, components & working, Advantages and disadvantages.

UNIT IV SOLAR & WIND ENERGY

Sun as source of energy - Introduction, Site selection, layout of power plant components & working, classifications, Types of collectors, collection systems efficiency, Solar cells. Wind Energy - Introduction, advantages/limitations, Site selection, layout of power plant, components & working, classification.

UNIT V BIOMASS ENERGY

Introduction, advantages/limitations, Photosynthesis, biomass fuel, biomass gasification, biogas from waste biomass, factors affecting biogas generation, types of biogas plant, Biomass programme in India,

Text Books

- 1. Trivedi R.R. and Jalka K.R, "Energy Management", Commonwealth Publication, 20177.
- 2. Diamant R.M.E., "Total Energy", Pergamon, OxfordPublishers, 2017.
- 3. N.G. AJJANNA " Energy auditing & demand side management" first edition, Gouthami Publications, Shimoga
- 4. Chakrabarti, M.L.Soni, P.V. Gupta,U.S. Bhatnagar "Power system Engineering" 2001, DhanpatRai&Co, New Delhi.

(9 Hrs)

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5. D.P.Kothari, K.C Singal, Rajesh Ranjan, "Renewable Energy sources and Emerging Technologies" second edition , PHI , India

Reference Books

- 1. Boyle G, Everett B and Ramett J, "Energy systems and sustainability", Oxford University Press, 2018
- 2. "Pollution Control Acts, Rules and Notifications", CPCB, Pollution Control series, PC/2/2014, Vol.I,2014
- 3. Peavy.H, Rowe.D, and Tchobanoglous, G., Environmental Engineering, Tata McGraw-Hill, 2013
- 4. S.Rao, Dr. BB Parulekar "Energy Technologies" Khanna Publications , New Delhi
- 5. David M Buchla, Thomas E Kissel, Thomas L Floyd "Renewable Energy systems" Pearson, India
- 6. Godfrey Boyle "Renewable Energy power for sustainable future" oxford Publications , New Delhi

Web Resources

- 1. https://onlinecourses.nptel.ac.in/noc20_ce23/announcements
- 2. https://swayam.gov.in/nd1_noc20_ce23/preview
- 3. www.iucn.org
- 4. www.cites.org
- 5. www.thesummitbali.com/
- 6. http://engineering geology.gov.in/

COs/POs/PSOs Mapping

					Progr	am O	utcom	nes (P	Os)				Prog Outco	ram Sp omes (F	ecific 'SOs)
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO 9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	2	1	2	2	1	-	-	-	-	3	-	1	2
CO2	1	1	1	-	-	2	1	-	-	-	-	3	-	1	1
CO3	2	2	2	2	2	3	3	-	1	1	2	3	-	2	2
CO4	2	2	2	2	3	3	3	-	1	1	2	3	-	2	2
CO5	2	2	2	2	3	3	3	-	1	1	2	3	-	2	2

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

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- 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

Artificial kidney, Dialysis action, hemodialyser unit, membrane dialysis, portable dialyser monitoring and functional parameters, Heart-Lung Machine.

UNIT IV PHYSICAL MEDICINE AND BIOTELEMETRY

Diathermies - Shortwave, ultrasonic and microwave type and their applications, Surgical Diathermy, Biotelemetry - Single Channel and Multiple Channel.

UNIT V RECENT TRENDS IN MEDICAL INSTRUMENTATION

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.

(9 Hrs)

(9 Hrs)

- 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 Resources

- 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					Prog	ram O	utcom	es (PC	s)				Prog Outco	ram Spe omes (P	ecific 'SOs)
	P01	PO2	PO3	PO4	PO5	PO6	P07	P08	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	-	2	2	2	-	1	-	-	-	-	-	-	1
2	3	2	-	2	2	2	-	1	-	-	-	-	-	-	1
3	3	-	-	2	3	3	-	1	-	-	-	-	-	-	1
4	3	-	2	2	3	2	-	1	-	-	-	-	-	-	1
5	3	2	2	3	3	2	-	1	-	-	-	-	-	-	1

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

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	BASIC DBMS	L	Т	Ρ	С	Hrs
U19CCO41	(Common to EEE, ECE, MECH, CIVIL, ICE, Mechatronics, BME Branches)	3	0	0	3	45
	,					

- 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

Introduction to Database Management systems – History - Characteristics – Users- three-level architecture-Entity-- relationship data model.

UNIT – II - THE RELATIONAL DATA MODEL AND RELATIONAL ALGEBRA

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

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

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

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.

(9 Hrs)

(9 Hrs)

(9 Hrs)

(9 Hrs)

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 Resources

- 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					Progr	am O	utcon	nes (P	Os)				Prog Outco	ram Sp omes (F	ecific PSOs)
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	1	-	1	-	-	-	-	-	1	1	1	1	-
CO2	3	1	1	-	1	-	-	-	-	-	1	1	1	1	-
CO3	3	3	1	-	1	-	-	-	-	-	1	1	1	1	-
CO4	3	1	1	-	1	-	-	-	-	-	1	1	1	1	-
CO5	3	1	1	-	1	-	-	-	-	-	1	1	1	1	-

COs/POs/PSOs Mapping

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	INTRODUCTION TO COMMUNICATION	L	Т	Ρ	С	Hrs
U19CCO42	SYSTEMS					
01000012	(Common to EEE, CSE, IT, MECH, CIVIL, ICE, Mechatronics,	3	0	0	3	45
	BME)					

- 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

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

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

Low pass sampling theorem - Quantization - PAM - PCM, DPCM, DM, and ADPCM And ADM - Time Division Multiplexing, Frequency Division Multiplexing

UNIT IV DIGITAL COMMUNICATION

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

(9 Hrs)

(9 Hrs)

(9 Hrs)

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 Resources

- 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					Progr	am O	utcon	nes (P	Os)				Prog Outco	ram Sp omes (F	ecific PSOs)
	P01	PO2	PO3	PO4	PO5	P06	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	1	-	1	-	-	-	-	-	1	1	1	-	1
CO2	3	1	1	-	1	-	-	-	-	-	1	1	1	-	1
CO3	3	3	1	-	1	-	-	-	-	-	1	1	1	-	1
CO4	3	1	1	-	1	-	-	-	-	-	1	1	1	-	1
CO5	3	1	1	-	1	-	-	-	-	-	1	1	1	-	1

COs/POs/PSOs Mapping

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U19EEO53

CONVENTIONAL AND NON-CONVENTIONAL L T P C Hrs ENERGY SOURCES

(Common to ECE, ICE, MECH, CIVIL, BME, Mechatronics) 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

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

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

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

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

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",

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(9 Hrs)

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Academic Curriculum and Syllabi R-2019 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 Resources

- 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					Pro	gram O	utcom	es (POs	5)				Pro Oute	gram Spec comes (PS	ific Os)
	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	1	1	2	-	1	2	-	-	-	-	1	1	1	1
2	3	1	1	2	-	1	2	-	-	-	-	1	1	1	1
3	3	1	1	2	-	1	2	-	-	-	-	1	1	1	1
4	3	1	1	2	-	1	2	-	-	-	-	1	1	1	1
5	3	1	1	2	-	1	2	-	-	-	-	1	1	1	1

COs / POs and PSOs Mapping

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

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U19EEO54

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

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

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

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

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

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

(9 Hrs)

(9 Hrs)

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(9 Hrs)

(9 Hrs)

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Web Resources

- 1. www.siemens.com/paperwww.siemens.com/cemet
- 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					Prog	ram O	utcom	es (PO	s)				Prog Outo	gram Spec comes (PS	cific SOs)
	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	2	-	-	-	-	-	-	-	-	-	2	2	2
2	3	2	2	-	-	-	-	-	-	-	-	-	2	2	2
3	3	3	3	1	-	-	-	-	-	-	-	-	2	2	2
4	3	3	3	1	-	-	-	-	-	-	-	-	2	2	2
5	3	3	3	1	-	-	-	-	-	-	-	-	2	2	2

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

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111050052	ELECTRONIC PRODUCT	L
01920055	DESIGN AND PACKAGING	3

- 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

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

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

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

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

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

(9 Hrs)

(9 Hrs)

(9 Hrs)

(9 Hrs)

Т	Ρ	С	Hrs
0	0	3	45

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 Books:

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

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

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		L	Т	Ρ	С	Hrs
01911054	WODILE AFFLICATION DEVELOPMENT	3	0	0	3	45

- 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

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

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

Global System for Mobile Communication (GSM) – General Packet Radio Service (GPRS) – Universal Mobile Telecommunication System (UMTS).

UNIT III MOBILE AD-HOC NETWORKS

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

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

- 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.

(9 Hrs)

(9 Hrs)

(9 Hrs)

(9 Hrs)

Reference Books

- Dharma Prakash Agarval, Qing and An Zeng, "Introduction to Wireless and Mobile systems", Thomson Asia Pvt Ltd, 2005.
- 3. William.C.Y.Lee, "Mobile Cellular Telecommunications-Analog and Digital Systems", Second Edition, TataMcGraw Hill Edition, 2006.
- 4. UweHansmann, LotharMerk, Martin S. Nicklons and Thomas Stober, "Principles of Mobile Computing", Springer, 2003.

Web Resources

- 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

COs	Brogrom Outcomes (POs)													Program Specific			
				Outcomes (PSOs)													
	P01	PO2	PO3	PO4	P05	P06	P07	PO8	PO9	PO10	P011	PO12	PSO1	PSO2	PSO3		
1	2	1	-	-	-	-	-	-	-	-	-	-	1	2	2		
2	2	1	-	-	-	-	-	-	-	-	-	-	2	2	1		
3	2	1	-	-	1	-	-	-	-	-	-	-	1	2	3		
4	3	2	1	1	-	1	-	-	-	-	-	-	1	2	1		
5	3	2	1	1	2	1	-	-	-	-	-	-	2	1	2		

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

Dr.G.Balamuruga Mohan kaj.M.Tech.Ph.D., Professor & Head, Dept. of Mechatronics Engineering Sri Manabula Vinayagar Engineering College, Madagadipet, Puducherry-605 107.

Academic Curric	ulum and Syllabi R-2019					
U19ICO54	MEASUREMENT AND INSTRUMENTATION	L	Т	Ρ	С	Hrs
	(Common to ECE, Mechatronics)	3	0	0	3	45

- To introduce the meters used to measure current & voltage
- To have an adequate knowledge in the measurement techniques for power and energy, power and energy meters are included
- To provide Elaborate discussion about potentiometer & instrument transformers
- To provide detailed study of resistance measuring methods
- To provide detailed study of inductance and capacitance measurement

Course Outcomes

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

CO1 - Measure current and voltage.

- CO2 Understand AC and DC measurements.
- **CO3** Measure power and calibration of energy meters
- CO4 Measure current and voltage using potentiometric method.
- CO5 Understand the resistance measurement

UNIT I MEASUREMENT OF VOLTAGE AND CURRENT

Galvanometers: – Ballistic, D'Arsonval galvanometer – Theory, calibration, application – Principle, construction, operation and comparison of moving coil, moving iron meters, dynamometer, induction type & thermal type meter, rectifier type – Extension of range and calibration of voltmeter and ammeter – Errors and compensation

UNIT II MEASUREMENT OF POWER AND ENERGY

Electrodynamometer type wattmeter: –Theory & its errors – Methods of correction – LPF wattmeter– Phantom loading –Induction type kWh meter – Induction type energy meter – Calibration of wattmeter and Energy meter.

UNIT III POTENTIOMETERS & INSTRUMENT TRANSFORMERS

DC potentiometer:- Basic circuit, standardization - Laboratory type (Crompton's) - AC potentiometer:-Drysdale (polar type) type - Gall-Tinsley (coordinate) type - Limitations & applications - Instrument Transformer:-C.T and P.T construction, theory, operation and characteristics

UNIT IV RESISTANCE MEASUREMENT

Measurement of low, medium & high resistance: – Ammeter, voltmeter method – Wheatstone bridge– Kelvin double bridge – Series and shunt type ohmmeter – High resistance measurement :-Loss of charge method, Megohm bridge method –Megger – Direct deflection methods – Price's guard wire method – Earth resistance measurement

UNIT V IMPEDANCE MEASUREMENT

A.C bridges:- Measurement of inductance, capacitance – Q of coil – Maxwell Bridge –Wein's bridge– Schering bridge – Anderson bridge –Hay's bridge- Campbell bridge to measure mutual inductance – Errors in A.C. bridge methods and their compensation – Detectors – Excited field – A.C. galvanometer– Vibration galvanometer.

Text Books

- 1. E.W. Golding & F.C. Widdis, 'Electrical Measurements & Measuring Instruments', A.H. Wheeler& Co,2001
- 2. H.S. Kalsi, Electronic Instrumentation, McGraw-Hill Education, New Delhi, 2010

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Reference Books

- 1. A.K. Sawhney, A Course in Electrical & Electronic Measurements & Instrumentation Dhanpat Rai and Co, New Delhi, 2010.
- 2. S.K.Singh, 'Industrial Instrumentation and control', Tata McGraw Hill, 2nd edn., 2002.
- 3. J.B.Gupta 'A Course in Electronic and Electrical Measurements and Instrumentation', S.K. Kataria & Sons, Delhi, 2003.

Web Resources

- 1. https://lecturenotes.in/notes/7259-notes-for-electrical-measurement-and-instrumentation-mi-byranu-singh
- 2. https://lecturenotes.in/subject/265/electrical-measurement-and-instrumentation

COs			Program Specific Outcomes (PSOs)												
	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	P011	PO12	PSO1	PSO2	PSO3
1	3	3	-	-	-	2	-	-	-	2	-	1	1	1	1
2	3	3	-	3	3	2	-	-	-	2	-	2	1	1	1
3	3	3	2	3	3	2	-	-	-	2	-	2	1	1	1
4	3	3	3	3	3	2	-	-	-	2	-	2	1	1	1
5	3	3	3	2	2	2	-	-	-	2	-	2	1	1	1

COs/POs/PSOs Mapping

Dr.G.Balamuruga Mohan ka, M.Tech, Ph.D., Professor, & Head, Dept. of Mechatronics Engineering Sri Manakula Vinayagar Engineering College, Madagadipet, Puducherry-605 107.
CREATIVITY INNOVATION AND NEW PRODUCT LTP С Hrs **U19MEO55** DEVELOPMENT

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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

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

Collection of ideas and purpose of project - Selection criteria - screening ideas for new products evaluation techniques

UNIT III NEW PRODUCT DEVELOPMENT

Research and new product development - Patents - Patent search - Patent laws-International code for patents -Intellectual property rights (IPR)

UNIT IV NEW PRODUCT PLANNING

Design of proto type - testing - quality standards - marketing research introducing new Products

UNIT V MODEL PREPARATION & EVALUATION

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.

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Web Resources

- 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 For Mechatronics

COs				F	Progra	am O	utcon	nes (F	POs)				Prog Outc	ram Spe omes (P	cific SOs)
	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	P011	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

Dr.G.Balamuruga Mohan ka, M.Tech, Ph.D., Professor, & Head, Dept. of Mechatronics Engineering Sri Manakula Vinayagar Engineering College, Madagadipet, Puducherry-605 107.

BIOMETRIC SYSTEMS

				Г	C	1113
1	(Common to CSE, IT, MECH, MECHATRONICS)	3	0	0	3	45

Course Objectives:

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- 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 Describe the 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

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 II FINGERPRINT TECHNOLOGY

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

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

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

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.

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Text Books

- 1. Anil K. Jain, Arun Ross, and Karthik Nandakumar "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, Davide Maltoni, Dario Maio, "Biometric Systems, Technology Design and Performance Evaluation", Springer, 2005
- 5. Nikolaos V. Boulgouris, Konstantinos N. Plataniotis , Evangelia Micheli-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					Prog	ram O	utcom	es (PC)s)				Prog Outce	ram Spe omes (P	ecific 'SOs)
	PO1	PO2	PO3	PO4	P011	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	-

COs/POs/PSOs Mapping

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

Dr.G.Balamuruga Mohan Kaj.M.Tech.P Professor & Head, Dept. of Mechatronics Engineering Manakula Vinayagar Engineering College, Madagadipet, Puducherry-605 107.

MEDICAL ROBOTICS

(Common to CSE, IT, MECH, MECHATRONICS)

Course Objectives:

U19BMO54

- 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

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

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

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

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 BIOMETRIC AUTHENTICATION

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

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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. Gonzales and C. S. G. Lee, "Robotics", McGraw Hill, 2008.

Web Resources

- 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					Prog	ram O	utcom	es (PC)s)				Prog Outc	ram Spe omes (P	ecific SOs)
	P01	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	-	-	-	1	-	-	-	-	-	1	-	2	-
2	3	2	-	1	1	1	-	-	-	-	-	1	-	2	-
3	3	2	-	1	1	1	-	-	-	-	-	1	-	2	-
4	3	1	1	1	1	1	-	-	-	-	-	1	-	2	-
5	3	1	1	-	1	1	-	-	-	-	-	1	-	2	-

COs/POs/PSOs Mapping

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

Dr.G.Balamuruga Mohan KarM.Tech.Ph.D., Professor & Head, Dept. of Mechatronics Engineering Sri Manakula Vinayagar Engineering College, Madagadipet, Puducherry-605 107. NETWORK ESSENTIALS

U19CC053

3 0 0 3 45 (Common to EEEMECH, CIVIL, ICE MECHATRONICS, BME)

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

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

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

Logical addressing- IPv4 addresses- IPv6- Internet protocol- Transition from IPv4 to IPv6- Mapping logical to physical address- Mapping physical to logical address- ICMP-Direct Vs indirect delivery- Forwarding-Unicast and Multicast routing protocols- Different Routing Algorithms-Internetworking-Routers and gateways.

UNIT IV TRANSPORT AND CONGESTION

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

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

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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. Douglas E. Comer, "Internetworking with TCP/IP (Volume I) Principles, Protocols and Architecture", 6th Edition, Pearson Education, 2013.
- 2. Nader F. Mir, "Computer and Communication Networks", 2nd Edition, Prentice Hall, 2014.
- 3. Ying-Dar Lin, Ren-Hung Hwang and Fred Baker, "Computer Networks: An Open Source Approach", McGraw Hill Publisher, 2011.
- 4. Behrouz A. Forouzan and Firouz Mosharraf, "Computer Networks a Top Down Approach", Tata McGraw-Hill, 2017.
- 5. Rich Seifert, James Edwards, "The All New Switch Book: The Complete Guide to LAN Switching Technology", 2nd Edition, Wiley Publishing Inc, 2011

Web Resources

- 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					Prog	ram O	utcom	es (PC)s)				Prog Outco	ram Spo omes (F	ecific PSOs)
	PO1	PO2	PO3	PO4	PO12	PSO1	PSO2	PSO3							
1	2	1	1	1		1	-	-	-	-	-	1	1	1	1
2	2	1	2	1		1	-	-	-	-	-	1	2	2	2
3	2	1	2	1		1	-	-	-	-	-	1	2	1	1
4	2	1	1	1		1	-	-	-	-	-	1	2	2	1
5	2	1	1	1	1	1	-	-	-	-	-	1	1	2	2

COs/POs/PSOs Mapping

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

Dr.G.Balamuruga Mohan kaj.M.Tech.Ph.D., Professor & Head, Dept. of Mechatronics Engineering Sri Manakula Vinayagar Engineering College, Madagadipet, Puducherry-605 107.

Course Objectives

- To Learn the fundamentals of web application development
- To understand the design components and tools using CSS
- To Learn the concepts of JavaScript 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

Protocols, secure connections, application and development tools, the web browser, What is server, dynamic IP, Web Design: Web site design principles, planning the site and navigation. HTML: The development process, Html tags and simple HTML forms.

UNIT – II STYLE SHEETS

CSS: Need for CSS, Introduction to CSS, basic syntax and structure, using CSS, background images, colors and properties, manipulating texts, using fonts, borders and boxes, margins, padding lists, positioning using CSS, CSS2.

UNIT - III JAVA SCRIPTS

Client side scripting, JavaScript, develop JavaScript, simple JavaScript, variables, functions, conditions, loops and repetition.

UNIT -IV XML

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

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. Hirdesh Bhardwaj,, "Web Designing", Pothi.com, 2016
- 3. P.J. Deitel and H.M. Deitel, Internet and World Wide Web How to Program, Pearson Education, 2009.

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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 Resources

- 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					Prog	ram O	utcom	es (PC)s)				Prog Outco	ram Spo omes (F	ecific 'SOs)
	P01	PO1 PO2 PO3 PO4 PO5 PO6 PO7 PO8 PO9 PO10 PO11 2 1 1 2 1 1 2 1 <th>PSO2</th> <th>PSO3</th>												PSO2	PSO3
1	2	1	1	1	2	1	-	-	-	-	-	1	1	-	-
2	2	1	2	1	2	1	-	-	-	-	-	1	1	-	-
3	2	1	2	1	2	1	-	-	-	-	-	1	1	-	-
4	2	1	1	1	2	1	-	-	-	-	-	1	1	-	-
5	2	1	1	1	2	1	-	-	-	-	-	1	1	-	-

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

Dr.G.Balamuruga Mohan ka, M.Tech, Ph.D. Professor & Head, Dept. of Mechatronics Engineering Vinayagar Engineering College, Medagadipet, Puducherry-605 107.

Hrs DATA SCIENCE APPLICATION OF VISION L т Ρ С

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

Mechatronics)

Course Objectives

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- To understand the capability of a machine to get and analyze visual information and makedecisions
- 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

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

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

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

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

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.

(9 Hrs)

(9 Hrs)

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(9 Hrs)

45

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

					Drog	nam O	utcom	oos (D	0c)				Prog	ram Sp	ecific
COs					Flogi		ucon	IES (F	05)				Outco	omes (F	PSOs)
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO 9	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

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		L	Т	Ρ	С	Hrs
019113001	FRODUCT DEVELOFMENT AND DESIGN	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

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

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

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

Concept selection- Screening - scoring, Product architecture - Implication of architecture - Establishing the architecture - Related system level design issues.

UNIT V: PROTOTYPING

Reliability, failure identification techniques, Poka-Yoke, Design for the environment, design for maintainability, product safety, liability and design, design for packaging.

Text Books

- 1. Kari 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.

265

(9 Hrs)

(9 Hrs)

(9 Hrs)

(9 Hrs)

- 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 Resources

- 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					Prog	ram Oi	utcom	es (PC)s)				Prog Outco	ram Spo omes (F	ecific PSOs)
	P01	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	-	3	-	3	-	-	-	-	-	-	2	2	1	3
2	1	-	2	-	3	-	-	-	-	-	-	3	1	2	2
3	1	-	3	-	2	-	-	-	-	-	-	2	1	2	3
4	3	-	1	-	3	-	-	-	-	-	-	1	1	2	3
5	1	-	3	-	3	-	-	-	-	-	-	2	1	1	3

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

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U19HSO62 INTELLECTUAL PROPERTY AND RIGHTS

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: Disseminating the 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

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

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

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

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

(9 Hrs)

(9 Hrs)

(9 Hrs)

(9 Hrs)

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UNIT V OTHER FORMS OF IP

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.
- 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 Resources

- 1. http://www.bdu.ac.in/cells/ipr/docs/ipr-eng-ebook.pdf
- 2. Cell for IPR Promotion and Management (http://cipam.gov.in/)
- 3. World Intellectual Property Organisation (https://www.wipo.int/about-ip/en/)
- 4. Office of the Controller General of Patents, Designs & Trademarks (http://www.ipindia.nic.in/)
- 5. Journal of Intellectual Property Rights (JIPR): NISCAIR

COs					Prog	jram O	utcome	es (PO:	s)				Prog Outc	ram Spe omes (P	ecific 'SOs)
	P01	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	1	-	3	-	2	-	1	2	-	-	-	2	1	1	3
2	1	-	3	-	2	-	2	2	-	-	-	2	2	2	1
3	-	-	2	-	1	-	3	3	-	-	-	2	2	2	3
4	2	-	3	-	2	-	2	2	-	-	-	2	2	2	1
5	1	-	1	-	2	-	1	2	-	-	-	2	2	2	1

COs/POs/PSOs Mapping

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

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U19HSO63

MARKETING MANAGEMENT AND L RESEARCH 3

T P C Hrs 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

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

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

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

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

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

(9 Hrs)

(9 Hrs)

(9 Hrs)

(9 Hrs)

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 Resources

- 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

					Prog	ram C)utco	mes					Prog	gram S	pecific
COs					(POs	5)							Outo	omes	
													(PSC)s)	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P01	PO1	PO1	PSO	PSO	PSO
										0	1	2	1	2	3
1	-	-	1	-	-	-	2	-	-	1	-	1	3	-	-
2	-	1	2	-	1	-	3	-	-	2	-	1	2	3	1
3	-	-	1	-	1	-	-	-	2	1	-	1	1	2	3
4	-	3	2	2	-	1	-	1	1	2	-	1	2	2	1
5	-	2	2	1	2	2	-	2	2	2	-	1	2	2	1

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

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U19HSO64 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

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

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

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

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

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.

(9 Hrs)

(9 Hrs)

(9 Hrs)

(9 Hrs)

Text Books

- 1. Erik Larson and Clifford Gray. "Project Management: The Managerial Process". 6th Edn. McGraw Hill Education; 2017.
- 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					Prog	gram O	utcom	es (PO	s)				Prog Outc	jram Spe omes (P	ecific 'SOs)
003	PO1	PO2	PO3	PO4	PO5	PO6	P07	P08	PO9	PO10	P011	PO12	PSO1	PSO2	PSO3
1	2	-	1	-	-	-	-	-	2	-	2	2	2	1	1
2	-	2	1	-	-	1	-	-	1	1	1	1	2	2	1
3	-	1	3	-	-	-	-	-	-	-	1	-	2	1	1
4	3	1	1	-	-	1	1	-	-	1	1	3	2	2	1
5	3	-	3	-	-	-	-	3	3	2	3	2	1	1	3

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

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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

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

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

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

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

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.

(9 hrs)

(9 hrs)

(9 hrs)

(9 hrs)

(9 hrs)

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

COs	Program Outcomes (POs)														ecific PSOs)
	PO1	PO2	PO3	PO12	PSO1	PSO2	PSO3								
1	-	-	1	-	-	-	2	-	-	1	2	1	3	2	1
2	-	1	2	-	1	-	3	-	-	2	2	1	3	3	1
3	-	-	1	-	1	-	-	-	2	1	2	1	3	2	2
4	-	3	2	2	-	1	-	1	1	2	2	1	1	2	3
5	-	2	2	1	2	2	-	2	2	2	2	1	1	1	3

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

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U19EEO75

HYBRID AND ELECTRICAL VEHICLE

(Common to ECE, MECH, Mechatronics)

Course Objectives

- To familiarize with the fundamental concept of electrical vehicle
- To understand the concept of hybrid and electrical vehicle architecture, component sizing and electrical motor drive.
- To determine various drives suitable for electrical vehicles.
- To understand the design concepts of electrical vehicle
- To overview the energy storage technologies used for hybrid and electrical vehicle.

Course Outcomes

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

CO1 - Summarize the basics of electrical vehicle based on working principle. (K2)

- CO2 Describe the working of different configurations of hybrid vehicles. (K2)
- CO3 Apply suitable drives for electrical vehicles. (K2)
- CO4 Review the working of different configurations of electrical vehicle and its design concepts (K2)

CO5 - Combine the different energy storage and their technologies on implementing hybrid vehicle. (K3)

UNIT I INTRODUCTION TO ELECTRICAL VEHICLE

History of hybrid and electrical vehicles - social and environmental importance - impact of modern drive - trains on energy supplies - Fundamentals of vehicle propulsion and Braking: Dynamic Equation - Vehicle Power Plant and Transmission Characteristics - Vehicle Performance - Braking Performance.

UNIT II HYBRID VEHICLE

Classification - Series and Parallel HEVs - Advantages and disadvantages - Series-Parallel Combination -Internal Combustion Engines: Reciprocating Engines - Gas Turbine Engine- Design of an HEV: Hybrid Drive train - Sizing of Components.

UNIT III ELECTRIC PROPULSION DRIVE SYSTEMS

Electric drives used in EV/HEV: Induction motor drives - DC motor drives - Permanent magnet motor drives their Configuration - Control and Applications in EV/HEV.

UNIT IV DESIGN OF ELECTRICAL VEHICLE

Hrs)

Components of EV - advantages - EV transmission configuration: Transmission components - gear ratio - EV motor sizing - EV market.

UNIT V ELECTRICAL VEHICLE STORAGE TECHNOLOGY

Battery Types - Parameters - Technical characteristics – modelling and equivalent circuit - Methods of battery charging - Fuel cells: Types - Fuel cell electrical vehicle - Ultra capacitors - Hydrogen storage systems -Flywheel technology.

Text Books

- 1. Mehrdad Ehsani, Yimin Gao, Sebastien E.Gay, Ali Emadi, "Modern Electric, Hybrid Electric and Fuel Cell Vehicles", CRC Press, 3rd Edition, 2019.
- 2. Igbal Hussain, "Electric and Hybrid Vehicles Design Fundamentals", CRC Press, 2nd Edition, 2011.

Reference Books

- 1. K. T. Chau, "Electric vehicle machines and drives: Design, analysis and application", John Willey and Sons Singapore pte. ltd., 1st Edition, 2015.
- 2. M. Ehsani, Y. Gao and A. Emadi, "Modern electric, hybrid electric and fuel cell vehicles: Fundamentals, Theory and design", CRC press, 2nd Edition, 2011.
- 3. J. Larminie and J. Lowry, "Electric vehicle technology explained", John Willey & Son Itd., 2nd Edition, 2012.
- 4. I. Husain, "Electric and hybrid vehicles: Design fundamentals", CRC press, 2003.

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Web Resources

- 1. https://nptel.ac.in/courses/108103009/
- 2. https://www.evgo.com/why-evs/types-of-electric-vehicles/
- 3. https://www.electrichybridvehicletechnology.com/
- 4. http://www.ieahev.org/
- 5. https://www.sae.org/learn/content/acad06/
- 6. https://www.intechopen.com/books/electric-vehicles-modelling-and-simulations

COs/POs/PSOs Mapping

COs					Prog	ram O	utcom	es (PC)s)				Prog Outco	ram Spo omes (F	ecific 'SOs)
	P01	PO2	PO3	PO12	PSO1	PSO2	PSO3								
1	3	3	2	2	-	-	3	-	-	-	-	1	2	2	1
2	2	3	3	3	-	-	3	-	-	-	-	1	3	3	1
3	3	3	2	2	-	-	3	-	-	-	-	1	2	2	1
4	3	3	3	2	-	-	3	-	-	-	-	1	3	2	1
5	2	3	3	2	-	-	3	-	-	-	-	1	3	2	1

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

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ELECTRICAL ENERGY CONSERVATION AND L T

AUDITING

(Common to ECE, ICE, MECH, CIVIL, BME, Mechatronics)

Course Objectives

U19EEO76

- 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

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

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

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

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

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.

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References Books

- 1. P. Venkataseshaiah K.V. Sharma, "Energy Management and Conservation", Dreamtech Press, 1stEdition, 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 Resources

- 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

					Prog	ram O	utcom	es (PC)s)				Prog Outo	gram Sp comes (oecific PSOs)
COs	PO1	PO1 PO2 PO3 PO4 PO5 PO6 PO7 PO8 PO9 PO10 PO11 PO1												PSO2	PSO3
1	2	2	3	-	-	-	-	-	-	-	-	1	2	1	2
2	3	2	3	-	-	-	-	-	-	-	-	1	2	1	1
3	3	2	3	-	-	-	-	-	-	-	-	1	2	1	-
4	3	2	2	-	-	-	-	-	-	-	-	1	1	1	-
5	2	2	3	-	-	-	-	-	-	-	-	1	1	1	-

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

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SENSORS FOR INDUSTRIAL APPLICATIONS **U19ECO76** С Hrs L Т Ρ

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

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

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

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

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.

UNITY APPLICATIONS OF SENSORS

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, VI Edition, Tata McGraw-Hill Book Company, 2012.

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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 Resources

- 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/

005					Progr	am O	utcom	es (PC	Ds)				Prog Outc	ram Spe omes (P\$	cific SOs)
003	P01	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	1	1	-	-	-	1	-	-	-	-	1	1	1	2
2	3	1	3	-	-	-	1	-	-	-	-	1	1	1	1
3	2	2	3	-	-	-	1	-	-	-	-	1	1	2	-
4	2	2	3	-	-	-	1	-	-	-	-	1	1	2	-
5	2	2	3	-	-	-	1	-	-	-	-	1	1	2	-

COs /POs/PSOs Mapping

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

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U19CSO77

CLOUD TECHNOLOGY AND ITS L T P C Hrs APPLICATIONS

(Common to EEE, ICE, MECH, CIVIL, BME, **3 0 0 3 45** CCE, Mechatronics)

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 and 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

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

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

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

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

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 -

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Application Transformation Program - Business Model Scenarios - Virtual Services for Organizations - The Future.

Text Books

- 1. Sandeep Bhowmik,"Cloud Computing",Cambridge University Press; First editiouun,2017.
- 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					Prog	ıram O	utcom	ies (PC	Ds)				Prog Outce	ram Spo omes (P	ecific 'SOs)
	P01	PO2	PO3	PO4	PO5	PO6	P07	P08	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
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

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U19IT076

С Т Ρ Hrs L **AUTOMATION TECHNIQUES & TOOLS -**3 0 0 3 45 DEVOPS

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

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

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

Introduction to DevOps - Version control - Automated testing - Continuous integration - Continuous delivery -Deployment pipeline - Infrastructure management - Databases

UNIT IV PURPOSE OF DEVOPS

Minimum Viable Product- Application Deployment- Continuous Integration- Continuous Delivery

UNIT V CAMS (CULTURE, AUTOMATION, MEASUREMENT AND SHARING)

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.

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COs					Progr	am O	utcom	es (P	Os)				Prog Outco	ram Sp omes (F	ecific 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

COs/POs/PSOs Mapping

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

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01910075	INDUSTRIAL AUTOMATION	3	0	0	3	45

Course Objectives

- To know about the design of a system using PLC.
- To study about PLC Programming
- To study knowledge on application of PLC
- To have an exposure SCADA architecture
- To know about the fundamentals of DCS.

Course Outcomes

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

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

UNIT I PLC ARCHITECTURE

Introduction and overview of Industrial automation – Block diagram of PLC – different types of PLC – Type of input and output – Introduction to relay logic- Application of PLC.

UNIT II PLC PROGRAMMING

Introduction to Ladder logic programming – Basic instructions – Timer and Counter instruction Arithmetic and logical instruction – MCR, PID controller and other essential instruction sets - Case studies and examples for each instruction set.

UNIT III APPLICATION OF PLC

Introduction to high level PLC language – Programming of PLC using simulation software – Real time interface and control of process rig/switches using PLC.

UNIT IV INTRODUCTION OF SCADA

Introduction to DCS and SCADA - Block diagram – function of each component – Security objective – Operation and engineering station interface – Communication requirements.

UNIT V DISTRIBUTED CONTROL SYSTEM

Development of different control block using DCS simulation software – Real time control of test rigs using DCS. Introduction to HART, Field bus and PROFIBUS – Application and case studies of large scale process control using DCS.

Text Books

- 1. John W. Webb and Ronald A Reis, Programmable Logic Controllers Principles and Applications, Prentice Hall Inc., New Jersey, 5th Edition, 2002.
- 2. Lukcas M.P, Distributed Control Systems, Van Nostrand Reinhold Co., New York, 1986.
- 3. Frank D. Petruzella, Programmable Logic Controllers, McGraw Hill, New York, 4th Edition, 2010.

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Reference Books

- 1. Deshpande P.B and Ash R.H, Elements of Process Control Applications, ISA Press, New York, 1995.
- 2. Curtis D. Johnson, Process Control Instrumentation Technology, Prentice Hall, New Delhi, 8th Edition, 2005.
- 3. Krishna Kant, Computer-based Industrial Control, Prentice Hall, New Delhi, 2 nd Edition, 2011.

Web Resources

- 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

							Progra	am Out	come	e (POe	<u>۱</u>		Pro	gram Sj	pecific
COs						ſ	logia		come	5 (F 05)		Out	comes(PSOs)
	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	P011	PO12	PSO1	PSO2	PSO3
1	3	3	1	-	-	1	-	-	-	1	1	2	1	3	2
2	3	3	1	-	-	1	-	-	-	1	1	2	1	3	2
3	3	2	1	-	-	1	-	-	-	1	1	2	1	3	2
4	2	3	1	-	-	1	-	-	-	1	1	2	1	3	2
5	3	2	1	-	-	1	-	-	-	1	1	3	1	3	2

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

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U19ICO76	ULTRASONIC INSTRUMENTATION	L	Т	Ρ	С	Hrs
		3	0	0	3	45
Course Objectives						

- To know about the ultrasonic waves characteristics
- To study about ultrasonic wave generation
- To study knowledge on ultrasonic test methods
- To have an exposure on ultrasonic measurements
- To explore the ultrasonic applications

Course Outcomes

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

CO1- Know the fundamentals of ultrasonic characteristics (K1).

CO2- Know about the generation of ultrasonic generation (K1).

- CO3- Acquire knowledge on ultrasonic test methods (K1, K2)
- CO4- Know about the ultrasonic density (K1)

CO5- Explore knowledge on ultrasonic applications (K1,K3)

UNIT I ULTRASONIC WAVES CHARACTERISTICS

Ultrasonic waves: principle and propagation of various waves, characterization of ultrasonic transmission, reflection and transmission coefficients, intensity and attenuation of sounds beam .power level, medium parameters.

UNIT II ULTRASONIC WAVE GENERATION

Generation of ultrasonic waves: magnetostrictive and piezoelectric effects, search unit types, construction and characteristics

UNIT III ULTRASONIC TEST METHODS

Ultrasonic test methods: pulse echo, transit time, resonance, direct contact and immersion type and ultrasonic methods of flaw detection.

UNIT IV ULTRASONIC MEASUREMENTS

Ultrasonic measurements: ultrasonic methods of measuring thickness, depth and flow, variables affecting ultrasonic testing in various applications.

UNIT V ULTRASONIC APPLICATIONS

Ultrasonic applications: ultrasonic applications in medical diagnosis and therapy, acoustical holography.

Text Books

- 1. J.David N. Cheeke, Fundamentals And Applications of Ultrasonic Waves, CRC Press 2002.
- 2. Dale Ensminger, Ultrasonic: Fundamentals, Technology, Applications, CRC press, 1988, Second Edition.

Reference Book

- 1. Baldev Raj, Palanichamy P., Rajendran. V, Science And Technology Of Ultrasonic, Alpha Science, 2004
- 2. Emmanuel P. Papadakis, Ultrasonic Instruments and Devices, ASA, 1998

(9 Hrs)

(9 Hrs)

(9 Hrs)

(9 Hrs)

Web Resources

- 1. https://www.intechopen.com/chapters/47872
- 2. https://nptel.ac.in/courses/108/105/108105064/
- 3. https://www.ti.com/lit/an/slaa907c/slaa907c.pdf?ts=1630072911996&ref_url=https%253A%252F%252Fwww. google.com%252F
- 4. https://pocketdentistry.com/6-ultrasonic-instrumentation-technique/

COs/POs/PSOs Mapping

COs						F	Progra	am Out	come	s (POs)		Pro Out	gram S _l comes(pecific PSOs)
	P01	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2	PSO3
1	3	1	-	1	1	-	-	-	-	1	-	2	2	1	1
2	3	1	-	1	1	-	-	-	-	1	-	2	2	1	1
3	3	1	-	1	1	-	-	-	-	1	-	2	2	1	1
4	2	1	-	1	1	-	-	-	-	1	-	2	2	1	1
5	3	1	-	2	1	-	2	-	-	1	-	3	2	1	1

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

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U19MEO77

SUPPLY CHAIN MANAGEMENT

L T P C Hrs 3 0 0 3 45

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 Examine the process and strategy of supply chain management (K2)
- CO2 Enumerate the inventory in supply chain management (K2)
- CO3 Identify the importance of logistics and information technology in supply chain management (K3)
- CO4 Discuss the importance of integrated systems in supply chain management (K2)

CO5 - Demonstrate how agile and lean method will help to optimise resources in supply chain management (K2)

UNIT I INTRODUCTION TO SUPPLY CHAIN MANAGEMENT

Generic Types of supply chain, Various Definitions and Implications, Major Drivers of Supply chain. Strategic Decisions- in Supply Chain Management-Introduction, Business Strategy, Core Competencies in Supply Chain, Strategic SC Decisions

UNIT II SOURCE OF MANAGEMENT AND INVENTORY IN SUPPLY CHAIN MANAGEMENT

(9 Hrs)

(9 Hrs)

Elements of Strategic Sourcing, - Collaborative Perspective, Development of Partnership, Types of Inventory, Supply/ Demand Uncertainties, Inventory costs, Selective Inventory Control, Vendor Manage Inventory system, Inventory Performance Measure

UNIT III LOGISTICS AND INFORMATION TECHNOLOGY IN SUPPLY CHAIN MANAGEMENT

(9 Hrs)

(9 Hrs)

(9 Hrs)

Strategy, Transportation Selection, Trade-off, Third Party Logistics,, Overview of Indian Infrastructure for Transportation- Types of IT Solutions like Electronic Data Interchange (EDI), Data Mining/ Data Warehousing, E-Commerce, E- Procurement, Bar Coding Technology- Computer Based Information Systems- ERP, ERP & SCM.

UNIT IV REVERSE AND COLLABORATIVE SUPPLY CHAIN MANAGEMENT

Reverse Supply Chain v/s Forward Supply Chain, Types and, Issues, Reverse Supply Chain for Food items, Reverse Logistic and Environment Impact. Evolution of collaborative SCM, Efficient Customer response, Collaboration at various levels, Imperatives for Successful Integrative Supply Chains.

UNIT V AGILE AND LEAN SUPPLY CHAIN MANAGEMENT

Source of Variability, Characteristics of Agile Supply Chain, Achieving Agility in Supply Chain. Lean supply chain management-Concept and Application, Cases of Supply Chain like, News Paper Supply Chain, Book Publishing, Mumbai Dabbawala, Disaster management, Organic Food, Fast Food.

Text books

1. Chopra, Sunil, Peter Meindl, and Dharam Vir Kalra. Supply chain management: strategy, planning, and operation. 6/e Edition, MA: Pearson, 2016.

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Academic Curriculum and Syllabi R-2019

- 2. Martin Christopher, Logistics and Supply Chain Management, 5th Edition, FT Publishing International, 2016.
- 3. D K AGRAWAL , A text book of Logistics and supply chain management, MACMILAN, 2015
- 4. Badenhorst Weiss H Supply Chain Management: A Logistic Approach, Oxford E-Books, 2018
- 5. Sunil Chopra, Supply Chain Management: Strategy, Planning, and Operation, Pearson, 2017

Reference books

- 1. Michael H. Hugos, Essentials of Supply Chain Management, 3rd edition, John Wiley & Sons, 2018.
- 2. Richard B. Chase, Ravi Shankar, F. Robert Jacobs, Operations & Supply Chain Management, 15 edition Mc Graw Hill India, 2018.
- 3. William C Copacino, Supply chain Management, Basics and Beyond, , CRC press, 2010.
- William C Copacino, Retail supply chain Management, James B. Ayers, Mary Ann Odegaard, CRC press, 2018.
- 5. James R Good, The essentials of Supply Chain Management, ,.Bowling Green state University, 2019

Web Resources

- 1. https://www.edx.org/learn/supply-chain-management
- 2. http://library.jgu.edu.in/content/logistics-and-supply-chain-management
- 3. https://onlinelibrary.wiley.com/ Journal of Supply Chain Management
- 4. https://www.emerald.com/insight/ An International Journal of Operations and Logistics Management
- 5. https://nptel.ac.in/noc/courses/noc19/SEM1/noc19-mg22/

COs/POs/PSOs Mapping

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

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

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U19CCO75

DATA SCIENCE USING PYTHON (Common to EEE, ECE, MECH, CIVIL, IC Mechatronics, BME)

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

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

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.

UNITIII INTRODUCTION TO NUMPY

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

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

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.

291

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(9Hrs)

(9Hrs)

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. 3. Jake VanderPlas, "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. RajendraAkerkar, PritiSrinivasSajja, "Intelligence Techniques for Data Science", Spring International Publication, 2016.
- 5. Longbing Cao "Data Science Thinking: The Next Scientific, Technological and Economic Revolution", Spring International Publication, 2018.

Web Resources

- 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

			Program Specific												
COs					Outcomes (PSOs)										
	P01	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	2	2	1	1	-	-	-	-	-	-	-	1	-	1
2	2	2	2	2	2	-	-	-	-	-	-	-	1	1	-
3	2	2	2	2	2	-	-	-	-	-	-	-	1	-	1
4	3	3	3	3	3	-	-	-	-	-	-	-	1	-	-
5	3	2	2	2	2	-	-	-	-	-	-	-	1	-	1

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

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U19CCO76

MOBILE APPLICATIONS DEVELOPMENT USING ANDRIOD (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 INTRODCTION

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

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

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

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

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

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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

			Program Specific												
COs				Outcomes (PSOs)											
	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	P011	PO12	PSO1	PSO2	PSO3
1	3	2	3	2	2	3	-	-	-	3	2	2	2	2	2
2	3	2	3	2	2	3	-	-	-	3	2	2	2	2	2
3	3	2	3	2	2	3	-	-	-	3	2	2	2	2	2
4	3	2	3	2	2	3	-	-	-	3	2	2	2	2	2
5	3	2	3	2	2	3	-	-	-	3	2	2	2	2	2

COs/POs/PSOs Mapping

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

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Ac	ademic Curriculum and Syllabi R-2019												
	DATA SCIENCE APPLICATION OF NLP	L	Т	Ρ	С	Hrs							
U 1	I9AD073 (Common to EEE, ECE, CSE, IT, ICE, MECH, CIVIL, BME, Mechatronics)	3	0	0	3	45							
Сс	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

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

Character Encoding, Word Segmentation, Sentence Segmentation, Introduction to Corpora, Corpora Analysis.

UNIT III MORPHOLOGY

Inflectional and Derivation Morphology, Morphological Analysis and Generation using finite state transducers.

UNIT IV LEXICAL SYNTAX AND LANGUAGE MODELING

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

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. Emily Bender, "Linguistics Fundamentals for NLP", Morgan Claypool Publishers, 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.

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(9 Hrs)

- 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
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COs				Program Specific Outcomes (PSOs)											
	P01	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	P011	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

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