

Puducherry

B.TECH. BIOMEDICAL ENGINEERING

ACADEMIC REGULATIONS 2019 (R-2019)

CURRICULUM AND SYLLABI



COLLEGE VISION AND MISSION

Vision

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

Mission

M1: Quality Education

To provide comprehensive academic system that amalgamates the cutting edge technologies with best practices.

M2: Research and Innovation

To foster value-based research and innovation in collaboration with industries and institutions globally for creating intellectuals with new avenues.

M3: Employability and Entrepreneurship

To inculcate the employability and entrepreneurial skills through value and skill based training.

M4: Ethical Values

To instill deep sense of human values by blending societal righteousness with academic professionalism for the growth of society.

DEPARTMENT VISION AND MISSION

Vision

To provide quality education in Biomedical Engineering focused on promoting continuous enrichment in the relevant research field and innovations in medical diagnosis for human health care.

Mission

M1: Medical science Engineering

To provide quality biomedical engineering education that integrates engineering principles with biomedical sciences.

M2: Research and Development

To develop biomedical engineers to apply innovative strategies for the design and development of medical equipment.

M3: Industrial Intelligence

To incorporate novel technologies towards the healthcare industrial needs for medical applications and to become an entrepreneur.

M4: Ethical Responsibilities

To impart the desirable skill sets to become a globally competent ethical professionals.



PROGRAM 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: Professional Skills

To become outstanding professionals to demonstrate their skills in solving challenges for healthcare diagnosis.

PEO2: Higher Education and Research

Work successfully in multi-disciplinary environments or pursue higher studies.

PEO3: Entrepreneurial Competencies

To address the challenges in biomedical engineering that supports employment and entrepreneurship to serve the society.

PEO4: Leadership Quality

To enable the graduates to exhibit leadership, make decisions with ethical responsibilities.

PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO1: Knowledge in Biomedical Engineering

Comprehending fundamental concepts in biomedical engineering to meet the Emerging trends.

PSO2: Problem Solving in Medical Diagnosis

Apply Biosignal and Image processing techniques to solve real time problems in medical field.

PSO3: Troubleshooting and Design of Medical Equipment

Troubleshoot the faulty medical Equipment used in health care industry.

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SI.No	Course Category	Breakdown of Credits
1	Humanities and Social Sciences (HS)	9
2	Basic Sciences (BS)	38
3	Engineering Sciences (ES)	36
4	Professional Core (PC)	61
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

STRUCTURE FOR UNDERGRADUATE ENGINEERING PROGRAM

SCHEME OF CREDIT DISTRIBUTION - SUMMARY

	AICTE		-	Total						
SI.NO	Suggested Course Category	Т	II	ш	IV	v	VI	VII	VIII	Credits
1	Humanities and Social Sciences (HS)	4				3		1	1	9
2	Basic Sciences(BS)	16	12	3	3	4	-	-	-	38
3	Engineering Sciences (ES)	10	18	4	4	-	-	-	-	36
4	Professional Core (PC)	-	-	14	8	12	15	9	3	61
5	Professional Electives (PE)	-	-	-	3	3	3	3	6	18
6	Open Electives (OE)	-	-	-	3	-	3	3	-	9
7	Project work (PW)	-	-	-	-	-	-	2	8	10
8	Internship (PW)	-	-	-	-	-	-	2	-	2
9	Employability Enhancement Courses (EEC) *	-	-	-	-	-	-	-	-	-
10	Mandatory courses (MC) *	-	-	-	-	-	-	-	-	-
Total			30	21	21	22	21	20	18	183

* EEC and MC credits are not included for CGPA calculation

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		SEM	ESTER – I							
SI.	Course	Course Title	Catagory	Pe	erio	ds	Crodite	Ma	ax. Mar	ks
No.	Code	Course Thie	Calegory	L	Т	Ρ	Credits	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 Civil and Mechanical Engineering	ES	4	0	0	4	25	75	100
5	T111	Engineering Mechanics	ES	3	1	0	4	25	75	100
6	T112	Communicative English	HS	4	0	0	4	25	75	100
Prac	tical									
7	P104	Physics Laboratory	BS	0	0	3	2	50	50	100
8	P105	Chemistry Laboratory	BS	0	0	3	2	50	50	100
9	P106	Workshop Practice	ES	0	0	3	2	50	50	100
							30	300	600	900

		SEME	ESTER – II							
SI.	Course		Cotogony	Pe	erio	ds	Cradita	м	lax. Mar	ks
No.	Code	Course Thie	Calegory	L	Т	Ρ	Credits	CAM	ESM	Total
The	ory	·								
1	T107	Mathematics –II	BS	3	1	0	4	25	75	100
2	T108	Material Science	BS	4	0	0	4	25	75	100
3	T109	Environmental Science	BS	4	0	0	4	25	75	100
4	T104	Basic Electrical and Electronics Engineering	ES	3	1	0	4	25	75	100
5	T105	Engineering Thermodynamics	ES	3	1	0	4	25	75	100
6	T106	Computer Programming	ES	3	1	0	4	25	75	100
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 & Electronics Laboratory	ES	0	0	3	2	50	50	100
Man	Mandatory Course									
11	P107	NCC / NSS *	MC	-	-	-	-	-	-	-
							30	300	600	900

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

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SEMESTER – III										
SI.	Course	Course Title	Cotogony	Pe	eriod	ls	Cradita	N	lax. Ma	rks
No.	Code	Course Title	Category	L	Τ	Ρ	Credits	CAM	ESM	Total
Theo	ory									
1	U19BMT31	Numerical Methods	BS	2	2	0	3	25	75	100
2	U19BMT32	Data Structures	ES	3	0	0	3	25	75	100
3	U19BMT33	Electron Devices and Circuits	PC	3	0	0	3	25	75	100
4	U19BMT34	Biosensors and Transducers	PC	3	0	0	3	25	75	100
5	U19BMT35	Human Anatomy and Physiology	PC	3	0	0	3	25	75	100
6	U19BMT36	Biosignals and systems	PC	2	2	0	3	25	75	100
Pract	tical									
7	U19BMP31	Data Structures Laboratory	ES	0	0	2	1	50	50	100
8	U19BMP32	Electron Devices and Circuits Laboratory	PC	0	0	2	1	50	50	100
9	U19BMP33	Biosensors and Transducers Laboratory	PC	0	0	2	1	50	50	100
Emp	loyability Enhan	cement Course								
10	U19BMC3X	Certification Course – I **	EEC	0	0	4	-	100	-	100
11	U19BMS31	Skill Development Course 1: General Proficiency - I	EEC	0	0	2	-	100	-	100
12	U19BMS32	Skill Development Course 2 *	EEC	0	0	2	-	100	-	100
Mano	datory Course									
13	U19BMM31	Physical Education	MC	0	0	2	-	100	-	100
							21	700	600	1300

	SEMESTER – IV									
SI.	Course		Cotogony	Ρ	erio	ds	Cradita	Max. Marks		ks
No	Code	Course Title	Category	L	Т	Ρ	Creatts	CAM	ESM	Total
Theo	ry									
1	U19BMT41	Probability and Queuing Theory	BS	2	2	0	3	25	75	100
2	U19BMT42	Programming in Java	ES	3	0	0	3	25	75	100
3	U19BMT43	Biosignal Processing	PC	2	2	0	3	25	75	100
4	U19BMT44	Analog and Digital Integrated Circuits	PC	3	0	0	3	25	75	100
5	U19BME4X	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	lical									
7	U19BMP41	Programming in Java Laboratory	ES	0	0	2	1	50	50	100
8	U19BMP42	Biosignal Processing using MATLAB	PC	0	0	2	1	50	50	100
9	U19BMP43	Integrated Circuits Laboratory	PC	0	0	2	1	50	50	100
Empl	oyability Enhanc	ement Course								
10	U19BMC4X	Certification Course – II **	EEC	0	0	4	-	100	-	100
11	U19BMS41	Skill Development Course 3: General Proficiency - II	EEC	0	0	2	-	100	-	100
12	U19BMS42	Skill Development Course 4 *	EEC	0	0	2	-	100	-	100

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Manc	Mandatory Course										
13	U19BMM41	Indian Constitution	MC	2	0	0	-	100	-	100	
						21	700	600	1300		

[#] Professional Electives are to be selected from the list given in Annexure I ^{\$} Open electives are to be selected from the list given in Annexure II

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

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

		SEM	ESTER – V								
SI.	Course		Cotogony	P	erio	ds	Cradita	Max. Marks			
No.	Code	Course The	Category	L	Т	Ρ	Credits	CAM	ESM	Total	
Theo	ry										
1	U19BMT51	Bio Statistics	BS	2	2	0	3	25	75	100	
2	U19BMT52	Biomechanics	PC	3	0	0	3	25	75	100	
3	U19BMT53	Biomedical Instrumentation	PC	3	0	0	3	25	75	100	
4	U19BMT54	Biocontrol Systems	PC	2	2	0	3	25	75	100	
5	U19BME5X	Professional Elective – II #	PE	3	0	0	3	25	75	100	
6	U19XXO5X	Open Elective-II ^{\$}	HS	3	0	0	3	25	75	100	
Pract	ical										
7	U19BMP51	Statistical Laboratory	BS	0	0	2	1	50	50	100	
8	U19BMP52	Biomedical Instrumentation Laboratory	PC	0	0	2	1	50	50	100	
9	U19BMP53	Computation Laboratory	PC	0	0	2	1	50	50	100	
10	U19BMP54	Hospital Training	PC	0	0	2	1	50	50	100	
Empl	oyability Enhan	cement Course	· · ·								
11	U19BMC5X	Certification Course – III **	EEC	0	0	4	-	100	-	100	
12	U19BMS51	Skill Development Course 5: Foreign Language / IELTS - I	EEC	0	0	2	-	100	-	100	
13	U19BMS52	Skill Development Course 6: Presentation Skills using ICT	EEC	0	0	2	-	100	-	100	
Mand	latory Course										
14	U19BMM51	Essence of Indian Traditional Knowledge	MC	2	0	0	-	100	-	100	
	22 750 650 1400										

		SEMES	TER – VI							
SI.	Course		Cotogony	Pe	erio	ds	Cradita	М	ax. Mai	rks
No	Code	Course Title	Category	L	Т	Ρ	Credits	CAM	ESM	Total
Theo	ry									
1	U19BMT61	Diagnostic and Therapeutic Equipment	PC	3	0	0	3	25	75	100
2	U19BMT62	Medical Internet of Things	PC	3	0	0	3	25	75	100
3	U19BMT63	Microcontroller and Embedded Systems	PC	3	0	0	3	25	75	100
4	U19BMT64	Artificial Intelligence and Machine learning in Medicines	PC	2	2	0	3	25	75	100
5	U19BME6X	Professional Elective – III #	PE	3	0	0	3	25	75	100
6	U19XXO6X	Open Elective – III ^{\$}	OE	3	0	0	3	25	75	100
Pract	ical									
7	U19BMP61	Diagnostic and Therapeutic Equipment Laboratory	PC	0	0	2	1	50	50	100
8	U19BMP62	Medical Internet of Things Laboratory	PC	0	0	2	1	50	50	100

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9	U19BMP63	Microcontroller and Embedded Systems Laboratory	PC	0	0	2	1	50	50	100
Empl	oyability Enhan	cement Course						•		
10	U19BMC6X	Certification Course – IV **	EEC	0	0	4	-	100	-	100
11	U19BMS61	Skill Development Course 7: Foreign Language / IELTS - II	EEC	2	0	0	-	100	-	100
12	U19BMS62	Skill Development Course 8: Technical Seminar	EEC	0	0	2	-	100	-	100
13	U19BMS63	Skill Development Course 9: NPTEL / MOOC - I	EEC	0	0	0	-	100	-	100
Mand	latory Course									
14	U19BMM61	Professional Ethics	MC	2	0	0	-	100	-	100
							21	800	600	1400
		SEM	ESTER – VII							·
SI.	Course		Cotogony	Р	erio	ds	Cradita	M	ax. Mar	ks
No	Code	Course little	Category	L	Т	Ρ	-Credits	CAM	ESM	Total
Theo	ry									
1	U19BMT71	Virtual Bioinstrumentation	PC	3	0	0	3	25	75	100
2	U19BMT72	Medical Image Processing	PC	3	0	0	3	25	75	100
3	U19BME7X	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	ical									
5	U19BMP71	Business Basics for Entrepreneur	HS	0	0	2	1	100	-	100
6	U19BMP72	Virtual Bioinstrumentation Laboratory	PC	0	0	2	1	50	50	100
7	U19BMP73	Medical Image Processing Laboratory	PC	0	0	2	1	50	50	100
8	U19BMP74	Comprehensive Viva-voce	PC	0	0	2	1	50	50	100
Proje	ct Work									
9	U19BMW71	Project Phase – I	PW	0	0	4	2	50	50	100
10	U19BMW72	Internship / Inplant Training	PW	0	0	0	2	100	-	100
							20	500	500	1000

	SEMESTER – VIII											
SI.	Course Code	Course Title	Category	Periods			Credits	Max. Marks				
No.			Category	L	Т	Ρ	orcaits	CAM	ESM	Total		
Theo	ry											
1	U19BMT81	Biomaterials and Artificial Organs	PC	3	0	0	3	25	75	100		
2	U19BME8X	Professional Elective – V $^{\#}$	PE	3	0	0	3	25	75	100		
3	U19BME8X	Professional Elective – VI #	PE	3	0	0	3	25	75	100		
Pract	ical											
4	U19BMP81	Entrepreneurship Management	HS	0	0	2	1	100	-	100		

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Proje	Project Work											
5	U19BMW81	Project phase – II	PW	0	0	16	8	40	60	100		
Empl	Employability Enhancement Course											
6	U19BMS81	Skill Development Course 10: NPTEL / MOOC -II	EEC	0	0	0	-	100	-	100		
							18	315	285	600		

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ANNEXURE – I

PROFESSIONAL ELECTIVE COURSES

Professional Elective – I (Offered in Semester IV)										
SI. No.	Course Code	Course Title								
1	U19BME41	Pathology and Microbiology								
2	U19BME42	Hospital Equipment Safety and Management								
3	U19BME43	Medical Physics								
4	U19BME44	Communication Systems								
5	U19BME45	VLSI Design								
Profession	nal Elective – II (Offer	red in Semester V)								
SI. No.	SI. No. Course Code Course Title									
1	U19BME51	Biotelemetry and Telemedicine								
2	U19BME52	Environmental Biotechnology								
3	U19BME53	Laser and Fiber Optics in Medicine								
4	U19BME54	Medical Informatics								
5	U19BME55	1E55 Computers in Medicine								
Professional Elective – III (Offered in Semester VI)										
SI. No.	Course Code	Course Title								
1	U19BME61	Hospital Engineering and Information Systems								
2	U19BME62	Transportation in Living Systems								
3	U19BME63	Soft Computing Techniques								
4	U19BME64	Medical Image Acquisition Techniques								
5	U19BME65	Troubleshooting and Quality Control in Medical Equipment								
Profession	nal Elective – IV (Offe	ered in Semester VII)								
SI. No.	Course Code	Course Title								
1	U19BME71	Physiological System Modelling								
2	U19BME72	Pattern Recognition and Expert Systems in Medicine								
3	U19BME73	Radiological Equipment								
4	U19BME74	Acoustics and Optical Imaging								
5	U19BME75	Dynamics of Biofluids								
Profession	nal Elective – V (Offe	red in Semester VIII)								
SI. No.	Course Code	Course Title								
1	U19BME80	Nanotechnology in Medicine								

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2	U19BME81	Human Assist Devices						
3	U19BME82	Neural Networks						
4	U19BME83	Biometric Recoginzation systems						
5	U19BME84	Tissue Engineering						
Professior	nal Elective – VI (Offe	red in Semester VIII)						
SI. No.	Course Code	Course Title						
1	U19BME85	Brain Computer Interface and Applications						
2	U19BME86	Rehabilitation Engineering						
3	U19BME87	Bio MEMS						
4	U19BME88	Wearable Systems						
5	U19BME89	Clinical Engineerig						

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Annexure – II OPEN ELECTIVE COURSES

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

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2	U19HSO52/ U19HSO62	Intellectual Property and Rights	MBA	(Offered in Semester V for EEE, ECE, ICE, CIVIL, BME)			
3	U19HSO53/ U19HSO63	Marketing Management and Research	MBA	(Offered in Semester VI for CSE , IT, MECH, Mechatronics)			
4	U19HSO54/ U19HSO64	Project Management for Engineers	MBA				
5	U19HSO55/ U19HSO65	Finance for Engineers	MBA				
Open Ele (Offered i (Offered i	e ctive – II / Ope n Semester V fo n Semester VI fo						
1	U19EEO53/ U19EEO63	Conventional and Non- Conventional Energy Sources	EEE	ECE, ICE, MECH, CIVIL, BME, Mechatronics			
2	U19EEO54/ U19EEO64	Industrial Drives and Control	EEE	ECE, ICE, MECH, Mechatronics			
3	U19ECO53/ U19ECO63	Electronic Product Design and Packaging	ECE	EEE, CSE, IT, ICE MECH, BME, Mechatronics			
4	U19ECO54/ U19ECO64	Automotive Electronics	ECE	EEE, ECE, ICE, MECH			
5	U19CSO54/ U19CSO64	Platform Technology	CSE	EEE, ECE, ICE, MECH, CIVIL, BME			
6	U19CSO55/ U19CSO65	Graphics Designing	CSE	EEE, ECE, ICE, MECH, CIVIL, BME			
7	U19ITO53/ U19ITO63	Essentials of Data Science	IT	EEE, ECE, ICE, MECH, CIVIL, BME			
8	U19ITO54/ U19ITO64	Mobile App Development	IT	EEE, ECE, ICE, MECH, CIVIL, BME, Mechatronics			
9	U19ITO55/ U19ITO65	Data Structures	IT	MECH			
10	U19ICO53/ U19ICO63	Fuzzy logic and neural networks	ICE	CSE, IT, CIVIL, BME			
11	U19ICO54/ U19ICO64	Measurement and Instrumentation	ICE	ECE, Mechatronics			
12	U19MEO54/ U19MEO64	Heating, ventilation and air conditioning system (HVAC)	MECH	EEE, ECE, ICE, CIVIL			
13	U19MEO55/ U19MEO65	Creativity Innovation and New Product Development	MECH	EEE, ECE, ICE, CIVIL, BME, Mechatronics			
14	U19CEO53/ U19CEO63	Disaster Management	CIVIL	EEE, ECE, CSE, IT, ICE, MECH, BME			
15	U19CEO54/ U19CEO64	Air Pollution and Solid Waste Management	CIVIL	EEE, ECE, CSE, IT, ICE, MECH, BME			
16	U19BMO53/ U19BMO63	Biometric Systems	BME	EEE, ECE, CSE, IT, ICE, MECH, Mechatronics			
17	U19BMO54/ U19BMO64	Medical Robotics	BME	EEE, ECE, CSE, IT, ICE, MECH, CIVIL , Mechatronics			
18	U19CCO53/ U19CCO63	Network Essentials	CCE	EEE, MECH, CIVIL, ICE, Mechatronics, BME			
19	U19CCO54/ U19CCO64	Web Programming	CCE	EEE, ECE, MECH, CIVIL, ICE, Mechatronics, BME			

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20	U19ADO51/ U19ADO61	Principle of Artificial Intelligence and Machine Learning	AI&DS	EEE, ECE, CSE, IT, ICE, MECH, CIVIL
21	U19ADO52/ U19ADO62	Data science Application of Vision	AI&DS	EEE, ECE, CSE, IT, ICE, MECH, CIVIL, BME, Mechatronics
Open Ele	ective – IV (Offe	red in Semester VII)		
1	U19EEO75	Hybrid and Electrical Vehicle	EEE	ECE, Mechatronics, MECH
2	U19EEO76	Electrical Energy Conservation and auditing	EEE	ECE, ICE, MECH, CIVIL, BME, Mechatronics
3	U19ECO75	IoT and its Applications	ECE	EEE, ICE, CSE, MECH, IT, CIVIL
4	U19ECO76	Sensors for Industrial Applications	ECE	EEE, ICE, CSE, MECH, IT, CIVIL, BME, Mechatronics
5	U19CSO76	Artificial Intelligence	CSE	EEE, ICE, CIVIL, MECH
6	U19CSO77	Cloud Technology and its Applications	CSE	EEE, ICE, MECH, CIVIL, BME, Mechatronics
7	U19ITO76	Automation Techniques & Tools- DevOps	IT	EEE, ECE, ICE, CSE, MECH, CIVIL, BME, Mechatronics
8	U19ITO77	Augmented and Virtual Reality	IT	EEE, ICE, MECH, CIVIL, BME
9	U19ICO75	Industrial Automation	ICE	EEE, ECE, CSE, MECH, IT, CIVIL, BME, Mechatronics.
10	U19ICO76	Ultrasonic Instrumentation	ICE	EEE, ECE, MECH, Mechatronics
11	U19MEO76	Principles of Hydraulic and Pneumatic System	MECH	EEE, ECE, ICE, CIVIL
12	U19MEO77	Supply Chain Management	MECH	EEE, ECE, CIVIL, Mechatronics
13	U19CEO75	Energy Efficient Buildings	CIVIL	EEE, ECE, MECH
14	U19CEO76	Global Warming and Climate Change	CIVIL	EEE, ECE, CSE, IT, ICE, MECH, BME
15	U19MCO71	Building Automation	Mechatronics	MECH, CIVIL
16	U19MCO72	Automation in Manufacturing Systems	Mechatronics	MECH, CIVIL
17	U19BMO75	Internet of Things for Healthcare	BME	EEE, ECE, ICE
18	U19BMO76	Telehealth Technology	BME	EEE, ECE, ICE
19	U19CCO75	Data Science using python	CCE	EEE, ECE, MECH, CIVIL, ICE, Mechatronics, BME,
20	U19CCO76	Mobile Applications Development using Android	CCE	EEE, ECE, MECH, CIVIL, ICE, Mechatronics, BME,
21	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

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Annexure - III EMPLOYABILITY ENHANCEMENT COURSES – (A). CERTIFICATION COURSES

SI. No.	Course Code	Course Title
1	U19BMCX1	Android Medical app development
2	U19BMCX2	Data Science using R
3	U19BMCX3	Design of Biomedical Devices and Systems
4	U19BMCX4	Embedded system using Arduino
5	U19BMCX5	Fuzzy Logic and Neural Networks
6	U19BMCX6	Introduction to C++ Programming
7	U19BMCX7	Machine Learning for medical Diagnosis
8	U19BMCX8	Medical Robotics
9	U19BMCX9	Python Programming

Annexure - IV EMPLOYABILITY ENHANCEMENT COURSES – (B). SKILL DEVELOPMENT COURSES

SI. No.	Course Code	Course Title					
1	U19BMS31	Skill Development Course 1 : General Proficiency - I					
		Skill Development Course 2 *					
2		1) PowerPoint Presentation Design and Animation					
2	01901032	2) Masters in Microsoft Excel					
		3) Microsoft Word Documentation					
3	U19BMS41	Skill Development Course 3 : General Proficiency - II					
		Skill Development Course 4 *					
4		1) Trouble Shooting of Medical Instruments					
4	0195101342	2) PCB Board Designing					
		3) Testing of Electronic and Medical Devices					
5	U19BMS51	Skill Development Course 5 : Foreign Language/ IELTS -I					
6	U19BMS52	Skill Development Course 6 : Presentation Skills using ICT					
7	U19BMS61	Skill Development Course 7 : Foreign Language/ IELTS - II					
8	U19BMS62	Skill Development Course 8 : Technical Seminar					
9	U19BMS63	Skill Development Course 9 : NPTEL/MOOC - I					
10	U19BMS81	Skill Development Course 10 : NPTEL/MOOC-II					

* Choose any one skill development course in the list for SDC 2 and SDC 4

A. On-

T101	MATHEMATICS - I	L	т	Ρ	С	Hrs
	(Common to all branches)	3	1	0	4	60

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

Course Outcomes

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

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

UNIT I CALCULUS

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, 41st Edition, 2011.

Reference Books

- 1. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.
- 2. Kandasamy P. et al, Engineering Mathematics, Vol.1 & 2, S. Chand & Co., New Delhi.
- 3. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.
- 4. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons, New Delhi, 8th Edition.

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

Dr. A.Vijayalakshmi

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(12 Hrs)

(12 Hrs)

(12 Hrs)

(12 Hrs)

(12 Hrs)

Web References

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

COs/POs/PSOs Mapping

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

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

T102	PHYSICS	L	Т	Ρ	С	Hrs
1102	(Common to all branches)	4	0	0	4	45

- 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

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

CO1 - Understand the basic concepts of sound Engineering and ideas to get good audibility inside a hall. Also gain knowledge about the production, propagation, properties and application of ultrasonic waves. **(K2)**

CO2 - Interpret the different characteristic behavior of light waves with air, glass, lens, grating, prism etc., Gain adequate knowledge about the interference, diffraction and polarization phenomenon of light waves and their applications. **(K2)**

CO3 - Understand the principle mechanism of laser light; distinguish between ordinary light and laser light. Basic idea about the various laser sources. Also gain knowledge about the optical fibers and their importance in communication. **(K3)**

CO4 - Understand the basic concept of quantum mechanics, dual nature of matter, and importance of energy of electrons associated with the properties of the materials. Also able to calculate energy of electron in an energy level by solving Schrodinger's equation. **(K1)**

CO5 - Gain knowledge about the structure of nucleus its constituents, nature. Understanding the nuclear energy fission and fusion concepts. Basic ideas of nuclear reactors to produce energy. **(K3)**

UNIT I – ACOUSTICS & NDT

Ultrasonics - Ultrasonic Waves Productions (Piezoelectric & Magnetostriction method) – Detections (Acoustic Grating) NDT applications – Ultrasonic Pulse Echo Method - Liquid Penetrant Method

Acoustics - Factors affecting Acoustic of Buildings (Reverberation, Loudness, Focusing, Echo, Echelon Effect and Resonance) and their Remedies - Sabine's formula for Reverberation Time – Doppler effect and its 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, CO₂ laser, GaAs Laser-applications of lasers

Fiber Optics - Principle and Propagation of light in optical fiber – Numerical aperture and acceptance angle – Types of optical fibers (material, refractive index, mode)-applications to sensors and Fibre Optic Communication

(9 Hrs)

(9 Hrs)

(9 Hrs)

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UNIT IV – WAVE MECHANICS

Matter Waves – de Broglie Wavelength – Uncertainty Principle – Schrödinger Wave Equation – Time Dependent – Time Independent – Application to Particle in a One Dimensional potential Box – Quantum Mechanical Tunneling – Tunnel Diode.

UNIT V – NUCLEAR ENERGY SOURCE

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 References

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

COs/POs/PSOs Mapping

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

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

(9 Hrs)

(9 Hrs)

21

Hrs

45

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Т1	US
	US

CHEMISTRY

(Common to all branch)

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 behavior 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. (K2)
- CO3 Understand the application of the concept of oxidation and reduction reaction to various cells. (K2)
- CO4 Understand the application of electrochemistry in corrosion of metals and also about different types of corrosion control methods. (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 hard water -boiler scale and sludge, caustic embrittlement, priming & foaming and boiler corrosion. Water softening methods- internal & external conditioning-Lime-Soda process, Zeolite process and Ion-exchange process. Desalination-reverse osmosis & electrodialysis

UNIT II – POLYMER

Classification, types of polymerization reactions - mechanism of radical, ionic and Ziegler-Natta polymerizations. Polymer properties -chemical resistance, crystallinity and effect of temperature, Mn and Mw. Thermoplastics and thermosets. Preparation, properties and uses of PVC, TEFLON, Nylons, Bakelite, Polyurithane, Rubbers- vulcanization, synthetic rubber, BuNa-S, BuNa-N, silicone and butyl rubber. Conducting polymers-classification and applications. Polymer composites-FRP-laminar composites. Moulding constituents of plastic, moulding techniques-compression, injection, transfer and extrusion moulding

UNIT III – 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/AgCl& glass electrodes. Batteries- primary and secondary cells, Leclanche cell, Lead acid storage cell, Ni-Cd batterv& alkaline batterv. Fuelcells-H2-O2fuelcell

UNIT IV – CORROSION ANDITSCONTROL

Chemical & electrochemical corrosion-Galvanic, pitting, stress and concentration cell corrosion. Factors influencing corrosion - corrosion control methods - cathodic protection and corrosion inhibitors. Protectivecoating-typesofprotectivecoatings-metalliccoating-tinning and galvanizing, cladding, electroplating and anodizing.

UNIT V – PHASE RULE

Definition and derivation of phase rule. Application to one component system- water and sulphur systems. Thermalanalysis, condensed phase rule. Two component systems- Pb-Ag, Cu-Ni and Mg-Zn systems.

Dr. A.Vijayalakshmi

B.Tech. Biomedical Engineering

(9 Hrs)

(9 Hrs)

(9 Hrs)

(9 Hrs)

(9 Hrs)

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.
- 4. Engineering Chemistry by Rama Devi, VenkataRamana 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.
- 3. P. Kannan and A. Ravi Krishnan "Engineering Chemistry" Hi-Tech Sri Krishna Publications, Chennai, 9th Ed, 2009
- 4. N. Krishnamurthy, P. Vallinayagam and D. Madhavan, Engineering Chemistry, 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 References

- 1. https://water.usgs.gov/edu/hardness.html
- 2. https://www.polymer-project.org/
- 3. www.materials.unsw.edu.au/tutorials/online-tutorials/corrosion
- 4. www.electrochem.org/redcat-blog/4-useful-electrochemistry-websites-2/
- 5. https://serc.carleton.edu/research_education/equilibria/phaserule.html

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

COs/POs/PSOs Mapping

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

A. MIL

BASIC CIVIL AND MECHANICAL ENGINEERING Ρ С Hrs L т T110 4 0 0 4 45

(Common to all branches)

Course Objectives

- To be able to differentiate the type of buildings according to national building code.
- To understand building components and their functions.
- Discuss the different types of roads, bridges and dams.
- To describe different types of combustion systems such as Internal and External Combustion systems ٠
- 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).

A. M

B.Tech. Biomedical Engineering

(8 Hrs)

(7 Hrs)

(8 Hrs)

(7 Hrs)

(7 Hrs)

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UNIT – VI MANUFACTURING PROCESS

Machines – Lathe – Drilling – Bending – Grinding – Shearing (Description only) Machine Process – Turning – 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.
- 7. Lindberg, R.A. Process and Materials of Manufacture, PHI, 1999.
- 8. H.N.Gupta, R.C. Gupta and Arun Mittal, Manufacturing Process, New Age Publications, 2001.
- 9. Nagpal, Power Plant Engineering, Khanna Publishers, Delhi, 1998.

Web References

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

Cos Mapping with POs and PSOs

COs					Progr		Prog Outo	cific SOs)							
000	P01	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	1	3	1	1	2	1	-	1	2	1	3	-	-	-
2	3	1	3	1	1	2	1	-	1	2	1	3	-	-	-
3	3	1	3	1	1	2	1	-	1	2	1	3	-	-	-
4	3	2	1	-	-	1	2	-	-	-	-	3	3	2	1
5	3	2	2	2	2	2	2	-	-	-	-	3	3	2	1
6	3	2	2	2	2	2	2	-	-	-	-	3	3	2	1

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



(8 Hrs)

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

T111

- 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

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(12 Hrs) nt of inerti

(12 Hrs)

(12 Hrs)

(12 Hrs)

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. K Rajesekaran, S and Sankara Subramanian., G., Engineering Mechanics, Vikas Publishing House Private 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.

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- 1. Palanichamy, M.S. Nagan, S., Engineering Mechanics Statics & Dynamics, Tata McGraw-Hill, 2011.
- 2. Beer, F.P and Johnson Jr. E.R, Vector Mechanics for Engineers, Vol. 1 Statics and Vol.2 Dynamics, McGraw Hill International Edition, 1997.
- 3. Bhavikatti,S.S and K.G. Rajashekarappa, Engineering Mechanics, New Age International (p) Ltd, New Delhi, 2010.
- 4. Arthur P. Boresi and Richard J. Schmidt, "Engineering Mechanics: Statics and Dynamics", Thomson Asia Private Limited, Singapore, 2010.
- 5. D.P.Sharma "Engineering Mechanics", Dorling Kindersley India Pvt. Ltd, New Delhi, 2010.

Web References

- 1. http://nptel.iitm.ac.in/video.php?subjectId=112103108
- 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/

				, ng									Due		
COs					Progr	am O	utcom	nes (P	Os)				Outo	omes (P	SOS)
	P01	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	2	3	-	-	-	-	-	-	-	1	1	-	-
2	3	2	2	3	-	-	-	-	-	-	-	1	1	-	-
3	3	2	2	3	-	-	-	-	-	-	-	1	1	-	-
4	3	2	2	3	-	-	-	-	-	-	-	1	1	-	-
5	3	2	2	3	-	-	-	-	-	-	-	1	1	-	-

COs/POs/PSOs Mapping

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



COMMUNICATIVE ENGLISH Ρ С Hrs Т L 0 4 0 4 45

(Common to all branches)

Course Objectives

T112

- 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.

B.Tech. Biomedical Engineering

(9Hrs)

(9Hrs)

(9Hrs)

(9Hrs)

27

(9Hrs)

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

Web References

- 1. https://books.google.co.in/books/about/Effective_Tech_Communication.html
- 2. http://www.prenhall.com/bov
- 3. https://global.oup.com/academic/product/technical-communication
- 4. https://www.amazon.in/Everyday-Dialogues-English-Dixson-R-J/dp
- 5. https://www.sapnaonline.com/books/practical-course-english-pronunciation-w-sethi-j-812032594x-9788120325944

COs/POs/PSOs Mapping

COs					Prog	ram O	utcom	es (PC	Ds)				Prog Outco	ecific 'SOs)	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	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

A. (M) L

P104	PHYSICS LABORATORY	L	Т	Ρ	С	Hrs
1 104	(Common to all branches)	0	0	3	2	30

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

Course Outcomes

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

CO1 - Ability to operate optical equipments like Spectrometer, Polarimeter to find the optical properties like dispersive power, Resolving power and specific rotatory power. **(K2)**

CO2 - Capable of handling screw gauge, venire caliper and travelling microscope to calculate the required parameters. (K4)

CO3 - Acquired basic knowledge about Thermal conduction and magnetic field due to a current carrying coil. (K3)

CO4 - Ability to prepare formal laboratory reports describing the results of experiments and to interpret the data from the experiments. **(K5)**

List of experiments (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

C 0 s	Program Outcomes (POs)												Program Specific Outcomes (PSOs)					
003	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3			
1	3	3	1	1	3	3	2	2	3	3	2	3	-	2	1			
2	3	3	1	1	3	3	1	2	3	3	2	3	-	1	-			
3	3	3	2	1	3	3	2	2	3	3	2	3	-	1	1			
4	3	3	2	1	-	3	2	3	3	3	2	3	-	2	1			

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



P105	CHEMISTRY LAB	L	т	Ρ	С	Hrs
1105	(Common to all the 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.

Course Outcomes

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

CO1- Describe titrimetric analysis which can be used to estimate the amount of metal in a mineral. **(K2) CO2-**Identify titrimetric analysis which can be used to estimate the amount of chemical present in a sample.**(K2)**

CO3- Demonstrate about titrimetric analysis which can be used to estimate the quality of any sample.(K2) CO4- Perform conductometric titration and its uses to analyze any sample.(K3)

CO5- Use 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.
- 6.

Estimation of magnesium by

- EDTA.
- 7. Estimation of acetic acid in vinegar.
- 8. Estimation of ferrous by permanganometry.
- 9. Estimation of ferrous and ferric iron in a solution mixture by dichrometry.
- 10. Estimation of available chlorine in bleaching powder.
- 11. Estimation of copper in copper sulphate solution.

Demonstration Experiments

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

COs/POs/PSOs Mapping

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

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

D106	WORKSHOP PRACTICE	L	Т	Ρ	С	Hrs
FIUO	(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 References

- 1. http://www.nptelvideos.in/2012/12/manufacturing-processes-ii.html
- 2. http://ecoursesonline.iasri.res.in/mod/page/view.php?id=3804
- 3. https://www.tpctraining.com/collections/machine-shop-practices-training
- 4. https://www.vlab.co.in/broad-area-mechanical-engineering
- 5. https://nptel.ac.in/courses/112/107/112107219/

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

COs/POs/PSOs Mapping

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

T107	MATHEMATICS - II	L	Т	Ρ	С	Hrs
1107	(Common to all branches)	3	1	0	4	60

- 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.

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(12 Hrs)

(12 Hrs)

(12 Hrs)

(12 Hrs)

Web References

- 1. https://www.youtube.com/watch?v=1wjXVdwzgX8
- 2. http://www.snggdcg.ac.in/pdf/study-material/mathematics/SMch18.pdf
- 3. https://www.youtube.com/watch?v=MLSfh33ZCwE
- 4. https://www.khanacademy.org/math/differential-equations/laplace-transform/convolution-integral/v/the-convolution-and-the-laplace-transform
- 5. http://www-users.math.umn.edu/~mille003/fouriertransform.pdf

COs/POs/PSOs Mapping

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

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

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- 4	

MATERIAL SCIENCE	L	Т	Ρ	С	Hrs
(Common to all branches)	4	0	0	4	45

T108

- To understand the importance of Material Science as a subject that revolutionized modern day technologies
- To understand the significance of material science in the development of new materials and devices for all branches of Engineering
- To impart knowledge to the Engineering students about some of the important areas of Materials Science so as to enable them perceive the significant contributions of the subject in Engineering and Technology

Course Outcomes

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

CO1-Identify crystal lattices and their structures, crystalline planes and directions in a crystal lattice in terms of Miller Indices. To interpret X-ray diffraction studies and different types of lattice defects and their impact. **(K2) CO2-**To identify the nature of polarization in a dielectric material and to explain the various dielectric material

and their characterization. (K2)

CO3-Understand the source of a materials magnetic behaviour and be able to distinguish types of magnetism. Having Basic idea about the read/ write mechanism of various magnetic storage devices. **(K3)**

CO4-Differentiate semiconductors; calculate the intrinsic carrier concentration in semiconductors.Understand the phenomenon of superconductivity: Student is able to define basic properties of superconducting materials and identify potential areas of their applications. **(K1)**

CO5 - Able to differentiate between nanomaterials and conventional materials. Have a broad understanding of the techniques used to synthesize nanomaterials, evaluate the properties of nanomaterials, identify the role of nanomaterials in current nanotechnology revolution, be prepared for more advanced courses in Materials Science and Engineering. **(K3)**

UNIT I - CRYSTAL STRUCTURE AND LATTICE DEFECTS

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

Dr. A.Vijayalakshmi

B.Tech. Biomedical Engineering

(9 Hrs)

(9 Hrs)

(9 Hrs)

(9 Hrs)

Academic Curriculum and syllabi R-2019

concentration and electrical conductivity in semiconductors (qualitative ideas), Hall effect in Semiconductors --Application of Hall Effect, Basic Ideas of Compound Semiconductors (II-VI & III-V)

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

UNIT V – ADVANCED MATERIALS

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.

Reference Books

- 1. Ali Omar M, Elementary Solid State Physics, Addison Wesley Publishing Co., 2009.
- 2. William D Callister Jr., Material Science and Engineering, 6th Edition, John Wiley and sons, 2009.
- 3. Charles Kittel, Introduction to Solid State Physics, 7th Edition, John Wiley & sons, Singapore, 2007.
- 4. V Raghavan , Materials Science and Engineering- A First Course, 5th Edition, Prentice Hall of India, 2008.
- 5. B.S. Murty, P. Shankar, Baldev Raj, B.B. Rath, and James Murday, Text book of Nanoscience and Nanotechnology, Universities Press, Hyderabad 2012
- 6. M.N. Avadhanulu, Enginerring Physics- Volume-II, S.Chand & Co, New Delhi, 2009
- 7. Pillai S.O, Solid State Physics, 6th Edition New Age International, 2005.

Web References

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

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

COs/POs/PSOs Mapping

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



(9 Hrs)
ENVIROMENTAL SCIENCE

(Common to all branches)

T109

Course Objectives

- To know about theenvironment
- To understand about environmentalpollution
- To apply the knowledge in understanding various environmental issues and problems.

Course Outcomes

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

- CO1 Understand the various environmental segments, its significance to life, also about various natural resources, effects of over utilization and its protection which can lead to sustainable development. (K2)
- CO2 Understand the study of ecology of various systems of nature and also about the diverse species present and its protection. (K2)
- 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. (K2)
- CO5 Understand the concept of spectroscopy and its application to monitor pollution. (K2)

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.

UNIT V POLLUTION CONTROL AND MONITORING

Basic concepts and instrumentation of IR, UV-VIS, atomic absorption spectrometry, Gas Chromatography and Conductometry. Analysis of air pollutants – NOx, COx, SOx, H2S, Hydrocarbons and particulates.

B.Tech. Biomedical Engineering

(12 Hrs) re.Causes

(12 Hrs)

(12 Hrs)

(12 Hrs)

(12 Hrs)

L T P C Hrs 3 1 0 4 60

Text Books

- 1. PK. De, "Environmental chemistry" 7th Ed; New age international (P) Ltd, New Delhi, 2010.
- 2. K. RaghavanNambiar, "Text Book of Environmental Studies" 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.

Reference Books

- 1. 1. B.K. Sharma, "Environmental chemistry" 11th Ed, KRISHNA Prakashan Media (P) Ltd, Meerut, 2007.
- 2. 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. 3. Richard T. Wright, Environmental Science: Toward a Sustainable Future, 10thedition, Prentice Hall, 2008

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/
- 5. https://www.tceq.texas.gov/airquality/monops/sites

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

COs/POs/PSOs Mapping

BASIC ELECTRICAL AND ELECTRONICS	L	т	Р	С	Hrs
ENGINEERING	_	-			
(Common to all branches)	3	1	0	4	60

Course Objectives

T104

- 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.

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B.Tech. Biomedical Engineering

(10 Hrs)

(10 Hrs)

39

(10 Hrs)

(10 Hrs)

(10 Hrs)

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, 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
- 4. Donald P Leach, Albert Paul Malvino and Goutam Saha, "Digital Principles and Applications," 6th edition,Tata McGraw Hill Publishing Company Ltd.,New Delhi,2008.
- 5. S.K. Sahdev, Fundamentals of Electrical Engineering and Electronics, Dhanpat Rai & Co, 2013.
- 6. Jacob Millman and Christos C. Halkias, "Electronic Devices and Circuits" Tata McGraw Hill
- 7. R.L. Boylestad and L. Nashelsky, "Electronic Devices and Circuit Theory", PHI Learning Private Limited, Ninth Edition, 2008
- 8. M.S.Sukija and T.K.Nagasarkar, "Basic electrical and Electronics Engineering", Oxford University Press, 2012.

Web References

- 1. https://nptel.ac.in/courses/108/108/108108076/
- 2. https://www.electrical4u.com/
- 3. https://nptel.ac.in/courses/108/102/108102146/
- 4. http://electrical-engineering-portal.com/
- 5. http://www.electronics-tutorials.ws
- 6. https://www.geeksforgeeks.org/digital-electronics-logic-design-tutorials/
- 7. https://nptel.ac.in/courses/117/102/117102059/

COs/POs/PSOs Mapping

COs				Program Specific Outcomes (PSOs)											
	PO1	PO2	PO3	PO12	PSO1	PSO2	PSO3								
1	3	3	2	2	3	-	-	-	-	-	-	-	1	-	2
2	3	3	2	2	3	-	-	-	-	-	-	-	1	-	2
3	3	3	2	2	3	-	-	-	-	-	-	-	-	-	2
4	3	1	2	2	-	-	-	-	-	-	-	-	2	2	2
5	3	2	2	2	-	-	-	-	-	-	-	-	2	1	2
6	3	-	2	-	2	2	2								

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

(10 Hrs)

ENGINEERING THERMODYN	NAMICS
(Common to all branches)	

Course Objectives

T105

- 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.

(12 Hrs)

(12 Hrs)

Hrs

60

L

3

P C

0 4

Т

1

(12 Hrs)

(12 Hrs)

(12 Hrs)

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., 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 References

- 1. https://nptel.ac.in/courses/112105266/
- 2. https://nptel.ac.in/courses/112108148/
- 3. https://nptel.ac.in/courses/112/103/112103275/
- 4. https://www.linkedin.com/company/heat-transfer-and-process-design-htpd
- 5. https://www.udemy.com/course/an-introduction-to-heat-transfer/

COs					Progr	am O	utcon	nes (P	Os)				Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO12	PSO1	PSO2	PSO3									
1	3	2	2	2	2	-	-	-	-	-	-	-	1	-	-	
2	3	2	2	2	2	-	-	-	-	-	-	-	1	-	-	
3	3	2	3	3	2	-	-	-	-	-	-	-	-	-	-	
4	3	2	3	3	-	-	-	-	-	-	-	-	-	-	-	
5	3	2	3	3	-	-	-	-	-	-	-	-	1	-	1	

Cos Mapping with POs and PSOs

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

A. Mr

Ρ С Hrs COMPUTER PROGRAMMING L Т (Common to CSE, ECE, EEE, IT, ICE, MECH, 3 1 Ω Δ 60 CIVIL, BME, MECHTRONICS, CCE)

Course Objectives

T106

- 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

(12 Hrs)

History of Computers – Block diagram of a Computer – Components of a Computer system –Classification of computers - Hardware - Software - Categories of Software - Operating System - Applications of Computers - Network structure - Internet and its services - Intranet - Study of word processor - Preparation of worksheets.

UNIT II

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

(12 Hrs)

(12 Hrs)

(12 Hrs)

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

UNIT IV

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

(12 Hrs) 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 Books

- 1. Vikas Verma, "A Workbook on C ", Cengage Learning, Second Edition, 2012.
- 2. Ashok N Kamthane, "Computer Programming", Pearson education, Second Impression, 2008.
- 3. Kernighan, B.W and Ritchie, D.M, "The C Programming language", Second Edition, Pearson Education, 2006.
- 4. R.G. Dromey, "How to Solve it by Computer", Pearson Education, Fourth Reprint, 2007.
- 5. Stephen G. Kochan, "Programming in C", Third Edition, Pearson Education, 2007.

Web References

- 1. https://www.geeksforgeeks.org/classification-of-computers/
- 2. http://www.btechsmartclass.com/c_programming/C-Program-Development-Life-Cycle.html
- 3. https://www.learn-c.org/en/Multidimensional_Arrays
- 4. https://www.tutorialspoint.com/cprogramming/c_structures.htm
- 5. https://www.w3schools.in/c-tutorial/command-line-arguments/

COs/POs/PSOs Mapping

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

COMPUTER PROGRAMMI	NG L	Т	Ρ	С	Hrs
LABORATORY		•	•	-	•••
(Common to CSE, ECE, EEE, IT, ICE	, MECH, 0	0	3	2	30

Course Objectives

P101

- To study and understand the use of OS commands
- To gain a hands on experience of compilation and execution of 'C' programs
- To understand the working of control statements
- To design functional methods.
- To make use pointers in various programs

Course Outcomes

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

CO1 - Apply and practice logical ability to solve the problems. Understand C programming development. Environment, compiling, debugging, linking and executing a program using the development environment. **(K2)**

CO2 - Analyzing the complexity of problems, Modularize the problems into small modules and then convert them into programs. **(K2)**

CO3 - Understand and apply the in-built functions and customized functions for solving the problems. (K3)

CO4 - Understand and apply the pointers, memory allocation techniques and use of files for dealing with variety of problems. (K3)

CO5 - Document and present the algorithm's, flowcharts and programs in form of user-manuals. (K3)

List of Exercises

- 1. Study of OS Commands
- 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.
- 4. Write a simple C program to read a three digit number and produce output like
 - a. 1 hundreds
 - b. 7 tens
 - c. 2 units for an input of 172.
- 5. Write a simple C program to check whether a given character is vowel or not using Switch Case statement.
- 6. Write a simple C program to print the numbers from 1 to 10 along with their squares.
- 7. Write a simple C program to find the sum of 'n' numbers using for, do while statements.
- 8. Write a simple C program to find the factorial of a given number using Functions.
- 9. Write a simple C program to swap two numbers using call by value and call by reference.
- 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.

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Academic Curriculum and syllabi R-2019

- 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 References

- 1. https://www.javatpoint.com/factorial-program-in-c
- 2. https://www.studytonight.com/c/programs/array/largest-and-smallest-element-in-array
- 3. https://www.programiz.com/c-programming/examples/information-structure-array
- 4. https://www.geeksforgeeks.org/c-program-print-contents-file/
- 5. https://www.studytonight.com/c/command-line-argument.php

COs				Program Specific Outcomes (PSOs)											
	P01	PO1 PO2 PO3 PO4 PO5 PO6 PO7 PO8 PO9 PO10 PO11 PO12												PSO2	PSO3
1	2	1	-	-	3	-	-	-	-	-	-	-	-	-	-
2	2	1	-	-	3	-	-	-	-	-	-	-	-	-	-
3	3	2	1	1	3	-	-	-	-	-	-	-	-	-	-
4	3	2	1	1	3	-	-	-	-	-	-	-	-	-	-
5	3	2	1	1	3	-	-	-	-	-	-	-	-	-	-

COs/POs/PSOs Mapping



P102	ENGINEERING GRAPHICS (Common to all branches)	L 2	Т 0	Р 3	C 2	Hrs 60
 Course Objectives To convey the bas To explain the imp To teach different To establish the in To develop the ro 	5 sics of engineering drawing portance of an engineering drawing methods of making the drawing nportance of projects and developments mode in drawin le of computer aided design Auto Cad and significance o	ig that a	ire us these	ed in e drav	real	systems s
Course Outcomes After completion of CO1 - Understand the CO2 - Apply various projection.(K3) CO3 - Improve their in CO4 - Create engined CO5 - Analysis the di	the course, the students will be able to e basic concepts of engineering drawings. (K2) concepts like dimensioning, conventions and BIS con magination and visualization skills to design new product ering drawing of physical object representing engineering fferent views and computer aided drafting tools. (K3)	des, the ts. (K4) g syster	e theo ns. (F	ory a (4)	nd n	nethods of
UNIT I Introduction to Stand sections, Involutes, S	lards for Engineering Drawing practice, Lettering, Line pirals, Helix. Projection of Points, Lines and planes	work a	and [Dime	nsior	(12 Hrs) hing Conic
UNIT II Projection of Solids a	nd Sections of Solids					(12 Hrs)
UNIT III Development of surfa	ces – Intersection of surfaces (Cylinder-Cylinder, cylinde	er-cone))			(12 Hrs)
UNIT IV Isometric projections	and Orthographic projections					(12 Hrs)
						(12 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.
- 3. David I cook and Robert N Mc Dougal, Engineering Graphics and Design with computer applications, Holt Sounders Int. Edn. 1985.
- 4. James D Bethune and et. al., Modern Drafting, Prentice Hall Int., 1989.
- 5. K.V. Natarajan, A Text Book of Engineering Drawing, Dhanalakshmi Publishers, 2006.
- 6. BIS, Engineering Drawing practice for Schools & Colleges, 1992.

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Web References

- 1. http://nptel.ac.in/courses/112103019
- 2. https://en.wikipedia.org/wiki/Engineering drawing
- 3. https://nptel.ac.in/courses/105/104/105104148/
- 4. https://onlinecourses.nptel.ac.in/noc20_me79/preview
- 5. https://www.btechguru.com/courses--nptel--engineering-drawing----video-lecture.html

COs/POs/PSOs Mapping

C.O.e				I	Progr	am O	utcon	nes (F	POs)				Program Specific Outcomes (PSOs)			
003	PO1 PO2 PO3 PO4 PO5 PO6 PO7 PO8 PO9 PO10 PO11 PO1													PSO2	PSO3	
1	3	1	-	-	3	-	-	-	-	-	-	3	-	-	-	
2	3	1	-	-	3	-	-	-	-	-	-	3	-	-	-	
3	3	1	-	-	3	-	-	-	-	-	-	3	-	-	-	
4	3	1	-	-	3	-	-	-	-	-	-	3	-	-	-	
5	3	1	-	-	3	-	-	-	-	-	-	3	-	-	-	

A. M

BASIC ELECTRICAL AND ELECTRONICS L T P C Hrs LABORATORY (Common to oll bronchos) 0 0 3 2 45

(Common to all branches)

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.

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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.

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- 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					Progr	am O	utcom	nes (P	Os)				Program Specific Outcomes (PSOs)				
	PO1 PO2 PO3 PO4 PO5 PO6 PO7 PO8 PO9 PO10 PO11 PO1													PSO2	PSO3		
1	3	3	3	3	3	-	-	-	3	-	-	-	3	3	3		
2	3	3	3	3	3	-	-	-	3	-	-	-	1	1	1		
3	3	3	2	3	3	-	-	-	3	-	-	-	2	2	2		
4	3	3	2	3	2	-	-	-	3	-	-	-	2	2	2		
5	3	3	2	3	2	-	-	-	3	-	-	-	2	2	2		
6	3	3	2	3	2	-	-	-	3	-	-	-	2	2	2		

D4 07		L	Т	Ρ	С	Hrs
P107	NCC/NSS	0	0	2	-	30

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 45 hours.
- 4. The above activities will be monitored by the respective faculty incharge and the First Year Coordinator.
- 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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1110BMT31	NUMERICAL METHODS	L	Т	Ρ	С	Hrs
019010131	(Common to CSE, IT, BME)	2	2	0	3	60

Course Objectives

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

Course Outcomes

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

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

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

- CO3 Analyze and apply the knowledge of differentiation and integration by using numerical methods. (K3)
- CO4 Solve the ordinary differential equations by various methods. (K3)

CO5 - Solve the partial differential equations by numerical methods. (K3)

UNIT I SOLUTION OF ALGEBRAIC AND TRANSCENDENTAL EQUATIONS AND EIGEN VALUE PROBLEMS (12 Hrs)

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

UNIT II LINEAR SIMULTANEOUS EQUATIONS

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

UNIT III INTERPOLATION

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

UNIT IV SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS

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

UNIT V SOLUTION OF PARTIAL DIFFERENTIAL EQUATIONS

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

Text Books

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

Reference Books

- 1. C. Xavier, "C Language And Numerical Methods", New Age International, 2007.
- 2. P. Siva Ramakrishna Das, "Numerical Analysis", Kindle Edition, 2016.
- Timo Heister, Leo G. Rebholz, FeiXue, "Numerical Analysisan Introduction", Publisher De Gruyter, 2019.
 K. SankaraRao, "Numerical Methods for Scientists and Engineers", 3rd Edition, PHI Learning Pvt.Ltd, New Delhi, 2018.
- 5. Steven C. Chapra, Raymond P. Canale, "Numerical Methods for Engineers"McGraw Hill Higher Education, 2010.

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Web References

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

COs/POs/PSOs Mapping

COs					Prog	ram O	utcom	es (PC	Ds)				Prog Outco	ram Spo omes (P	ecific PSOs)
	P01	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	1	-	-	-	1	-	-	-	-	-	1	1	2	-
2	2	1	-	-	-	1	-	-	-	-	-	1	1	2	-
3	3	2	1	1	-	1	-	-	-	-	-	1	1	2	-
4	3	2	1	1	-	-	-	-	-	-	-	1	1	2	-
5	3	2	1	1	-	-	-	-	-	-	-	1	1	2	-

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U19BMT32

(Common to ECE, EEE, IT, ICE, MECH, CIVIL, **3 0 0 3 45** BME, MECHATRONICS)

Course Objectives

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

Course Outcomes

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

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

UNIT I BASIC TERMINOLOGIES OF DATA STRUCTURES

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

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Reference Books

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

Web References

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

COs					Prog	ram O	utcom	es (PC)s)				Prog Outc	ram Spo omes (P	ecific 'SOs)
	P01	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	1	1	-	-	-	-	-	-	-	-	3	2	-
2	3	2	1	1	-	-	-	-	-	-	-	-	3	2	-
3	3	2	1	1	-	-	-	-	-	-	-	-	3	2	-
4	3	2	1	1	-	-	-	-	-	-	-	-	3	2	-
5	3	2	1	1	-	-	-	-	-	-	-	-	3	2	-

COs/POs/PSOs Mapping

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1140DMT22		L	Т	Ρ	С	Hrs
019010133	ELECTRON DEVICES AND CIRCUITS	3	0	0	3	45

Course Objectives

- To study the basic semiconductor diodes and its applications.
- To understand the characteristics of transistors
- To enable the student to select appropriate devices for a particular application
- To classify and understand the types of amplifiers
- To know the functions of feedback amplifiers and oscillators

Course Outcomes

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

CO1 - Explain the operation of basic semiconductor diodes and its applications (K2)

CO2 - Categorize the transistors configuration and analyse its characteristics (K3)

CO3 - Distinguish the special semiconductor devices and its applications (K3)

CO4 - Analyse the transistor using small signal model and understand the operation of different categories of amplifiers (K4)

CO5 - Investigate the operation of different types of feedback amplifiers and oscillators (K3)

UNIT I DIODES AND THEIR APPLICATIONS

Formation of P-N junction diode- forward and reverse biased P-N junction, V-I characteristics, diffusion and transition capacitance, Zener diode and its reverse characteristics, Zener breakdown, Avalanche breakdown, Rectifiers-half wave rectifier, full wave rectifier with and without filters, Clippers, Clampers, Voltage Regulator - Zener diode as Voltage regulator.

UNIT II BIPOLAR JUNCTION TRANSISTOR AND FIELD EFFECT TRANSISTOR (9 Hrs)

Principle of transistor action-Current components, CE, CB, and CC Configurations, Input and output characteristics - Cut-off, active and saturation region, Transistor as a switch, Transistor as an amplifier. FET Classification-Fundamentals of JFETs and its characteristics - JFET parameters, MOSFET - principle of operation- Depletion and enhancement modes.

UNIT III SPECIAL SEMICONDUCTOR DEVICES

Unijunction Transistor (UJT), Tunnel diode, Varactor diode, Schottky diode, Gunn diode, Light Emitting Diode (LED), Laser, PIN diode, Photo diode, Liquid Crystal Display (LCD), Silicon Control Rectifier (SCR), DIAC, TRIAC, Applications of SCR, DIAC, TRIAC.

UNIT IV AMPLIFIERS

BJT small signal low frequency model using h parameter - Analysis of CE, CB and CC amplifiers, Differential amplifier - Common mode and Differential mode analysis, RC coupled amplifiers, Cascade amplifier, Power amplifiers – Class A, Class B, Class AB, Push Pull amplifiers, Class C amplifiers.

UNIT V FEEDBACK AMPLIFIERS AND OSCILLATORS

Feedback amplifiers-Properties of negative feedback-voltage and current, series, Shunt feedback, Positive feedback, Barkhausen Condition for oscillations, Classification of Oscillators - RC phase shift, Wien bridge, Hartley, Colpitts and Crystal oscillators, Clapp Oscillator.

Text Books

- 1. Jacob Millman, Chritos C Halkias," Electronic Devices and Circuits", Fourth edition, McGraw Hill Education India Private Ltd., 2015.
- 2. Robert L. Boylestad, "Electronic Devices and Circuit Theory", Eleventh Edition, 2015
- 3. David A. Bell, "Electronic Devices and Circuits", 5th Edition, Prentice Hall of India, 2008

Reference Books

1. Thomas L. Floyd, "Electronic devices", Tenth Edition, Prentice Hall, 2018.

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- 2. Donald A Neaman, "Semiconductor Physics and Devices", Fourth edition, McGraw Hill Education India Private Ltd., 2011
- 3. Salivahanan," Electron Devices and Circuits", Fourth edition, McGraw Hill Education India Private Ltd., 2016
- 4. Sedra and Smith, "Microelectronic Circuits, Fifth Edition, Oxford University Press 2012
- 5. Balbir Kumar, Shail.B.Jain, "Electronic devices and circuits", Second edition, PHI learning private limited, 2014.

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- 1. www.allaboutcircuits.com
- 2. www.circuitstoday.com
- 3. http://www.electronics-tutorials.ws
- 4. https://nptel.ac.in/courses/108/108/108108112/
- 5. https://nptel.ac.in/courses/117/103/117103063/

COs/POs/PSOs Mapping

COs					Prog	ram O	utcom	es (PC)s)				Prog Outce	ram Spe omes (P	ecific SOs)
	P01	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	2	-	-	-	-	1	-	-	-	-	3	-	2
2	3	3	2	-	-	-	-	1	-	-	-	-	3	-	2
3	3	3	2	1	-	-	-	1	-	-	-	-	3	-	2
4	3	3	2	1	-	-	-	1	-	-	-	-	3	-	2
5	3	3	2	-	-	-	-	1	-	-	-	-	3	-	2

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Т Ρ С Hrs L **BIOSENSORS AND TRANSDUCERS U19BMT34** 3 0 0 3 45

Course Objectives

- To study the various measuring devices used in instruments.
- To know about the types of transducers available and their applications in different fields.
- To understand the concepts of optical sensors and its functions
- To study chemical biosensors and bio potential electrodes
- To compare various bridges and display devices

Course Outcomes

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

CO1 - Understand the parameters of various measurement devices (K2)

- CO2 Realize the applications of various sensors and transducers available for physiological measurements (K2)
- CO3 Understand the fundamentals of optical sensors and transducers (K2)
- CO4 Gain knowledge in chemical biosensors and bio potential electrodes (K2)
- CO5 compare various bridges and display devices (K3)

UNIT I BASICS OF MEASUREMENTS

(9 Hrs) Functional elements of an instrument, Static and dynamic characteristics, Errors in measurement Statistical evaluation of measurement data, Standards and calibration.

UNIT II TRANSDUCERS AND SENSORS

Resistive Transducers: Strain Gauge: Gauge factor, sensing elements, configuration, biomedical applications; strain gauge as displacement and pressure transducers, RTD materials and range, Characteristics, thermistor characteristics, biomedical applications of Temperature sensors Capacitive transducer, Inductive transducer, LVDT, Active type: Thermocouple -characteristics.

UNIT III PHOTOELECTRIC AND PIEZOELECTRIC SENSORS

Phototube, scintillation counter, Photo Multiplier Tube (PMT), photovoltaic, Photo conductive cells, photo diodes, phototransistor, comparison of photoelectric transducers, spectrophotometric applications of photo electric transducers. Piezoelectric active transducer and biomedical applications as pressure and Ultrasound transducer.

UNIT IV CHEMICAL BIOSENSORS AND BIOPOTENTIAL ELECTRODES

Blood gas and Acid-Base Physiology, Electrochemical sensors, reference electrode, pH, pO2, pCO2 electrodes, Half Cell potential, Surface electrodes and its types, Needle Electrodes, and Microelectrodes with its circuit diagram.

UNIT V COMPARISON METHODS OF MEASUREMENTS

D.C and A.C potentiometers, DC Bridges -Wheatstone, Kelvin, AC bridges- Maxwell, Hay, Schering and Wien bridge (only derivations), Cathode ray oscilloscope (CRT) and Digital storage oscilloscope (DSO), Liquid Crystal Display (LCD)

Text Books

- 1. A.K.Sawhney, "A Course in Electrical and Electronic measurements and Instruments", Dhanpat Rai and Sons, 2010.
- 2. Prof. Ping Wang and Dr. Qingjun Liu, "Biomedical Sensors and Measurement", First Edition, Springer Publications", 2011.
- 3. Tatsuo Togawa , Toshiyo Tamura and Ake Oberg, "Biomedical Sensors and Instruments", Second Edition, CRC Press Taylor and Francis Group, 2011.

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Reference Books

- 1. R.Anandanatarajan, "Biomedical Instrumentation and measurements", Second Edition, PHI Learning, December 2015.
- 2. Ernest O Doebelin and Dhanesh N Manik, "Measurement Systems, Applications and Design", Fifth edition MC Graw-Hill, 2011.
- 3. Michael J. McGrath, CliodhnaNíScanaill, "Sensor Technologies: Healthcare, Wellness and Environmental Applications, Apress, 2013.
- 4. Richard S.C. Cobbold, "Transducers for Biomedical Measurements: Principles and Applications ", John Wiley and Sons, 2014.
- 5. Nandini K. Jog, "Electronics in Medicine and Biomedical Instrumentation", Second Edition, PHI, 2013.

Web References

- 1. http://www.gvpcew.ac.in/unit%202.pdf
- 2. http://www.123seminarsonly.com/Seminar-Reports/018/31005914-Notes-on-Transducers.pdf
- 3. https://nptel.ac.in/courses/108/108/108108147/
- 4. https://nptel.ac.in/content/storage2/courses/112103174/pdf/mod2.pdf
- 5. https://www.uvpce.ac.in/content/biomedical-transducers-and-biosensors-laboratory

Cos	s/POs/PSOs Mapping		
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COs					Progr	am 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	-	-	-	-	-	1	-	-	-	-	3	2	1
2	3	2	-	-	-	-	-	1	-	-	-	-	3	2	1
3	3	2	2	2	-	-	-	1	-	-	-	-	3	2	1
4	3	2	2	-	-	-	-	1	-	-	-	-	3	2	1
5	3	2	3	3	-	-	-	1	-	-	-	-	3	-	1

U19BMT35 HUMAN ANATOMY AND PHYSIOLOGY L T P C 3 0 0 3

Course Objectives

- To study the basic structural and functional elements of human body.
- To gain knowledge about cardiovascular systems and nervous system
- To understand the basic concepts of respiratory and human skeletal
- To understand the urinary system
- To understand the basic concepts of visual and hearing system

Course Outcomes

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

CO1 - Describe basic structural and functional elements of human body (K2)

CO2 - Explain the function of cardiovascular system and knowledge on nervous systems (K2)

- CO3 Distinguish the types of skeletal systems and functions of respiration (K4)
- CO4 Illustrate the Physiological function of Digestive and Excretory systems (K4)
- CO5 Elucidate special senses in the human body (K3)

UNIT I BASIC ELEMENTS OF HUMAN BODY

Structure and function of Cell and Cellular components, Membrane Potential, Action Potential - Generation and Conduction, Blood Cell - Composition, Fluid and electrolytic balance, Blood Groups - ABO and Rh System, Estimation - RBC and WBC.

UNIT II CARDIOVASCULAR AND NERVOUS SYSTEM

Cardiovascular system - Heart and vascular system, ECG, Blood Pressure, Homeostasis, Cardiac Cycle, Basics of Cardiac Output and Heart Sounds

Nervous System - Structure and functions of Neurons, Synapse, Reflex action and Receptors, Velocity of Conduction of Nerve Impulses, Nervous control of Heart.

UNIT III MUSCULO SKELETAL AND RESPIRATORY SYSTEM

Musculo Skeletal System - Muscle Tissue, Structure of Skeletal Muscle, Types of Muscle, Types of Joints, Major Muscles of Limbs and their actions.

Respiratory system - Physiological aspects of respiration, Exchange of gases, Regulation of Respiration, Disturbance of respiration function, Pulmonary Function Test, Artificial respiration, Cardio-Pulmonary Resuscitation.

UNIT IV URINARYSYSTEM

Gastro Urinal system - Digestion and absorption, Movement of GI tract, Structure and function of kidneys and Nephron, Mechanism of Urine formation, Urine Reflex, Skin and Sweat Gland - Temperature regulation.

UNIT V ENT SYSTEM

Optics of Eye - Retina, Photochemistry of Vision, Accommodation Neurophysiology of Vision, EOG, Structure and functions Internal Ear, Mechanism of Hearing, Auditory pathway, Hearing Tests.

Text Books

- 1. Guyton, "Text book of Medical Physiology", Tenth edition, WB Jaunder company Philadelphia, 2010
- 2. Elaine.N. Marieb, "Essential of human Anatomy and Physiology", Eight edition, Pearson Education New Delhi, 2010
- 3. C.L.Ghai, "A textbook of Practical physiology" Fifth edition, Jaypee Medical Publishers, 2013

Reference Books

1. Frederic H. Martini, Judi L. Nath, Edwin F. Bartholomew, "Fundamentals of Anatomy and Physiology",

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Pearson Publishers, 2014

- 2. Gillian Pocock, Christopher D. Richards, "The Human Body An introduction for Biomedical and Health Sciences", Oxford University Press, USA, 2013
- 3. William F.Ganong, "Review of Medical Physiology", 22nd Edition, McGraw Hill, New Delhi, 2010
- 4. Eldra Pearl Solomon, "Introduction to Human Anatomy and Physiology", W.B. Saunders Company, 2015
- 5. Guyton and Hall, "Medical Physiology", Thirteenth Edition, Elsevier Saunders, 2015

Web References

- 1. https://byjus.com/biology/human-body-anatomy/
- 2. https://www.khanacademy.org/
- 3. https://www.youtube.com/channel/UCJayvjGvKEblkA3KYK1BQQw
- 4. https://www.britannica.com/browse/Anatomy-Physiology

COs/POs/PSOs Mapping

COs					Prog	am Ou	utcom	es (PO)s)				Prog Outco	ram Spe omes (P	cific SOs)
	P01	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	2	-	-	-	-	1	-	-	-	-	1	-	-
2	3	3	2	-	-	-	-	1	-	-	-	-	2	-	-
3	3	3	2	-	-	-	-	1	-	-	-	-	2	-	-
4	3	3	2	-	-	-	-	1	-	-	-	-	2	-	-
5	3	3	2	-	-	-	-	1	-	-	-	-	2	-	-

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U19BMT36

BIOSIGNALS AND SYSTEMS

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Hrs

Course Objectives

- To understand classifications, properties of signal and systems
- To know the methods of characterization of LTI-CT systems in time domain
- To introduce Z transform and their properties
- To know the methods of characterization of LTI-DT systems in frequency domain •
- To learn discrete fourier transform, properties of DFT and its application to linear filtering

Course Outcomes

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

CO1 - Distinguish the continuous and discrete-time signals and systems (K2)

- CO2 Capable of characterizing LTI-CT systems in the time domain (K3)
- CO3 Understand the concepts of Z-transform and discrete Fourier transform (K3)

CO4 - Capable of characterizing LTI-DT systems in the frequency domain (K4)

CO5 - Apply DFT for the analysis of digital signals and systems (K4)

UNIT I BASICS OF DISCRETE AND CONTINUOUS TIME SIGNALS AND SYSTEMS (12 Hrs)

Generation, representation of discrete time signals and continuous time signals, standard discrete time signals, standard continuous time signals. Classification of signals: Continuous time (CT) Discrete time (DT) signals, Mathematical operations on CTS and DTS-scaling, folding, time shifting, addition and multiplication.

Classification of systems - static and dynamic systems, time invariant and time variant, linear and nonlinear systems, causal and non-causal systems, stable and unstable systems Basic bio signal measurements

UNIT II LINEAR TIME INVARIANT CONTINUOUS TIME SYSTEMS

Impulse response - convolution integrals- Differential Equation- Fourier and Laplace transforms in analysis of CT systems - Systems connected in series / parallel.

UNIT III TRANSFORMS OF DISCRETE TIME SIGNALS

Z transform-properties-region of convergence- representation of poles and zeros in z transform. Inverse z transform-Power series expansion, Partial Fraction method, residue method, Discrete time Fourier transformproperties, Relation between Z transform and DTFT

UNIT IV LINEAR TIME INVARIANT-DISCRETE TIME SYSTEMS

Impulse response, Difference equations, Convolution sum, Discrete Fourier Transform and Z Transform Analysis of Recursive and Non-Recursive systems-DT systems connected in series and parallel.

UNIT V DISCRETE FOURIER TRANSFORMS

Discrete Fourier transform (DFT) - properties of DFT, periodicity, symmetry, circular convolution, Linear filtering using DFT, Filtering long data sequences - overlap save and overlap add method, Fast computation of DFT - Radix-2 Decimation-in-time (DIT) Fast Fourier transform (FFT), Decimation-in-frequency (DIF) Fast Fourier transform (FFT), Linear filtering using FFT.

Text Books

- 1. B. P. Lathi, "Principles of Linear Systems and Signals", Third Edition, Oxford University Press, 2012.
- 2. Allan V. Oppenheim, Allan S.Willsky and S.HamidNawab, "Signals and Systems", Second Edition, PHI Learning, New Delhi, 2010.
- 3. P. Ramesh Babu, "Signals and Systems", Fifth Edition, Scitech Publishers, 2014.

Reference Books

1. A. Anand Kumar, "Signals and systems", Third edition PHI learning Pvt. Ltd., 2015.

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B.Tech. Biomedical Engineering

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- 2. M.J. Roberts, "Signals and Systems: Analysis using transform methods and MATLAB", Second edition, Tata McGraw Hill, 2012.
- 3. Suresh R, Devashayam, "Signals and Systems in Biomedical Engineering", Second edition, Springer US, 2013.
- 4. Dr Chitode "Signals and system", Technical Publications 2014.
- 5. A.Nagoor Kani, "Digital Signal Processing", 2nd edition, McGraw Hill Education, 2016.

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- 1. http://www.nptelvideos.in/2012/12/signals-and-system.html
- 2. http://freevideolectures.com/Course/3177/Signals-and-Systems
- 3. https://nptel.ac.in/courses/117/101/117101055/
- 4. http://www.cdeep.iitb.ac.in/webpage_data/nptel/Electrical%20and%20Comm%20Engg/Signals%20and% 20System/Course_home2.20.html
- 5. http://www.cdeep.iitb.ac.in/webpage_data/nptel/Electrical%20and%20Comm%20Engg/Signals%20and% 20System/Course_home4.30.html

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	P011	PO12	PSO1	PSO2	PSO3
1	3	2	1	1	-	-	-	-	-	-	-	-	2	2	-
2	3	2	1	1	-	-	2	2	-						
3	3	2	1	-	2	2	-								
4	3	2	1	1	-	-	-	-	-	-	-	-	2	2	-
5	3	2	1	1	-	2	2	-							
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COs/POs/PSOs Mapping



DATA STRUCTURES LABORATORY L

U19BMP31

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

Ρ С Hrs Т 0 0 2 1

Course Objectives

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

Course Outcomes

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

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

List of Exercises

- Write a C program to implement recursive and non-recursive i) Linear search ii) Binary Search. 1
- 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.
- Write a C program to implement the dequeue (double ended queue) ADT using a doubly 6.
- 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.

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- 1. https://www.tutorialspoint.com/data_structures_algorithms/
- 2. https://www.w3schools.in/data-structures-tutorial/intro/
- 3. https://nptel.ac.in/courses/106103069/
- 4. https://swayam.gov.in/nd1_noc20_cs70/preview
- 5. https://nptel.ac.in/courses/106103069/

COs/POs/PSOs Mapping

COs					Prog	jram O	utcom	es (PO	s)				Prog Outc	ram Spe omes (P	ecific 'SOs)
	P01	PO2	PO3	PO4	P05	PO6	P07	PO8	PO9	PO10	P011	PO12	PSO1	PSO2	PSO3
1	3	2	1	1	-	-	-	-	-	-	-	-	3	2	-
2	3	2	1	1	-	-	-	-	-	-	-	-	3	2	-
3	3	2	1	1	-	-	-	-	-	-	-	-	3	2	-
4	3	2	1	1	-	-	-	-	-	-	-	-	3	2	-
5	3	2	1	1	-	-	-	-	-	-	-	-	3	2	-

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U19BMP32

ELECTRON DEVICES AND CIRCUITSLTPCHrsLABORATORY002130

Course Objectives

- To conduct experiment and verify the basic Semiconductor diode characteristics.
- To study experimentally the characteristics of BJT,FET
- To understand the operation of UJT and thyristors
- To understand the applications of diodes
- To study PCB Simulation Tool

Course Outcomes

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

CO1 - Analyse the characteristic of PN Junction diode and Zener diode (K4)

- CO2 Experiment the characteristics of various transistors and analyse its characteristics (K4)
- CO3 Construct and analyse the applications of diodes (K4)
- CO4 Measure voltage and frequency of the waveform using CRO and plot the frequency response (K4)
- CO5 Construct transistor circuit using PCB Simulation Tool (K4)

List of Experiments

- 1. Characteristic analysis of PN Junction Diode (V-I Characteristics of Forward and Reverse Bias)
- 2. Characteristic analysis of Zener Diode (V-I Characteristics of Forward and Reverse Bias)
- 3. Characteristic analysis of BJT (Input and output characteristics)
- 4. Characteristic analysis of JFET devices (Drain and Transfer Characteristics)
- 5. Negative resistance characteristics of UJT
- 6. Characteristic analysis of Thyristors
- 7. Analysis of wave shaping circuits (Clippers and Clampers)
- 8. Design and analysis of Half wave Rectifiers and Full wave rectifiers
- 9. Study of frequency response of BJT Amplifier
- 10. Study of PCB Simulation Tool
- 11. Deign and study of Transistor as a switch using Simulation tool
- 12. Soldering of components on the PCB and testing (Regulated power supply)

Text Books

- 1. Jacob Millman, Chritos C Halkias, "Electronic Devices and Circuits", Fourth edition. McGraw Hill Education India Private Ltd., 2015.
- 2. Robert L. Boylestad, "Electronic Devices and Circuit Theory", Eleventh Edition, 2015
- 3. Thomas L.Floyd, "Electronic device", Tenth Edition, Pearson prentice hall, 2018.

Reference Books

- 1. Donald A Neaman, "Semiconductor Physics and Devices", Fourth edition, McGraw Hill Education India Private Ltd., 2011
- 2. Salivahanan, "Electron Devices and Circuits", Fourth edition, McGraw Hill Education India Private Ltd., 2016
- 3. Sedra and Smith, "Microelectronic Circuits, Fifth Edition, Oxford University Press, 2012
- 4. Balbir Kumar, Shail.B.Jain, "Electronic devices and circuits", Second edition, PHI learning private limited, 2014.
- 5. David A. Bell, "Electronic Devices and Circuits", Prentice Hall of India, 5th Edition, 2008

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Web References

- 1. www.allaboutcircuits.com
- 2. www.circuitstoday.com
- 3. www.tutorialspoint.com
- 4. www.nptel.ac.in

COs/POs/PSOs Mapping

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

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U19BMP33

BIOSENSORS AND TRANSDUCERS L T LABORATORY 0 0

68

Course Objectives

- To study and analyze the practical characteristics of the various transducers for the measurement of the vital physiological signals
- To get familiar with the various types of transducers and to study the compatibility for any clinical measurements
- To know the practical application of different biotransducers
- To get familiar with different types of bioelectrode placement
- To analyse the characteristics of ultrasound transducers

Course Outcomes

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

- CO1 Perform temperature, pressure and displacement measurement using relevant sensors / transducers (K3)
- CO2 Study the characteristics of an LDR, load cell and pH electrodes (K3)
- CO3 Perform torque measurement with strain gauge (K4)
- CO4 Study the characteristics of biotransducers and bioelectrodes (K4)
- CO5 Analyse the characteristics of Polarized Electrodes, Non-polarized Electrodes and Multi Point Electrodes (K4)

List of Experiments

- 1. Temperature measurement using AD590 IC sensor
- 2. Displacement measurement by using a capacitive transducer
- 3. Study of the characteristics of a LDR
- 4. Pressure and displacement measurement by using LVDT
- 5. Study of a load cell with tensile and compressive load
- 6. Torque measurement Strain gauge transducer
- 7. Study and characterize Biotransducers Pressure, Temparature, Humidity
- 8. Study and characterize Bioelectrodes ECG, EMG, EEG
- 9. Study and Characterize pH electrodes
- 10. Characteristics of Ultrasound Transducer and Phono Transducer.
- 11. Determination of characteristics of Polarized Electrodes, Non-polarized Electrodes and Multi Point Electrodes

Text Books

- 1. A.K.Sawhney, "A Course in Electrical and Electronic measurements and Instruments", DhanpatRai and Sons, 2010.
- 2. Prof. Ping Wang and Dr. Qingjun Liu, "Biomedical Sensors and Measurement ", First Edition, Springer Publications", 2011.
- 3. Tatsuo Togawa ,Toshiyo Tamura andAke Oberg, "Biomedical Sensors and Instruments", Second Edition, CRC Press Taylor and Francis Group, 2011.

Reference Books

- 1. R.Anandanatarajan, "Biomedical Instrumentation and measurements", Second Edition, PHI Learning, December 2015.
- Ernest O Doebelin and Dhanesh N Manik, "Measurement Systems, Applications and Design", Fifth edition MC Graw-Hill, 2011.
- 3. Michael J. McGrath, CliodhnaNíScanaill, "Sensor Technologies: Healthcare, Wellness and Environmental Applications, Apress, 2013.
- 4. Richard S.C. Cobbold, "Transducers for Biomedical Measurements: Principles and Applications ", John Wiley and Sons, 2004.

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Academic Curriculum and syllabi R-2019

5. Nandini K. Jog, "Electronics in Medicine and Biomedical Instrumentation ", Second Edition, PHI, 2013.

Web References

- 1. http://www.gvpcew.ac.in/unit%202.pdf
- 2. http://www.123seminarsonly.com/Seminar-Reports/018/31005914-Notes-on-Transducers.pdf
- 3. https://nptel.ac.in/courses/108/108/108108147/
- 4. https://nptel.ac.in/content/storage2/courses/112103174/pdf/mod2.pdf
- 5. https://www.uvpce.ac.in/content/biomedical-transducers-and-biosensors-laboratory

COs	Program Outcomes (POs)													Program Specific Outcomes (PSOs)			
	P01	PO2	PO3	PO4	PO5	P06	P07	P08	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3		
1	3	-	-	-	-	-	-	-	1	-	-	1	3	1	1		
2	3	-	-	-	-	-	-	-	1	-	-	1	3	1	1		
3	3	3	3	3	3	-	-	-	1	-	-	1	3	1	1		
4	3	3	3	3	3	-	-	-	1	-	-	1	3	1	1		
5	3	3	3	3	3	-	-	-	1	-	-	1	3	1	1		

COs/POs/PSOs Mapping

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		L	Т	Ρ	С	Hrs
UI9BMC3X	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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1110PM621		L	Т	Ρ	С	Hrs
0190101331	GENERAL PROFICIENCI"	0	0	2	-	30

Course Objectives

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

Course Outcomes

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

CO1 - Interpret meaning and apply reading strategies in technical and non-technical context (K2)

- CO2 Develop interpersonal communication skills professionally (K3)
- CO3 Infer the distinct speech sounds and overcome native language influence (K2)
- CO4 Demonstrate various forms of formal writing (K2)

CO5 - Apply the techniques of verbal aptitude in competitive exams (K3)

UNIT I COMPREHENSION ANALYSIS

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: Extemporeand Presentation (Soft Skills) - Reading: British and 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 and Situational attribution-Reading: Distinguish between facts and 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, 1975.
- 3. Bailey, Stephen. "Academic writing: A practical guide for students". Psychology Press, 2003.
- 4. Aggarwal, R. S. "A Modern Approach to Verbal and Non Verbal Reasoning". S. Chand, 2010.
- 5. Wren, Percival Christopher, and Wren Martin. "High School English Grammar and Composition", S Chand, 2005.

Web References

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

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

COs/POs/PSOs Mapping

A. On-
С L Т Ρ **SKILL DEVELOPMENT COURSE 2** U19BMS32 0 2 0

1. POWERPOINT PRESENTATION DESIGN AND ANIMATION

Course Content:

Module I: Getting acquainted with PowerPoint

Understanding and working with the PowerPoint interface including: the Outline and Slides pane, the Ribbon, Quick Access toolbar, notes pane and the Status Bar.

Module II: Objects and Formatting

Working with objects in PowerPoint. Copying and moving objects. Formatting including the format painter. Fonts and effects. Inserting new slides. Slide layout. Selecting multiple objects. Grouping objects. The different objects that you can include on a slide. Six slides that demonstrate the six content types: Table, Chart, Graphic, Picture, Clip art, Media clip (movie).

Module III: Slide Design

Templates and Slide Masters, How to use themes, masters and templates to make slide design quick and consistent. Layouts and footers. Principles of slide design - Principles to guide good, clean design and formatting of slides. Making your slides clearer. Creating professional-looking slides with real impact.

Module IV: Making an Impact

When and why to use images. How to insert and edit images. Cropping, resizing and manipulating images. Screenshots and videos. Removing picture backgrounds. Applying artistic effects.

Module V: Animation

Adding and controlling transition effects between slides. Detailed animation and transition options. Animating individual elements of text boxes, charts and diagrams. Presenter tools and features. Custom slide shows. Annotating your slide during a talk. Navigating a presentation. Self-running presentations.

Text Books

- 1. Joan Lambert, "Microsoft PowerPoint step by step 2016", Microsoft Press, 2016
- 2. Curtis Frye, Joan Preppernau, and Joyce Cox, "Microsoft® Office PowerPoint® 2007 Step by Step", Microsoft Press, 2015
- 3. John Walkenbach, Michael R. Groh, Herb Tyson, Faithe Wempen, "Office 2010 Library: Excel 2010 Bible, Access 2010 Bible, PowerPoint 2010 Bible, Word 2010 Bible", John Wiley & Sons, 2010

Reference Books

- 1. Joan Lambert, "Microsoft PowerPoint step by step 2019", Microsoft Press, 2019
- 2. David W. Beskeen, "Illustrated Course Guide: Microsoft PowerPoint 2013 Advanced" Cengage Learning, 2014
- 3. Joan Preppernau and Joyce Cox, "PowerPoint 2010", Microsoft Press, 2010
- 4. "Microsoft PowerPoint 2013", John Wiley and Sons, 2013
- 5. Ann Shaffer and Katherine T. Pinard, "New Perspectives Microsoft Office 365 & PowerPoint 2016: Intermediate", Course Technology, 2016

Web References

- 1. https://smallbusiness.chron.com/bibliography-powerpoint-40572.html
- 2. https://bookboon.com/en/powerpoint-ebooks
- 3. https://penandthepad.com/cite-book-powerpoint-8344519.html
- 4. https://www.bookdepository.com/category/1931/PowerPoint

Hrs

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2. MASTERS IN MICROSOFT EXCEL

Course Content:

Module I: Excel Basics

About Excel, The Excel environment, The Title Bar - The Ribbon - Scroll Bars - The MS Office Button - The Quick Access Toolbar - The Formula Bar - The Workbook Window - The Status bar - The Workbook View Buttons – The Zoom Slider – the Mini toolbar – Keyboard Shortcuts.

Module II: Data handling

Sorting & Filtering: Techniques for sorting and filtering data, including controlling the order of precedence in a sort, advanced filters, and an introduction to PivotTables. Using sorting and filtering to check and 'clean' data. Controlling user input: Controlling the way users can enter data into a spreadsheet to reduce risk of error and increase efficiency. Covers Data Validation and using IS- functions to trap errors. Working with Text: Entering and formatting text, extracting or combining parts of text. 'Cleaning' data for typos and bugs. Lookup & Reference: Looking up information in a basic table, and more flexibly. VLOOKUP() and the more flexible INDEX()/MATCH() combination. Advanced lookups.

Module III: Formatting

Cell Formatting - Basic font formatting, alignment - Including horizontal and vertical alignment, wrapping, merging, orientation, Alt-Return; consistent, sensible row heights & column. Number Formatting - Types of number (E.g., currency, %, decimal, negative numbers) - and Excel formats best employed. Custom number formats and how to maximise impact and clarity. Conditional Formatting - Changing the format of cells depending on their value. Graphical conditional formats. Writing conditional format formulas.

Module IV: Presentation

Graphs and Charts - Creating simple charts and editing them to control and improve formatting. Choosing the right chart Principles and guidelines for communicating well with charts. Sparkline's and Maps (when and how to use). Page & Print Setup - Displaying spreadsheets as pages. Page layout view, page breaks, print area, Printing from multiple Worksheets (and that default will be to print only from active Worksheet). Headers and footers. Adjusting page setup. Printing very large sheets of data And finally printing!

Module V: Advanced Excel Capabilities

Conditional formatting, Importing data and text to columns, Functions - Mathematical, String, IF, AND, OR, Searching: match, search, vlookup, Dates, Misc, Pivot tables, Recording and editing Macros.

Text Books

- 1. Michael Alexander, "Excel 2007 Dashboards and Reports for Dummies", John Wiley & Sons, 2011
- 2. Ellen Monk, Spring Davidson, Joseph Brady, "Problem Solving Cases in Microsoft Access and Excel", Cengage Learning, 2009
- 3. Colleen Conmy, Bill Hazlett, Bill Jelen, Adrienne Soucy, "Excel for Teachers", Tickling Keys, 2010

Reference Books

- 1. Noreen Brown, Barbara Lave, Julie Romey, "Beginning Excel 2019", Open Oregon Educational Resources, 2017
- 2. Greg Harvey, "Excel 2019 All-in-One For Dummies", John Wiley & Sons, 2018
- 3. John Walkenbach, "Excel 2007 Bible", John Wiley & Sons, 2011
- 4. Matthew MacDonald, "Excel 2010: The Missing Manual", O'Reilly Media, Inc., 2010
- 5. Rob Bovey, Stephen Bullen, Dennis Wallentin, John Green, "Professional Excel Development: The Definitive Guide to Developing Applications Using Microsoft Excel, VBA, and .NET", Addison-Wesley Professional, 2009

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Web References

- https://www.google.com/search?q=ms+excel+working&oq=MS+Excel+working&aqs=chrome.0.0i457j0l3j0 i22i30l4.9421j0j4&sourceid=chrome&ie=UTF-8
- 2. https://www.investintech.com/resources/blog/archives/5430-excel-data-tips.html
- 3. https://edu.gcfglobal.org/en/excel2010/working-with-basic-functions/1/
- 4. https://www.online-tech-tips.com/ms-office-tips/microsoft-excel-basics-tutorial-learning-how-to-use-excel/
- 5. https://spreadsheeto.com/how-to-use-excel/

3. MICROSOFT WORD DOCUMENTATION

Course Content:

Module I: Getting Familiar and Document Navigation

Introduction, Interface Overview, Common Buttons, Tabs and Ribbons, What's The Flashing Line, How Navigation Tips Help, Using The Slider, Keyboard Navigation Tips, Using Browse Objects Tools, Selecting Text Options

Module II: Manipulating Text and Formatting

Introduction, Page Layout, Cut, Copy, Paste, Move, Find and Replace, How Formatting Makes a Difference, Changing Fonts, Typical Text Format Options, Bullet and Numbered Lists, Other Formatting Tools, Line Spacing, What Are Quick Styles, More Quick Styles, Creating A New Quick Style, Paragraph Marks

Module III: Themes and Templates

Introduction, Applying Themes, Opening Existing Templates, Creating Templates, Working With Existing Content, Quick Parts - Options, Creating Quick Parts, Quick Parts - Inserting Fields, Quick Parts - Inserting Images

Module IV: Organizing Content

Introduction, Creating Lists, Creating and Formatting Tables, Converting Text To Tables, Table Borders and Shading, Creating Columns, Creating Tabular Lists, Creating Charts, Character Spacing, Inserting Shapes, Inserting Images, Using Word Art, Using Text Boxes, Sorting Text, Using Smart Art

Module V: Review, Protect, Share, and Print

Introduction, Document Views, Split Screen View, Tracking Changes, Collaboration options, Combining and Approving Changes, Using Comments, Compatibility Checker, Previous Word Versions Compatibility, Digital Signatures, Restricting Permissions, Spell and grammar Check, Saving a Document, Printing and Preview Options

Text Books

- 1. Alexander Mamishev, Murray Sargent, "Creating Research and Scientific Documents Using Microsoft Word", Microsoft Press, 2014
- 2. Jennifer Duffy, Carol Cram, "Microsoft Word 2010: Illustrated Complete", Cengage Learning, 2010
- 3. Geoff Evelyn, John Pierce, "MOS 2010 Study Guide for Microsoft Word Expert, Excel Expert, Access, and SharePoint Exams", Pearson Education, 2011

Reference Books

- 1. Ann Shaffer and Katherine T. Pinard, "New Perspectives Microsoft Office 365 & PowerPoint 2016: Intermediate", Course Technology, 2016
- 2. Diane Koers, "Picture Yourself Learning Microsoft Word 2010", Cengage Learning, 2014
- 3. Gary B. Shelly, Misty E. Vermaat, "Microsoft Word 2010: Complete", Cengage Learning, 2010
- 4. Pasewark/Pasewark, Katherine T. Pinard, "Microsoft Word 2010 Introductory", Cengage Learning, 2012
- 5. Jennifer Duffy, "Microsoft Word 2013: Illustrated Introductory", Cengage Learning, 2013.

Dr. A.Vijayalakshmi

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Web References

- 1. https://www.investintech.com/resources/articles/beginnersmsoffice/
- 2. https://www.javatpoint.com/ms-word-tutorial
- 3. https://www.tutorialspoint.com/word/index.htm
- 4. https://www.thewindowsclub.com/microsoft-word-tutorial-for-beginners

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O I 9 DIVINI S I	PHISICAL EDUCATION	0	0	2	-	30

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

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U19BMT41

PROBABILITY AND QUEUING THEORY

(Common to MECHANICAL, BME)

Course Objectives

- Apply fundamental knowledge of the basic probability concepts.
- To introduce knowledge of standard discrete distributions.
- To acquire knowledge on Probability Distributions.
- To understand strength and weakness of Queuing model.
- To gain strong knowledge in principles of Queuing theory.

Course Outcomes

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

CO1 - Understand the fundamental knowledge of the probability concepts. (K2)

CO2 - Apply the basic rules of discrete random variables. (K3)

CO3 - Apply the fundamentals of probability theory and random processes. (K3)

CO4 - Understand and extend Queuing models to analyse real world systems. (K2)

CO5 - Apply the knowledge of Queuing theory in computer field. (K3)

UNIT I PROBABILITY AND RANDOM VARIABLE

Axioms of probability - Conditional probability - Total probability – Bayes theorem– Moments–Moment generating functions and their properties.

UNIT II DISCRETE RANDOM VARIABLES

Random Variables and their event spaces, Random variable – Probability mass function – Probability density function- Distribution functions, Binomial, Geometric, Negative Binomial and Poisson.

UNIT III CONTINUOUS RANDOM VARIABLES

Some important distributions: Uniform, Exponential, Gamma, Weibull and Normal distributions and their properties – Functions of a random variable.

UNIT IV QUEUING MODELS

Markovian queues – Birth and Death processes – Single and multiple server queuing models – Little's formula – Queues with finite waiting rooms – Queues with impatient customers: Balking and reneging.(M/M/I):(∞ /FIFO), (M/M/I):(N/FIFO), (M/M/C):(∞ /FIFO), (M/M/C):(∞ /FIFO))

UNIT V ADVANCED QUEUING MODELS

Finite source models -M/G/1 queue - Pollaczek-Khinchin formula -M/D/1 and M/EK/1 as special cases - Series queues - Open Jackson networks.

Text Books

- 1. N.P Bali. and Dr. Manish Goyal, "Engineering Mathematics", Lakshmi Publications Pvt. Ltd., New Delhi, 9th Edition, 2015.
- 2. T. Veerarajan," Probability and Statistics, Random Process and Queuing Theory", McGraw Hill Education, 2018
- 3. P. Sivaramakrishna Das, C. Vijayakumari , "Probability and Queuing Theory", Pearson Education, 6th Edition, 2019

Reference Books

- 1. C.Gupta, B. Shree Ram Singh, M. Kumar, "Engineering Mathematics for semester I & II", Tata McGraw Hill, New Delhi, 2015.
- 2. Erwin Kreyszig, "Advanced Engineering Mathematics", John Wiley & Sons, New Delhi, 10thEdition 2019.
- 3. John F. Shortle, James M. Thomson, Donald Gross, "Fundamental of Queuing theory", 5th Edition, Wiley series., 2018.

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- 4. M.Bhatt and Ravish R Singh, "Probability and Statistics", McGraw Hill Education, 2017.
- 5. P. Kandasamy, K. Thilagavathi. and K. Gunavathi., "Probability and Queuing Theory", S.Chand &Co. Pvt. Ltd, 2015

Web References

- 1. http://www.maths.qmul.ac.uk/~pjc/notes/prob.pdf
- 2. https://nptel.ac.in/courses/117/103/117103017/
- 3. https://youtu.be/COI0BUmNHT8
- 4. https://nptel.ac.in/courses/111107119/
- 5. http://www.sasurieengg.com/e-course-material/

COs/POs/PSOs Mapping

COs					Progr	am O	utcom	es (P	Os)				Prog Outco	ram Spo omes (F	ecific PSOs)
	P01	01 PO2 PO3 PO4 PO5 PO6 PO7 PO8 PO9 PO10 PO11 P											PSO1	PSO2	PSO3
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A. MIL

PROGRAMMING IN JAVA L (Common to CSE, ECE, EEE, IT, ICE, MECH, CIVIL, BME, MECHATRONICS) 3

Course Objectives

U19BMT42

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

Course Outcomes

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

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

- CO2 Demonstrate the use of inheritance, interface and package in relevant applications. (K3)
- CO3 Create java applications using exception handling, thread and generic programming. (K3)
- CO4 Build java distributed applications using Collections and IO streams. (K3)
- CO5 Exemplify simple graphical user interfaces using GUI components and database programs. (K3)

UNIT I INTRODUCTION TO JAVA PROGRAMMING

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

UNIT II INHERITANCE, PACKAGES AND INTERFACES

Inheritance: Basic concepts - forms of inheritance - super key word – method overriding, abstract classes, dynamic method dispatch - the Object class. Packages: Defining, Creating and Accessing, importing packages. Interfaces: Defining, implementing, applying, variables and extending interfaces

UNIT III EXCEPTION HANDLING, MULTITHREADING

Concepts of Exception handling, types of exceptions, creating own exception, Concepts of Mult ithreading, creating multiple threads, Synchronization, inter thread communication. Enumeration - Autoboxing - Generics.

UNIT IV COLLECTIONS, I/O STREAMS

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

UNIT V EVENT DRIVEN PROGRAMMING AND JDBC

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

Text Books

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

Reference Books

- 1. Cay S. Horstmann, Gary cornell, "Core Java Volume –I Fundamentals", 9thEdition, Prentice Hall, 2013.
- 2. H.M.Dietel and P.J.Dietel, "Java How to Program", Pearson Education/PHI, 11thEdition, , 2017.
- 3. Cay.S.Horstmann and Gary Cornell, "Core Java, Vol 2, Advanced Features", Pearson Education, 8th Edition, 2008.

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- "Java for Programmers", P.J. Dietel and H.M Dietel, Pearson Education (OR) JAVA:
 "Programming in Java", S. Malhotra and S. Choudary, Oxford Univ. Press.

Web References

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

COs/POs/PSOs Mapping

COs					Prog	ram Oi	utcom	es (PC)s)				Prog Outco	ram Spe omes (P	ecific SOs)
COS	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
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2	3	2	1	1	3	-	-	-	-	-	-	-	3	-	-
3	3	2	1	1	3	-	-	-	-	-	-	-	3	-	-
4	3	2	1	1	3	-	-	-	-	-	-	-	3	-	-
5	3	2	1	1	3	-	-	-	-	-	-	-	3	-	-

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- To understand the characteristics of digital filters, design digital IIR filters and apply these filters to filter undesirable signals in various frequency bands
- To understand the characteristics of digital filters, design digital FIR filters and apply these filters to filter undesirable signals in various frequency bands
- To understand the effects of finite precision representation on digital filters
- To gain knowledge on the signal processing techniques used for ECG in cardiology
- To gain knowledge on the signal processing techniques used for EEG in neurology

Course Outcomes

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

CO1 - Design and implement IIR digital filters (K4)

- CO2 Design and implement FIR digital filters (K4)
- CO3 Characterise the effects of finite precision representation on digital filters (K3)
- **CO4** Know the process of analysing ECG Signals (K4)
- CO5 Know the process of analysing EEG Signals (K4)

UNIT I INFINITE IMPULSE RESPONSE FILTERS

Characteristics of practical frequency selective filters. Characteristics of commonly used analog filters - Butterworth filters, Chebyshev filters. Design of IIR filters from analog filters (LPF, HPF, BPF, BRF) - Approximation of derivatives, Impulse invariance method, Bilinear transformation. Frequency transformation in the analogdomain.Structure of IIR filter - direct form I, direct form II, Cascade, parallel realizations.

UNIT II FINITE IMPULSE RESPONSE FILTERS

Design of FIR filters - symmetric and Anti-symmetric FIR filters - design of linear phase FIR filters using Fourier series method - FIR filter design using windows (Rectangular, Hamming and Hanning window), Frequency sampling method. FIR filter structures - linear phase structure, direct form realizations.

UNIT III FINITE WORD LENGTH EFFECTS

Fixed point and floating point number representation - ADC - quantization - truncation and rounding quantization noise - input / output quantization - coefficient quantization error - product quantization error overflow error - limit cycle oscillations due to product quantization and summation - scaling to prevent overflow.

UNIT IV CARDIOLOGICAL SIGNAL PROCESSING

Pre-processing of ECG signal, QRS detection Methods-Differentiation-based and template-based. Rhythm analysis and Arrhythmia detection algorithms. Automated ECG analysis. Data compression techniques: Turning Point algorithm, AZTEC, CORTES, and the KL transform. Adaptive filters, Weiner filter principles, LMS and RLS, medical Applications of Adaptive Noise Cancellation.

UNIT V NEUROLOGICAL SIGNAL PROCESSING

Stochastic process. Linear prediction. Yule-Walker equations. Auto Regressive Modelling of EEG signal. Detection of EEG Rhythms, Template matching for EEG spike-and-wave detection, Detection of EEG spikeand-wave complexes, Coherence analysis of EEG channels, Adaptive segmentation of EEG signals. Sleep stage analysis using Markov model. Analysis of evoked potential using Prony's method.

Text Books

- 1. John L. Semmlow, Benjamin Griffel, "Biosignal and Medical Image Processing", CRC Press, 2014
- 2. Willis J. Tompkins, "Biomedical Digital Signal Processing", Prentice-Hall of India Pvt. Ltd., 2012
- 3. Christoph Hintermuller, "Advanced Biosignal Processing and Diagnostic Methods", In Tech Open, 2016

B.Tech. Biomedical Engineering

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Reference Books

- 1. Jonathan Wolpaw and Elizabeth Winter Wolpaw, "Brain-Computer Interfaces: Principles and Practice", Oxford University Press, 2012.
- 2. Monson H.Hayes, "Statistical Digital Signal Processing and Modeling", Wiley-India, 2010.
- 3. StephaneMallat, "Wavelet Tour of Signal Processing: The Sparse Way", Third edition. Academic Press, 2011.
- 4. Kayvan Najarian Robert Splinter "Biomedical Signal and Image Processing" by Taylor & Francis Group, LLC, Second edition. 2012
- 5. Li Tan , Jean Jiang "Digital Signal Processing fundamentals and Applications", Second edition, Academic Press, 2013

Web References

- 1. https://www.youtube.com/watch?v=S_U-s27nPLE
- 2. https://www.youtube.com/watch?v=bFeYjFtSsrg
- 3. https://www.journals.elsevier.com/biomedical-signal-processing-and-control/recent-articles
- 4. https://www.classcentral.com/course/swayam-biomedical-signal-processing-10069
- 5. https://nptel.ac.in/content/syllabus_pdf/108105101.pdf

COs/POs/PSOs Mapping

COs					Progr	am Ou	utcome	es (PO	s)				Prog Outco	ram Spo omes (F	ecific PSOs)
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2	3	3	3	3	3	2	-	-	-	-	-	1	3	3	-
3	2	2	3	3	3	2	-	-	-	-	-	1	3	3	-
4	3	3	3	3	3	2	-	-	-	-	-	1	3	3	-
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U19BMT44 ANALOG AND DIGITAL INTEGRATED CIRCUITS

Course Objectives

- To study the basics of digital circuits and combinational circuits.
- To understand flip flop and counters.
- To learn the linear and non-linear applications of operational amplifiers.
- To introduce the concepts of active filters and waveform generators •
- To introduce the theory and applications of timer. PLL and data converters.

Course Outcomes

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

- CO1 Realize Number systems and construction of combinational circuits (K3)
- CO2 Construct and study the function of sequential circuits (K3)
- CO3 Categorize the linear and non-linear applications of operational amplifiers (K3)
- CO4 Explain the function of active filters and waveform generation (K3)
- CO5 Describe the operation and applications of Timer, PLL and data converters (K3)

UNIT I NUMBER SYSTEM AND COMINATIONAL LOGIC CIRCUITS

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-Design of Half and Full Adders-Multiplexer, Demultiplexer, Magnitude Comparator, Decoder, Encoder.

UNIT II REGISTERS AND COUNTERS

Flip flops – SR, JK, T, D, Master/Slave FF – operation and excitation tables, Triggering of FF-Design of Counters- Ripple Counters, MOD N Counter- Ring Counters, Shift registers, Universal Shift Register.

UNIT III OPERATIONAL AMPLIFIERS

Characteristics of Ideal Operational Amplifier-DC and AC performance characteristics, slew rate, Open and closed loop configurations -Linear application of op amp-Voltage Follower, V-to-I and I-to-V converters, adder, subtractor, Instrumentation amplifier, Integrator, Differentiator, Logarithmic amplifier, Antilogarithmic amplifier, Comparators, Schmitt trigger, Precision rectifier.

UNIT IV ACTIVE FILTERS AND SIGNAL GENERATOR

Active filters-Low-pass, high-pass, Band reject and band-pass Butterworth filters. Oscillators-RC phase shift and Wein bridge type-Waveform generators -Sine-wave generator and Triangular wave generator, Multivibrators.

UNIT V TIMER PLL AND DATA CONVERTERS

555 timers and its applications- mono stable and Astable multivibrator-phase locked loop (IC 565) and its applications. IC 723 general purpose regulator -Digital to Analog converter (DAC)-Weighted resistor DAC, R-2R ladder DAC, Analog to digital converter (ADC) - Flash type ADC, successive approximation ADC and dual slope ADC.

Text Books

1.D. Roy Choudhry, Shail Jain, "Linear Integrated Circuits", Fifth Edition, New Age International Pvt. Ltd., 2018,

- 2.Sergio Franco, "Design with Operational Amplifiers and Analog Integrated Circuits", Fourth Edition, Tata Mc Graw-Hill, 2016.
- 3.M. Morris Mano and Michael D. Ciletti, "Digital Design", Fifth Edition, Pearson, 2014

Reference Books

1. Ramakant A. Gavakwad, "OP-AMP and Linear ICs", Fourth Edition, Prentice Hall / Pearson Education, 2015

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- 2. Robert F.Coughlin, Frederick F.Driscoll, "Operational Amplifiers and Linear Integrated Circuits", Sixth Edition, PHI, 2010.
- 3. S.Salivahanan& V.S. KanchanaBhaskaran, "Linear Integrated Circuits", Second Edition, TMH, 4th Reprint, 2016.
- 4. S.Salivahanan and S.Arivazhagan. "Digital Electronics", First Edition, Vikas Publishing House pvt Ltd, 2012
- 5. A.Anand Kumar, "Fundamentals of Digital Circuits", Fourth Edition, PHI Learning Private Limited, 2016.

Web References

- 1. https://www.tutorialspoint.com/digital_circuits/index.htm
- 2. https://www.tutorialspoint.com/digital_circuits/index.htm
- 3. https://e-box.co.in/linear-integrated-circuits.shtml
- 4. https://www.tutorialspoint.com/linear_integrated_circuits_applications/index.html

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2	3	3	2	2	2	1	-	-	1	-	1	1	3	3	-
3	3	3	1	3	2	1	-	-	1	-	1	1	3	3	2
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COs/POs/PSOs Mapping

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PROGRAMMING IN JAVA LABORATORY L T

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

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Course Objectives

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

Course Outcomes

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

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

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

- CO3 Create java applications using exception handling, multithread. (K3)
- CO4 Build java distributed applications using Collections and IO streams. (K3)
- CO5 Develop simple database programs. (K3)

List of Experiments

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

Reference Books

- 1. E. Balaguruswamy, "Programming with Java", TMH Publ, 2nd Edition, 2005.
- 2. JAVA How to programming by DIETEL & DIETEL.
- 3. Herbert Schil dt, "The Complete Reference JAVA 2", TMH, Seventh Edition, 2006.
- 4. Cay.S.Horstmann and Gary Cornell, "Core Java 2", Vol 2, Advanced Features, Pearson Education, Seventh Edition, 2010.

Web References

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

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	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
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2	3	2	1	1	3	-	-	-	-	-	-	-	3	-	-
3	3	2	1	1	3	-	-	-	-	-	-	-	3	-	-
4	3	2	1	1	3	-	-	-	-	-	-	-	3	-	-
5	3	2	1	1	3	-	-	-	-	-	-	-	3	-	-

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	BIOSIGNAL BROCESSING USING MATLAR	L	Т	Ρ	С	Hrs
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- To familiarize the students with various computation techniques involved in signal processing.
- To introduce the theory and application of IIR and FIR filters along with its implementation.
- To impart knowledge on the various types of errors that affect signals during digital signal processing.
- To learn the characteristics of various bio signals.
- To learn the properties of Fourier Transform.

Course Outcomes

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

CO1 - Understand the computation of convolution and analysis of various systems (K2)

CO2 - Implement the FIR and IIR filters in various applications (K3)

CO3 - Analyse the spectrum and noise removal of biomedical signals (K3)

CO4 - Simulate and analyse Bio signals (K3)

CO5 - Analyses various Fourier transform properties (K4)

List of Experiments

- 1. Generation of Discrete and Continuous time signals
- 2. Linear and Circular Convolution
- 3. Auto Correlation and Cross Correlation
- 4. Frequency analysis using DFT
- 5. ECG and Arrhythmia signal generation
- 6. Spectrum analysis and noise removal of biomedical signals
- 7. ECG Data reduction algorithms
- 8. Detection of QRS Component from ECG signal.
- 9. Down sampling and up-sampling of ECG signals
- 10.IIR Filter Design
- 11.FIR Filter Design
- 12. Design of Notch filter for elimination of 50Hz from ECG Signal
- 13. Measurement of respiration rate using thermistor

Text Books

1. John L. Semmlow, Benjamin Griffel , "Biosignal and Medical Image Processing", CRC Press, 2014

2. Willis J. Tompkins, "Biomedical Digital Signal Processing", Prentice-Hall of India Pvt. Ltd., 2012

3. Christoph Hintermuller, "Advanced Biosignal Processing and Diagnostic Methods", InTechOpen, 2016

Reference Books

- 1. Jonathan Wolpaw and Elizabeth Winter Wolpaw, "Brain-Computer Interfaces: Principles and Practice", Oxford University Press, 2012.
- 2. Monson H.Hayes, "Statistical Digital Signal Processing and Modeling", Wiley-India, 2009.
- 3. Stephane Mallat, "Wavelet Tour of Signal Processing: The Sparse Way", Third edition. Academic Press, 2011.
- 4. Kayvan Najarian Robert Splinter "Biomedical Signal and Image Processing" by Taylor & Francis Group, LLC, Second edition. 2012
- 5. Li Tan , Jean Jiang "Digital Signal Processing fundamentals and Applications", Second edition, Academic Press, 2013

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1. https://www.youtube.com/watch?v=S_U-s27nPLE

Dr. A.Vijayalakshmi

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- 2. https://www.youtube.com/watch?v=bFeYjFtSsrg
- 3. https://www.journals.elsevier.com/biomedical-signal-processing-and-control/recent-articles
- 4. https://www.classcentral.com/course/swayam-biomedical-signal-processing-10069
- 5. https://nptel.ac.in/content/syllabus_pdf/108105101.pdf

COs/POs/PSOs Mapping

COs			•		Prog	ram O	utcom	es (PC	s)				Prog Outco	ram Spo omes (P	ecific 'SOs)
	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
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2	3	2	2	1	3	2	1	-	1	-	-	1	3	2	-
3	3	2	-	-	3	2	1	-	1	-	-	1	3	2	-
4	3	2	3	3	3	2	1	-	1	-	-	1	3	2	-
5	3	2	3	3	3	2	1	-	1	-	-	1	3	2	-

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- To examine combinational logic circuits
- To realize flip flop and counters
- To design the op-amp for various applications
- To analyse active filters and its response
- To understand the working of data converters and multivibrators

Course Outcomes

After completion of the course, students will be able to

- CO1 Investigate the functions of logic gates (K3)
- CO2 Realize Combinational and sequential circuits (K3)
- CO3 Demonstrate the applications of Operational Amplifier (K4)
- CO4 Evaluates the performance of Active filters (K4)
- CO5 Analyse the working of Data converters and Multivibrator (K4)

COURSE CONTENTS

- 1. Realization of different gates like AND, OR, NOT, NAND, NOR, EX-OR and EX-NOR.
- 2. Construction of simple arithmetic circuits-Adder, Subtractor.
- 3. Construction of simple Decoder and Multiplexer circuits using logic gates.
- 4. Realization of RS, JK and D flip-flops using Universal logic gates.
- 5. Realization of Shift Register using flip-flops and logic gates.
- 6. Realization of Universal Register using multiplexer and flip-flops.
- 7. Realization of Asynchronous Up/Down counters
- 8. Design of Summer, Subtractor, differentiator and integrator using op-amp
- 9. Design of instrumentation amplifier for bio-signal acquisition
- 10. Design of half wave and full wave rectifier using op-amp
- 11. Design of RC phase shift oscillator and Wien bridge oscillator using op-amp
- 12. Design of first and second order active low pass filter
- 13. Design of weighted resistor DAC and R-2R ladder DAC using op-amp
- 14. Design of Multivibrator using IC 555

Text Books

- 1. D.Roy Choudhry, Shail Jain, "Linear Integrated Circuits", Fifth Edition, New Age International Pvt. Ltd., 2018,
- 2. Sergio Franco, "Design with Operational Amplifiers and Analog Integrated Circuits", Fourth Edition, Tata Mc Graw-Hill, 2016.
- 3. M. Morris Mano and Michael D. Ciletti, "Digital Design", Fifth Edition, Pearson, 2014

Reference Books

- 1. Ramakant A. Gayakwad, "OP-AMP and Linear ICs", Fourth Edition, Prentice Hall / Pearson Education, 2015
- 2. Robert F.Coughlin, Frederick F.Driscoll, "Operational Amplifiers and Linear Integrated Circuits", Sixth Edition, PHI, 2010.
- 3. S.Salivahanan& V.S. KanchanaBhaskaran, "Linear Integrated Circuits", Second Edition, TMH, 4th Reprint, 2016.
- 4. S.Salivahanan and S.Arivazhagan. "Digital Electronics", First Edition, Vikas Publishing House pvt Ltd, 2012

5. A.Anand Kumar, "Fundamentals of Digital Circuits", Fourth Edition, PHI Learning Private Limited, 2016.

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- 1. https://www.tutorialspoint.com/digital_circuits/index.htm
- 2. https://www.tutorialspoint.com/digital_circuits/index.htm
- 3. https://e-box.co.in/linear-integrated-circuits.shtml
- 4. https://www.tutorialspoint.com/linear_integrated_circuits_applications/index.html

COs/POs/PSOs Mapping

COs					Progr	am O	utcom	es (P	Os)				Prog Outco	ram Spo omes (F	ecific 'SOs)
	P01	PO2	PO3	PO4	PO5	P06	P07	P08	PO9	PO10	P011	PO12	PSO1	PSO2	PSO3
1	3	3	3	2	2	1	-	-	1	-	1	1	3	3	-
2	3	3	2	2	2	1	-	-	1	-	1	1	3	3	-
3	3	3	1	3	2	1	-	-	1	-	1	1	3	3	2
4	3	3	2	3	2	1	-	-	1	-	1	1	3	3	-
5	3	3	3	3	2	1	-	-	1	-	1	1	3	3	-

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		L	Т	Ρ	С	Hrs
U19BMC4X	CERTIFICATION COURSES	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.

U19BMS41

- 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

GENERAL PROFICIENCY-II

- To understand the factors that influence the usage of grammar •
- To understand the basic concepts of logical reasoning skills •

Course Outcomes

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

CO1 - Infer ideas to attend international standardized test by broadening receptive and productive skills (K2) CO2 - Interpret the types of writing in different state of affairs (K2)

CO3 - Develop language skills professionally to groom the overall personality through sensitizing various etiquettes in real time situation (K3)

CO4 - Identify the rules of grammar in academic discourse settings (K3)

CO5 - Extend the skills to compete in various competitive exams like GATE, GRE, CAT, UPSC, etc. (K2)

UNIT I - CAREER SKILLS

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 & Reading: Read and transform- report, memo, notice and advertisement, Writing: informal context 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.
- 2. Tulgan, Bruce. "Bridging the soft skills gap: How to teach the missing basics to today's young talent". John Wiley & Sons, 2015.
- 3. Sherfield, Robert M. "Cornerstone: Developing Soft Skills". Pearson Education India, 2009.
- 4. Cullen, Pauline, Amanda French, and Vanessa Jakeman. "The official Cambridge guide to IELTS for academic & general training".Cambridge, 2014.

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5. Ramesh, Gopalaswamy. "The ace of soft skills: attitude, communication and etiquette for success". Pearson Education India, 2010.

Web References

- 1. https://www.englishclub.com/grammar/nouns-compound.htm
- 2. https://lofoya.com/Verbal-Test-Questions-and-Answers/Sentence-Completion/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/POs/PSOs Mapping

COs			Program Specific												
					Outcomes (PSOs)										
	P01	PO2	PO3	PO4	PO5	P06	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	1	-	-	-	-	-	-	1	-	3	-	2	1	-	-
2	1	-	-	-	-	-	-	1	-	3	-	2	1	-	-
3	1	-	-	-	-	-	-	1	-	3	-	2	1	-	-
4	1	-	-	-	-	-	-	1	-	3	-	2	1	-	-
5	1	-	-	-	-	-	-	1	-	3	-	2	1	-	-

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U19BMS42 SKILL DEVELOPMENT COURSE 4 L T P C Hrs 0 0 2 - 30

1. TROUBLE SHOOTIING OF MEDICAL EQUIPMENTS

Course Content:

- 1. Rules of Engagements
- 2. Blood Pressure Monitor Equipment (Manual)
 - a. Preventive Maintenance
 - b. Dissembling a Mercury Manometer
 - c. Mercury handling protocol
- 3. Cell Counter Equipment
 - a. Preventive maintenance
 - b. Run a test cycle
 - c. Adjustments of Probe and unclogging aperture
 - d. Checking Motor Functions
 - e. Lamp Functions and Allignments
- 4. Centrifuge Equipment
 - a. Preventive Maintenance
 - b. Checking Motor Functions
 - c. RPM Measurements
 - d. Bypassing Interlock
- 5. Microscope
 - a. Preventive Maintenance
 - b. Checking Light Source
 - c. Adjustments of Knobs
 - d. Ensuring the amount of Lubricants

Reference Books

1. Justin Cooper and Alex Dahinten, "Medical Equipment Troubleshooting Flowchart Handbook" Published by: Engineering world health, Vesion- 6, 2013

Web References

- 1. https://www.youtube.com/watch?v=whp2pnCBs6s
- 2. https://www.youtube.com/watch?v=EJJVrCm3YT4
- 3. https://www.youtube.com/watch?v=T0QmUe0bwL8
- 4. https://www.youtube.com/watch?v=3kXnL0AQhYA
- 5. https://www.usms.biz/preventive-maintenance-for-medical-devices/

2. PCB BOARD DESIGNING

Course Content:

MODULE 1: INTRODUCTION TO PCB DESIGNING CONCEPTS

Introduction & Brief History - What is PCB, Difference between PWB and PCB, Types of PCBs: Single Sided (Single Layer), Multi-Layer (Double Layer), PCB Materials? Introduction to Electronic design Automation (EDA) - Brief History of EDA, Latest Trends in Market, How it helps and why it requires, Different EDA tools, Introduction to SPICE and PSPICE Environment, Introduction and Working of PROTEUS.

MODULE 2: COMPONENT INTRODUCTION AND THEIR CATEGORIES

Types of Components - Active Components, Passive Components, Component Package Types - Through Hole Packages: Axial lead o Radial Lead, Single Inline Package(SIP), Dual Inline Package(DIP), Transistor Outline(TO), Pin Grid Array(PGA), Through Hole Packages: Metal Electrode Face(MELF), Leadless Chip

(6 Hrs)

(6 Hrs)

Academic Curriculum and syllabi R-2019

Carrier(LCC), Small Outline Integrated Circuit(SOIC), Quad Flat Pack(QPF) and Thin QFP (TQFP), Ball Grid Array(BGA), Plastic Leaded Chip Carrier(PLCC)

MODULE 3: INTRODUCTION TO DEVELOPMENT TOOLS

Introduction to PCB Design using OrCAD tool, Introduction to PCB Design using PROTEUS tool

MODULE 4: DETAILED DESCRIPTION AND PRACTICAL OF PCB DESIGNING (6 Hrs)

PCB Designing Flow Chart - Schematic Entry, Net listing, PCB Layout Designing, Prototype Designing - Design Rule Check(DRC), Design For Manufacturing(DFM), PCB Making - Printing, Etching, Drilling, Assembly of components. Description of PCB Layers - Electrical Layers, Mechanical Layers, Documentation Layers, PCB Materials, Rules for Track, Study of IPC Standards

MODULE 5: DESIGNING AND FABRICATION PROCESS

Starting the PCB designing, Understanding the schematic Entry, Creating Library & Components, Drawing a Schematic, Flat Design / hierarchical Design, Setting up Environment for PCB, Design a Board Auto routing - Introduction to Auto routing, Setting up Rules, Defining Constraints, Auto router Setup, PCB Designing Practice, Post Designing & PCB Fabrication Process.

Reference Books

- 1. Christopher T Robertson, Printed Circuit Board Designer's Reference; Basics, Prentice Hall Modern Semiconductor Design, 2003
- 2. Bosshart, Printed Circuit Boards: Design and Technology, Tata McGraw-Hill Education, 1983
- 3. R. S. Khandpur, Printed Circuit Boards, McGraw-Hills, 2005.
- 4. Charles A. Harper, High Performance Printed Circuit Boards, McGraw Hill Professional, 2000
- 5. Jon Varteresian, Fabricating Printed Circuit Boards, Newnes, 2002

Web References

- 1. https://www.electronics-notes.com/articles/analogue_circuits/pcb-design/how-to-design-pcb-board-basics.php
- 2. https://www.circuitbasics.com/make-custom-pcb/
- 3. https://learn.sparkfun.com/tutorials/pcb-basics/all
- 4. https://www.pcbpower.com/
- 5. https://www.build-electronic-circuits.com/pcb-design/

3. TESTING OF ELECTRONIC MEDICAL DEVICES

Course Content:

MODULE 1: TESTING OF ELECTRICAL EQUIPMENTS

AC, DC power supply, Grounding, shielding, Guarding, insulation testing, insulation resistance measurement, Types of Circuit Breakers, Rating – Testing of circuit breakers –Transformer testing- Earthing –Earth wires - Earthing of appliances –contactor, relay testing–CT and PT, Panel wiring- Megger-Testing equipment and instruments

MODULE 2: TESTING OF ELECTRONIC COMPONENTS

Troubleshooting of PCB boards, Calibration of analog and digital sensor probe, Display interface, DC Power supply design, testing, Safe electrical practice, Cables and standard, Fuse

MODULE 3: TESTING OF SURGICAL EQUIPMENT

Functions and operating procedure-Testing and maintenance of Heart lung machine, surgical lights, ventilator, patient monitor, anesthesia machine, dialyzer, surgical tools.

(6 Hrs)

(6 Hrs)

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B.Tech. Biomedical Engineering

(6 Hrs)

(6 Hrs)

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MODULE 4: TESTING OF ICU EQUIPMENTS

X-ray machines, Testing of ECG recorders, incubator, baby warmer, infusion pumps, annual maintenance, contract requirements, vendor services, quality and safety standards.

MODULE 5: LIFE CYCLE MANAGEMENT OF MEDICAL EQUIPMENT

Cost of the medical equipment, maintenance cost, replacement analysis, managing equipment service, decision making, extracting optimal benefit from medical equipment over its life cycle, Case study.

Reference Books

- 1. Joseph. J Carr, John M Brown, Introduction to Biomedical Equipment Technology, John Wiley& Sons, New York, 4th edition, 2008.
- Keith Willson, Keith Ison, Slavik Tabakov, "Medical equipment management", CRC Press, UK, 2014. 2.
- Jenny Dooley, John Lehnert Virginia Evans, "Career Paths: Medical Equipment Repair", Express 3. Publishing, UK,2018
- 4. Shakti Chatterjee, Aubert Miller, "Biomedical Instrumentation systems", Cengage Learning Technology & Engineering, 2010.
- 5. David Herres, "Troubleshooting and Repairing Commercial Electrical Equipment", McGraw Hill Professional edition, 2013.

Web References

- 1. https://www.element.com/connected-technologies/electronics-test-methods
- 2. https://www.electronics-notes.com/articles/test-method
- https://www.element.com/more-sectors/medical-device
 https://www.metlabs.com/industries/medical-device-testing/
- 5. https://www.intertek.com/medical/

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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.

Dr. A.Vijayalakshmi

		L	Т	Ρ	С	Hrs
019810121	BIOSTATISTICS	2	2	0	3	60

- To familiarize the concept Mean, median, mode and Standard deviation.
- To understand the concept of Correlation and Regression analysis
- To learn Analysis of variance.
- To learn the concept of testing of hypothesis using statistical analysis.
- To learn the concept of Small sampling.

Course Outcomes

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

CO1 - Solve problems related to Bar diagrams and Pie diagrams. (K3)

CO2 - Find the nature of correlation and regression. (K3)

CO3 - Analyse the applications of variance. (K3)

CO4 - Understand the applications of large samples. (K2)

CO5 - Solve the problems related to testing of hypothesis in small samples (K3)

UNIT I MEASURE OF DISPERSION

Collection - Classification and Tabulation of data, Bar diagrams and Pie diagrams, Histogram-Frequency curve and frequency polygon, Ogive, Mean, median, mode, Standard deviation.

UNIT II CORRELATION AND REGRESSION ANALYSIS

Correlation and Regression analysis: Relation between two variables- scatter diagram- definition of correlations - Two regression lines- Karl Pearson's coefficient of correlation, Rank correlation, Tied ranks.

UNIT III DESIGN OF EXPERIMENTS

Analysis of variance - One way and two-way classifications - Completely randomized design - Randomized block design – Latin square design - 22 Factorial design.

UNIT IV LARGE SAMPLES

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

UNIT V SMALL SAMPLES

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

Text Books

- 1. Irfan A Khan, "Fundamentals of Biostatistics". Ukaaz Publication 5th edition, 2016.
- 2. PSS Sunder Rao, "An introduction to Biostatistics", PHI Learning Pvt Ltd ,2012
- 3. Moore and McCabe, "Introduction to the Practice of Statistics", WH Freeman, 9th Edition .2009.

Reference Books

- 1. Marcello Pagano, "Principles of Biostatistics", 7th edition, 2015.
- 2. Course Manuals: S-PLUS Command Line Essentials, the Analysis of Microarrays
- 3. Richard.A. Johnson, Irwin Miller and John E.Freund ," Probability and Statistics for Engineers", 9th Edition, Pearson Education, 2018
- 4. P. Kandasamy K. Thilagavathy and K. Gunavathi.,"Probability and Queuing Theory", S. Chand & Co, Pvt.Ltd.2015

5.Dr.G. Balaji," Probability and Statistics", G.Balaji Publishers, 2017

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Web References

- 1. https://www.youtube.com/watch?v=_e4mwlqCQrc
- 2. https://www.youtube.com/watch?v=IQW_sWL_sfQ
- 3. https://www.youtube.com/watch?v=75pQPB1RF50
- 4. https://www.digimat.in/nptel/courses/video/102101056/L01.html

COs/POs/PSOs Mapping

COs				Program Specific Outcomes (PSOs)											
	P01	PO2	PO3	PO4	PO5	PO6	P07	P08	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	1	1	-	1	-	-	-	-	-	1	2	2	-
2	3	2	1	1	-	1	-	-	-	-	-	1	2	2	-
3	2	1	-	-	-	1	-	-	-	-	-	1	2	2	-
4	2	1	-	-	-	1	-	-	-	-	-	1	2	2	-
5	3	2	1	1	-	1	-	-	-	-	-	1	2	2	-

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U19BMT52

BIOMECHANICS

Course Objectives

- To understand the basics of biomechanics
- To describe the properties of blood, bone and soft tissues
- To gain knowledge about the mechanics of moving systems
- To understand Cardiac mechanisms
- To study respiratory Biomechanics

Course Outcomes

After completion of the course, the students will able to

- CO1 Describe the fundamentals of biomechanics. (K2)
- CO2 Analyse the properties, functions of hard and flexible tissues (K3)

CO3 - Describe the types and mechanics of skeletal joints and movement mechanics (K2)

- CO4 Explain the mechanical properties of Cardiac system. (K2)
- CO5 Understand the respiratory mechanisms (K2)

UNIT I INTRODUCTION TO BIOMECHANICS

Review of the principles of mechanics, Vector mechanics- Resultant forces of Coplanar and Non coplanar, Concurrent and non-concurrent forces, parallel force in space, Equilibrium of coplanar forces, Newton's laws of motion, Work and energy, Moment of inertia.

UNIT II TISSUE BIOMECHANICS

Hard Tissues: Bone structure and properties of bones, cortical and cancellous bones, type of fractures, biomechanics of fracture healing. **Soft Tissues:** Structure and functions of Soft Tissues: Cartilage, Tendon, Ligament, and Muscle; Material Properties: Cartilage, Tendon, Ligament, and Muscle.

UNIT III JOINTS AND MOVEMENT BIOMECHANICS

Joints - forces and stresses in human joints, free body diagrams, types of joint, biomechanical analysis of elbow, shoulder, hip, knee and ankle. Body and limbs- mass and motion characteristics actions, forces transmitted by joints. Biomechanics of push - like motions, Biomechanics of throw - like motions.

UNIT IV CARDIAC BIOMECHANICS

Cardiovascular system, Mechanical properties of blood vessels: arteries, arterioles, capillaries, and veins. artificial heart valves, biological and mechanical valves development, testing of valves.

UNIT V RESPIRATORY BIOMECHANICS

Alveoli mechanics, Interaction of blood and lung, P-V curve of lung, breathing mechanism, Airway resistance, lung diseases.

Text Books

- 1. Gerhard A. Holzapfel, Ray W. Ogden, "Mechanics of Biological Tissue", Springer, 2010.
- 2. Sean P. Flanagan and Flanagan, "Biomechanics: A case based Approach", Jones and Bartlett Publishers, 2018.
- 3. Carol A. Oatis, "The Mechanics and Pathomechanics of Human Movement", Lippincott Williams and Wilkins, 2010.

Reference Books

- 1. Ozkaya, N, Leger, D, Goldsheyder, D, Nordin, M, "Fundamentals of Biomechanics: Equilibrium, Motion, and Deformation", 4th edition. Springer International Publishing, 2017.
- 2. Donald R. Peterson and Joseph D. Bronzino," Biomechanics: principles and applications", third edition. CRC Press, 2011.

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Academic Curriculum and syllabi R-2019

- 3. Ray W. Ogden, "Biomechanics of Soft Tissue in Cardiovascular Systems", Springer Vienna, 2014.
- Subrata Pal, "Text book of Biomechanics", Viva education Private limited, New Delhi. 2009
 Susan J.Hall, "Basics Bio Mechanics" 5th Edition, McGraw-Hill Publishing Co, Newyork, 2007.

Web References

- 1. https://tinyurl.com/y9bm4f9q
- 2. https://tinyurl.com/y8osnq6d
- 3. https://tinyurl.com/y78y4cvy

COs/POs/PSOs Mapping **Program Specific Program Outcomes (POs)** Outcomes (PSOs) COs PO2 P01 PO3 PO4 PO5 PO6 PO7 PO8 **PO9** PO10 PO11 PO12 PSO1 PSO2 PSO3 1 3 3 3 1 2 ---1 2 2 -_ --2 3 3 3 1 2 ------1 2 -2 3 3 3 3 1 2 1 2 2 -------2 4 3 3 3 1 2 ---1 2 ----5 3 3 3 1 2 1 2 2 _ ----_ -

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II19BMT53	BIOMEDICAL INSTRUMENTATION	L	I	Ρ	C	Hrs
O I S BII I O O	BIOMEDICAE INSTRUMENTATION	3	0	0	3	45

- To acquire knowledge in the basics of bio potential electrodes
- To understand the different types of electrodes and its placement for various recordings
- To design bio amplifier for various physiological recording
- To learn the different measurement techniques for non-physiological parameters.
- Understand the design aspects of various assist and therapeutic devices

Course Outcomes

After completion of the course, students will be able to

- CO1 Gain knowledge in electrodes and its functions. (K2)
- CO2 Illustrate different electrode placement for various physiological recordings. (K3)
- CO3 Analyse bio amplifier for various physiological recordings. (K4)

CO4 - Explain various techniques for non-electrical physiological measurements. (K3)

CO5 - Investigate various assist and therapeutic devices. (K3)

UNIT I BIOPOTENTIAL ELECTRODES

Electrocardiogram (ECG), Electroencephalogram (EEG), Electromyogram (EMG), Electrooculogram (EOG), Electroretinogram (ERG), Recording Electrodes – Electrode-tissue interface, polarization, skin contact impedance, motion artifacts, Silver-Silver Chloride electrodes, Electrodes for ECG, Electrodes for EEG, Electrodes of EMG, Electrical conductivity of electrode jellies and creams, microelectrodes, Needle electrodes

UNITII BIOPOTENTIAL MEASUREMENTS

Bio signals characteristics – frequency and amplitude ranges. ECG – Einthoven 's triangle, standard 12 lead system, Principles of vector cardiography.EEG – 10-20 electrode system, unipolar, bipolar and average mode. EMG– unipolar and bipolar mode. Recording of ERG, EOG and EGG

UNIT III SIGNAL CONDITIONING CIRCUITS

Need for bio-amplifier - single ended bio-amplifier, differential bio-amplifier, Impedance matching circuit, isolation amplifiers – transformer and optical isolation - isolated DC amplifier and AC carrier amplifier., Power line interference, Right leg driven ECG amplifier, Band pass filtering

UNIT IV MEASUREMENT OF NON-ELECTRICAL PARAMETERS

Temperature, respiration rate and pulse rate measurements. Blood Pressure: indirect methods -Auscultatory method, oscillometric method, direct methods: electronic manometer, Pressure amplifiers, Systolic, diastolic, mean detector circuit. Blood flow and cardiac output measurement: Indicator dilution, thermal dilution and dye dilution method, Electromagnetic and ultrasound blood flow measurement.

UNIT V ASSIST DEVICES AND RESPIRATORY DEVICES

Pacemakers - Defibrillators – Audiometry – Hearing aid, Ventilators, Spirometer, Lung Volume and capacities, Pneumo tachometers: different types

Text Books

- 1. R. S. Khandpur, "Biomedical Instrumentation Technology and Applications", McGraw-Hill Professional, 2014.
- 2. Leshie Cromwell, Fred. J. Weibell and Erich. A. Pfeiffer, "Biomedical Instrumentation and Measurements", 2nd edition. PHI, 2008.
- 3. Raja Rao, C and Guha S.K, "Principles of Medical Electronics and Biomedical Instrumentation", Orient Longman Publishers, 2001

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- 1. R. Anandanatarajan, "Biomedical Instrumentation", 2nd edition, PHI Learning, 2016.
- 2. Andrew G. Webb, "Principles of Biomedical Instrumentation", Cambridge University Press, 2018.
- 3. John G. Webster, "Medical Instrumentation: Application and Design", 4th edition. John Wiley and Sons, New York, 2010.
- 4. A.K. Sawhney, "A Course in Electrical and Electronic measurements and Instruments", DhanpatRai and Sons, 2015
- 5. M. Arumugam, "Biomedical Instrumentation", Anuradha Agencies Publishers, 2002.

Web References

- 1. https://apm.iitm.ac.in/biomedical/sai/
- 2. https://www.youtube.com/watch?v=iK-6q4nnmtA
- 3. https://www.youtube.com/watch?v=8m8yNSaCMpg

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

COs/POs/PSOs Mapping

	BIOCONTROL SYSTEMS	L	Т	Ρ	С	Hrs
019010134	BIOCONTROL STOTEMS	2	2	0	3	60

- To explain the system concepts and the different mathematical modelling techniques
- To analyse the given system in time domain
- To estimate the stability of the system using various techniques
- To estimate the frequency response of any system by using various plots
- To examine the state space analysis

Course Outcomes

After completion of the course, the students will able to

- CO1 Explain the concepts of different modelling systems. (K3)
- CO2 Analyse the time response analysis of different order systems and steady state error (K4)
- CO3 Determine the stability and root locus concepts. (K4)
- CO4 Analyse the frequency response using various plots. (K4)
- CO 5- Investigate the state space analysis and biomedical applications. (K4)

UNIT I MODELLING OF SYSTEMS

Control system terminology - classification of control systems, feedback and its effects on overall gain, stability, noise and sensitivity, Open loop and closed loop control systems with physiological system examples- advantages and disadvantages ,Transfer function, modelling of electrical systems, Modelling of translational and rotational mechanical systems and electromechanical systems, analogous systems, Block diagram reduction technique, Signal flow graph, conversion of block diagram to signal flow graph.

UNIT II TIME RESPONSE ANALYSIS

Standard test signals - step, ramp, parabolic and impulse type and order of a system, Time response of first order systems, Time response of second order systems, Transfer function-Time constant form and pole zero form, time domain specifications, Evaluation of time domain specifications, Steady state error and error constants and its computation.

UNIT III STABILITY ANALYSIS

Stability criterion- necessary conditions for stability, Determining the stability by Routh and Hurwitz criterion ,Root locus concepts ,Rules for the construction of root locus ,Sketching of root locus for various systems , Effect of adding poles and zeros to a system.

UNIT 1V FREQUENCY RESPONSE ANALYSIS

Frequency response - Frequency domain specifications, Polar plot, Bode plot, Nyquist Plot, Nyquist Stability criterion, Closed loop Stability, Constant M&N Circuits, Nicholas Chart.

UNIT V STATE SPACE ANALYSIS AND BIOMEDICAL APPLICATIONS

Introduction-general state space representation, Applying the state space representation, Converting a transfer function to state space, Converting from state space to a transfer function, Controllers-P, PI and PID controllers, Lung mechanics model with proportional control.

Text Books

- Nagrath J and Gopal M, "Control system engineering", 5th edition, New Age International Publishers, 1 2011.
- Rajeev Gupta, "Control systems engineering", 1st edition. Wiley India Pvt Ltd, 2011. 2.
- Michael C K Khoo, Physiological control systems-Analysis, simulation and estimation", Second edition, 3 Prentice Hall of India, 2018.

Dr. A.Vijayalakshmi

B.Tech. Biomedical Engineering

(12 Hrs)

(12 Hrs)

(12 Hrs)

(12 Hrs)

(12 Hrs)

Reference Books

- 1. Norman S Nice, "Control system engineering", 7th edition, Wiley India Pvt Ltd, 2015.
- 2. K R Varmah, "Control systems", 1st edition. Tata McGraw Hill, 2010.
- 3. <u>Salivahanan</u>," Control systems Engineering", Pearson Education India, 2015
- 4. K. Padmanabhan,"Control systems", Wiley India Pvt Ltd, 2020
- 5. A. Anand Kumar, Control systems, 2nd edition. PHI Learning Pvt Ltd, 2015.

Web References

- 1. https://nptel.ac.in/courses/107106081/
- 2. https://www.youtube.com/watch?v=QY9NTVh-Awo&list=PLDK4cGT3XCf3GovuGIqmp-mgfm8pXIPH6
- 3. https://www.youtube.com/watch?v=RJleGwXorUk

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

COs/POs/PSOs Mapping



STATISTICAL LABORATORY	L	т	Ρ	С	Hrs
(USING MAT LAB / ANOVA TABLE)	0	0	2	1	30

- To familiarize the concept of Uni-variate, bi-variate frequency distributions.
- To understand the concept of Measures of location and dispersion.
- To learn Rank correlation.
- To understand the concept of Regression Equations.
- To introduce the concepts of curve fitting.

Course Outcomes

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

CO1 - Draw the different types of curves. (K3)

- CO2 Understand the concept of Skewness and Kurtosis. (K2)
- CO3 Compute Correlation coefficient. (K3)

CO4 - Compute regression lines. (K3)

CO5 - Find the straight line and parabola.(K3)

List of Experiments

- 1. Construction of bar diagram
- 2. Construction of pie diagram
- 3. Construction of Mean, Median, Mode
- 4. Construction of standard deviation
- 5. Measures of Skewness and Kurtosis for both grouped and ungrouped data.
- 6. Computation of Correlation co-efficient.
- 7. Computation Rank correlation.
- 8. Regression Equations.
- 9. Fit a straight line
- 10. Fit a parabola

Text Books

1. Irfan A Khan, "Fundamentals of Biostatistics", Ukaaz Publication 5th edition, 2016.

- 2. PSS Sunder Rao, "An introduction to Biostatistics", PHI Learning Pvt Ltd , 2012
- 3. Moore and McCabe, "Introduction to the Practice of Statistics", WH Freeman, 9th Edition ,2009.

Reference Books

- 1. Marcello Pagano, "Principles of Biostatistics", 7th edition, 2015.
- 2. Course Manuals: S-PLUS Command Line Essentials, the Analysis of Microarrays
- 3. Richard A. Johnson, Irwin Miller and John E. Freund," Probability and Statistics for Engineers",
- Pearson Education, Asia, 9th Edition, 2018

4. P.Kandasamy, K. ThilagavathyandK. Gunavathi," Probability and Queuing Theory", S.Chand&Co, Pvt.Ltd.2015

5. Dr.G.Balaji,"Probability and Statistics", G.Balaji Publishers, 2017.

Web References

- 1. https://youtu.be/9pHi2vkz2_Y
- 2. https://youtu.be/4IAvbp-yVs8
- 3. https://youtu.be/B3pAD8ie3k0?list=PLoNoar1DIEikiPbM5cdpXOxDtQcrb4fQ5

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- 4. https://youtu.be/6MEdP4zMLuQ
- 5. https://www.youtube.com/watch?v=LMSyiAJm99g

Program Specific Program Outcomes (POs) Outcomes (PSOs) COs PO PO PO PO PO PO PO PO10 PO12 PO PO PO11 PSO PSO **PSO** 2 3 4 5 6 7 8 9 1 2 3 1 1 2 1 1 1 1 2 2 3 ---_ -_ -2 3 2 1 1 -1 ----1 2 2 --1 2 3 2 1 2 1 ---------2 1 1 1 2 2 4 _ _ _ _ -_ _ _ _ 2 3 2 1 2 5 1 1 1 -------

COs/POs/PSOs Mapping

A. M
U1	9	B	М	P 5	52

BIOMEDICAL INSTRUMENTATION L T P C Hrs LABORATORY 0 0 2 1 30

Course Objectives

- To provide hands-on training on designing of bio signal acquisition system and measurement of physiological parameters.
- To acquire an adequate knowledge about measurement of various physiological parameters
- To understand the working of the biomedical instruments.
- To know about the stimulation of eye and its effects
- To understand the Artificial respiration and Cardio Pulmonary Resuscitation

Course Outcomes

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

- CO1 Determine the heart axis in different leads and analyse the heart rate (K4)
- CO2 Examine the blood pressure using sphygmomanometer (K4)
- CO3 Investigate cardiac efficiency test, tuning fork tests for hearing (K4)
- CO4 Explain the stimulation of eye, near point and near response (K3)
- CO5 Demonstrate Artificial respiration and Cardio Pulmonary Resuscitation (K4)

List of Experiments

- 1. Determination of Heart Axis by measuring QRS amplitude in the different leads (Lead I, Lead II and Lead III) and Plotting Einthoven Triangle
- 2. Recording of blood pressure using sphygmomanometer and stethoscope
- 3. Measurements of various time intervals between each segment of ECG, Measurement of R-R interval and calculation of Heart Rate
- 4. Cardiac Efficiency Test
- 5. Measurement of Visually Evoked Potential
- 6. Galvanic Skin Resistance (GSR) Measurement
- 7. Peripheral pulse signal in different physical posture
- 8. EMG Signal for different stress on the muscle
- 9. Recording and interpretation of Heart sounds
- 10. Demonstration of Artificial respiration and Cardio Pulmonary Resuscitation
- 11. Determination of Nerve conduction velocity

Text Books

- 1. A.K.Sawhney ,"A Course in Electrical and Electronic measurements and Instruments" Dhanpat Rai and Sons, 2000.
- 2. Leshie Cromwell, Fred. J. Weibell and Erich. A. Pfeiffer, "Biomedical Instrumentation and Measurements", 2nd edition. PHI, 2018.
- 3. Raja Rao, C and Guha S.K, "Principles of Medical Electronics and Biomedical Instrumentation", Orient Longman Publishers, 2001

Reference Books

- 1. R. Anandanatarajan, Biomedical Instrumentation. PHI Learning, 2009.
- 2. Andrew G. Webb, Principles of Biomedical Instrumentation. Cambridge University Press, 2018.
- 3. John G. Webster, "Medical Instrumentation: Application and Design", 4th edition. John Wiley and Sons, New York, 2010.
- 4. A.K. Sawhney, "A Course in Electrical and Electronic measurements and Instruments", Dhanpat Rai and Sons, 2015
- 5. M. Arumugam, "Biomedical Instrumentation", Anuradha Agencies Publishers, 2002.

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Web References

- 1. https://www.uvpce.ac.in/content/biomedical-transducers-and-biosensors-laboratory
- 2. https://apm.iitm.ac.in/biomedical/sai/
- 3. https://www.electrical4u.com/introduction-to-biomedical-instrumentation/

COs/POs/PSOs Mapping

COs	s Program Outcomes (POs)													Program Specific Outcomes (PSOs)				
	P01	PO2	PO3	PO4	PO5	PO6	P07	P08	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3			
1	3	3	3	2	2	1	-	-	-	-	-	2	2	-	-			
2	3	3	2	2	2	1	-	-	-	-	-	2	2	-	-			
3	3	3	2	2	2	-	-	-	-	-	-	2	1	-	-			
4	3	3	2	2	2	-	-	-	-	-	-	2	1	-	-			
5	3	3	2	2	2	-	-	-	-	-	-	2	1	-	-			

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

_ A. Or-



1110BMD53		L	т	Ρ	С	Hrs
01901975	COMPUTATION LAB	0	0	2	1	30

Course Objectives

- To perform different operations on signal using MATLAB.
- To familiarize with the generation of different signals using MATLAB
- To simulate Transient analysis of signals
- To simulate frequency response and stability analysis
- To simulate state space model

Course Outcomes

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

- CO1 Perform different operations on signal using MATLAB. (K4)
- CO2 Familiarize with the generation of different signals (K4)
- CO3 Demonstrate Transient analysis of signals (K4)
- CO4 -. Analyse frequency response and stability of systems (K4)
- CO5 Simulate state space model and Lung mechanics using transfer function. (K4)

List of Experiments

Simulation of experiments using MATLAB/SIMULINK

- 1. Generation of sequence and perform operation like shifting, folding, time scaling and multiplication.
- 2. Generation of Periodic, Exponential, Sinusoidal, Step, Impulse, Ramp signals
- 3. Transient Analysis of Impulse Response
- 4. Transient Analysis of Step Response
- 5. Determine the Time response of Second Order system
- 6. Frequency Domain Analysis of signals
- 7. Effect of P, PI, PID Controller on second order systems
- 8. Stability analysis (Bode, Root Locus, Nyquist) of Linear Time Invariant system.
- 9. State space model for classical transfer function
- 10. Simple Lung Mechanics using Transfer Function

Text Books

- 1. Allan V.Oppenheim, S.Wilsky and S.H.Nawab, Signals and Systems. Pearson, 2007.
- 2. A Michael C K Khoo, Physiological control systems-Analysis, simulation and estimation", Second edition, Prentice Hall of India, 2018.
- **3** Shailendra Jain, "Modeling and Simulation using MATLAB Simulink", 2nd edition, Wiley 2015.

Reference Books

- 1. B. P. Lathi, Principles of Linear Systems and Signals, 2nd ed. Oxford, 2009.
- 2. R.E.Zeimer, W.H.Tranter and R.D.Fannin, Signals and Systems Continuous and Discrete. Pearson, 2007.
- 3. Nagrath J and Gopal M, "Control system engineering", 5th edition, New Age International Publishers, 2011.
- 4. Rajeev Gupta, "Control systems engineering", 1st edition. Wiley India Pvt Ltd, 2011.
- 5. Salivahanan," Control systems Engineering", Pearson Education India, 2015

Web References

- 1. https://www.sciencedirect.com/
- 2. http://www.springer.com
- 3. http://www.researchgate.net

COs		Program Outcomes (POs)													Program Specific Outcomes (PSOs)			
	P01	PO2	PO3	PO4	PO5	P06	P07	P08	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3			
1	3	3	3	2	1	2	1	3	2	1	1	3	3	1	-			
2	3	3	3	2	1	2	1	3	2	1	1	3	3	1	-			
3	3	3	3	2	1	2	1	3	2	1	1	3	3	1	-			
4	3	3	3	2	1	2	1	3	2	1	1	3	3	1	-			
5	3	3	3	2	1	2	1	3	2	1	1	3	3	3	-			

COs/POs/PSOs Mapping

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

A. On-



	HOSPITAL TRAINING	L	Т	Ρ	С	Hours
UT9DWF 54	HOSFITAL TRAINING	0	0	3	1	30

Course Objectives

- To provide opportunity to observe medical professionals at work in the wards and the roles of Allied Health Professionals.
- To interact with healthcare Professionals to get a better understanding of their work.
- To demonstrate patient-care in a hospital setting.

Course Outcome

After completion of the course, the students will able to

- **CO1 -** Learn a patient-centered approach in healthcare.
- CO2 Communicate with other health professionals in a respectful and responsible manner.
- CO3 Recognize the importance of inter-professional collaboration in healthcare.
- **CO4** Propose a patient-centered inter-professional health improvement plan based upon the patient's perceived needs.
- **CO5** Use the knowledge of one's own role and those of other professions to address the healthcare needs of populations and patients served.

Department Visit

- 1. Cardiology
- 2. Ophthalmology
- 3. ENT
- 4. Orthopaedic and Physiotherapy
- 5. ICU/CCU
- 6. Operation Theatre
- 7. Neurology
- 8. Nephrology
- 9. Radiology
- 10. Nuclear Medicine
- 11. Pulmonology
- 12. Urology
- 13. Obstetrics and Gynaecology
- 14. Emergency Medicine
- 15. Biomedical Engineering Department
- 16. Histo Pathology
- 17. Biochemistry
- 18. Pediatric and Neonatal
- 19. Dental
- 20. Oncology
- 21. PAC's
- 22. Medical records/Telemetry

Text Books

- 1.Girdhar J Gyani and Alexander Thomas, "Handbook of Healthcare quality and patient safety", 2nd edition, Jaypee brothers medical publisher, 2019.
- 2.Shakti Kumar Gupta, Sunil Kant, R Chandrashekhar and Sidharth Satpathy, "Modern Trends in Planning & Designing of Hospitals: Principles and Practice", Jaypee, 2007.
- 3.Dr Malhotra's series, "Step by Step Hospital designing & planning", Jaypee, 2007.

Reference Books

1. Sonu Dr. Goel, "Textbook of Hospital Administration", Elsevier, 2014.

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COs/POs/PSOs Mapping

- 2. William Charney," Handbook of Modern Hospital Safety", 2nd edition, CRC press, 2010.
- 3. Cindy Taylor, "The Hospital Safety Professional's Handbook", 5th edition. HCPro, BLR, 2015.

Web References

- 1. https://en.wikipedia.org/wiki/Medical_equipment_management
- 2. http://www.who.int/hac/techguidance/preparedness/hospital_safety_index_forms.pdf
- 3. https://www.who.int/news-room/fact-sheets/detail/patient-safety
- 4. https://www.coursera.org/browse/health/healthcare-management
- 5. https://www.who.int/management/newitems/en/index1.html

COs	Program Outcomes (POs)													Program Specific Outcomes (PSOs)				
	P01	PO2	PO3	PO4	PO5	P06	P07	P08	PO9	PO10	P011	PO12	PSO1	PSO2	PSO3			
1	3	3	3	2	3	2	-	-	-	-	-	2	2	3	3			
2	3	3	3	2	3	2	-	-	-	-	-	2	2	3	3			
3	3	3	3	2	3	2	-	-	-	-	-	2	1	3	3			
4	3	3	3	2	3	2	-	-	-	-	-	2	1	3	3			
5	3	3	3	2	3	2	-	-	-	-	-	2	1	3	3			

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

A. M

U19BMC5X	CERTIFICATION COURSE – III	L	т	Ρ	С	Hrs
		0	0	4	-	50

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

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

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	SKILL DEVELOPMENT COURSE 5	L	т	Ρ	С	Hrs
U19BMS51	(Foreign Language / IELTS – I)	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.

С

Hrs

U19BMS52

SKILL DEVELOPMENT COURSE 6

(Presentation Skills using ICT)

0 0 2 - 30

LTP

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.



U19BMM51

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 and 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 Banarsidass Publishers, ISBN 13: 978-8120810990,2014

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U19BMT61 DIAGNOSTIC AND THERAPEUTIC EQUIPMENT

Course Objectives

- To impart knowledge on Ultrasonic Techniques.
- To describe patient monitoring and Biotelemetry equipment's
- To understand the classification of Diathermy
- To introduce special diagnostic techniques.
- To study patient safety

Course Outcomes

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

- CO1 Understand Ultrasonic Techniques. (K2)
- CO2 Describe the patient monitoring and Biotelemetry. (K3)
- CO3 Understand the classification of Diathermy. (K3)
- CO4 Interpret special diagnostic techniques. (K4)
- CO5 Acquire knowledge in patient's safety. (K3)

UNIT I ULTRASONIC TECHNIQUES

Diagnosis-Basic principles of Echo technique - display techniques A, B and M mode - Application of ultrasound as diagnostic tool - Echocardiogram, abdomen - obstetrics and gynaecology.

UNIT II PATIENT MONITORING AND BIOTELEMETRY

ICU/CCU Equipment's - Infusion pumps - bed side monitors - Central consoling controls - Radio Telemetry (single, multi) - Portable and Landline Telemetry unit - Applications in ECG and EEG Transmission.

UNIT III DIATHERMY

IR and UV lamp and its application - Thermography - Recording and clinical application - Short wave diathermy ultrasonic diathermy - Microwave diathermy - Electro surgery machine - Current waveforms, Tissue Responses - Electro surgical current level.

UNIT IV SPECIAL DIAGNOSTIC TECHNIQUES

Need for heart lung machine - functioning of bubble - disc type and membrane type oxygenators - finger pump - roller pump - electronic monitoring of functional parameter – Haemo Dialyzer unit – Lithotripsy- Principles of Cryogenic technique and application - Endoscopy, Laparoscopy.

UNIT V PATIENT SAFETY

Physiological effects of electricity - important susceptibility parameters – Macro shock – Micro shock hazards – Patient's electrical environment – Isolated Power system – Conductive surfaces – Electrical safety codes and standards – Basic Approaches to protection against shock - Protection equipment design - Electrical safety analyser – Testing the Electric system

Text Books

- 1. Leslie Cromwell," Biomedical Instrumentation and Measurement", Second edition. Prentice Hall, 2015.
- 2. John G. Webster, "Medical Instrumentation Application and Design", Fifth edition, John Willey and sons, 2020.
- 3. Joseph J. Carr and John M. Brown, "Introduction to Biomedical equipment technology", Third edition, John Willey and sons, New York, 2003.



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(9 Hrs)



Reference Books

1.Khandpur,R.S,"Handbook of Biomedical Instrumentation ",Second Edition. Tata Mc Graw Hill, 2003 2.Rick Krohn, David Metcalf, Patricia Salber, "Health-e Everything: Wearables and The Internet of Things for Health, 2013.

3. L.A Geddes and L.E.Baker, "Principles of Applied Biomedical Instrumentation", 3rd Edition, 2008. 4.John G. Webster, "Medical Instrumentation: Application and Design", 4th edition. John Wiley and Sons, New York, 2010.

5.Samuel A. Fricker, Christoph Thümmler , Anastasius Gavras, "Requirements Engineering For Digital Health", Springer, 2015

Web References

- 1. https://www.nap.edu/read/21794/chapter/7
- 2. https://www.embs.org/about-biomedical-engineering/our-areas-of-research/diagnostic-therapeutic-systems.
- https://www.wsh.nhs.uk/CMS-Documents/Trust-policies/201-250/PP19206
 DiagnosticandTherapeuticEquipmentTraining.pdf

COs/POs/PSOs Mapping

COs	Prog	jram C	Outcor		Program Specific Outcomes (PSOs)										
	P01	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	3	2	1	2	-	-	-	-	-	1	2	2	2
2	3	3	2	2	1	2	-	-	-	-	-	1	2	2	2
3	3	3	2	2	2	2	-	-	-	-	-	1	1	2	2
4	3	3	2	2	2	2	-	-	-	-	-	1	1	2	2
5	3	3	2	2	2	2	-	-	-	-	-	1	1	2	2

Correlation level: 1 - Low 2 - Medium 3 - High

APPL

U19BMT62	MEDICAL INTERNET OF THINGS	- 2	0	•	2	15
Course Objective	S	5	U	U	3	40
 To understand th To gain knowledge To understand A 	e architecture of IOT and its associated protocols ge on interfacing IOT and cloud oplication layer of IOT architecture					
To get trained wiTo understand w	h m-IOT components and equipment's earable technologies and applications of m-IOT					
Course Outcome	S					
After completion o CO1 - understand th	<i>f the course, the students will be able to</i> e architecture of IOT and its associated protocols (K2)					

MEDICAL INTERNET OF THINGS

- CO2 Explain interfacing IOT and cloud (K2)
- CO3 Gain knowledge on Application layer of IOT (K2)
- CO4 Explain m-IOT components and its role in surgery (K3)
- CO5 Describe wearable technologies and applications of m-IOT (K3)

UNIT I INTRODUCTION TO IOT

Brief History of IOT – Architectural Layers of IOT – Bluetooth – Zigbee - Wi-Fi - IP-Based Protocols – UPnP – CoAP - MQTT - XMPP - SCADA - Authentication protocols - IEEE 802.15.4

UNIT II IOT IN THE CLOUD

Network layer - Cloud - Network Technologies - Types of Networks - BAN - Cloud and Virtualization - Cloud terminologies - Types of Cloud - Service Models - Fog and edge customization

UNIT III APPLICATION LAYER

Data - Databases - Database Management systems - Real time Databases - Diagnosis and therapeutics - Big Data - Medical Data Mining and processing.

UNIT IV M-IOT IN SURGERY

Perception Layer - RFIDs - cameras - Sensors - Introduction to ASICs - pulse oximeters, instrumentation amplifiers - Surgical equipment and dependencies - Surgery and its types - role of IOT in surgery.

UNIT V APPLICATIONS OF IOT

Ventilators - Wearable Technologies - smart watches - Computer Assisted Anthropology - Smart Health Organizations

Text Books

- 1. Aboul Ella Hassanien, Nilanjan Dey, Surekha Borra "Medical Big Data and Internet of Medical Things", CRC Press, 1st edition, 2018
- 2. P. B. Pankajavalli, G. S. Karthick "Incorporating the Internet of Things in Healthcare Applications and Wearable Devices, Advances in Medical Technologies and Clinical Practice (AMTCP)", IGI Global, 1st edition, 2019
- 3. Peter Waher, "Learning Internet of Things", Packt Publishing, 2015

Reference Books

- 1. Valentia E.Balas, Le Hoang Son, Sudan Jha, Manju Khari, Raghvendra Kumar "Internet of Things in Biomedical Engineering", , Academic Press, 2019
- Dr. Guillaume Girardin , Antoine Bonnabel, Dr. Eric Mounier, 'Technologies Sensors for the Internet of 2. Things Businesses & Market Trends 2014 -2024', Yole Development Copyrights ,2014

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(9 Hrs)

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L	Т	Ρ	С	Hrs
3	0	0	3	45

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- 3. Vijender Kumar Solanki, Raghvendra Kumar, Md. Atiqur Rahman Ahad "A Handbook of Internet of Things in Biomedical and Cyber Physical System" Springer International Publishing,2019 4. Amit Banerjee, Lalit Garg, Joel J. P. C. Rodrigues "Internet of Medical Things for Smart Healthcare"
- Springer Singapore, 2019
- Subhas Chandra Mukhopadhyay "Intelligent IoT Systems in Personalized Health Care" Elsevier 5. Science,2020

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- 1. https://nptel.ac.in/noc/courses/noc19/SEM1/noc19-cs31/
- 2. https://www.digimat.in/nptel/courses/video/108105091/L01.html
- 3. https://ieeexplore.ieee.org/stamp/stamp.jsp?arnumber=7113786

COs/POs/PSOs Mapping

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

Correlation level: 1 - Low 2 - Medium 3 - High

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U19BMT63

MICROCONTROLLER AND EMBEDDED SYSTEMS

T P C Hrs 0 0 3 45

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Course Objectives

- To study the Architecture of 8051 microcontroller.
- To understand interfacing of microcontroller with external devices
- To introduce the Building Blocks of Embedded System
- To understand Embedded networking.
- To learn Embedded Product Development environment

Course Outcomes

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

CO1 - Explain the Architecture of 8051 microcontroller (K2)

CO2 - Gain knowledge in programming and interfacing of devices with microcontroller (K3)

- CO3 Explain the fundamentals of Embedded System (K2)
- CO4 Familiarize with various Embedded networking protocols (K2)
- CO5 Gain knowledge in Embedded Product Development environment (K2)

UNIT I MICROCONTROLLER

Architecture of 8051 – Special Function Registers (SFRs) – I/O Pins Ports and Circuits – Instruction set – Addressing modes – Assembly language programming.

UNIT II INTERFACING MICROCONTROLLER

Programming 8051 Timers – Serial Port Programming – Interrupts Programming – LCD and Keyboard Interfacing – ADC, DAC and Sensor Interfacing – External Memory Interface- Stepper Motor and Waveform generation – Comparison of Microcontroller - PIC and ARM processors.

UNIT III INTRODUCTION TO EMBEDDED SYSTEMS

Introduction to Embedded Systems – The build process for embedded systems- Structural units in Embedded processor - selection of processor and memory devices- DMA – Memory management methods-Timer and Counting devices, Watchdog Timer - Real Time Clock - In circuit emulator -Target Hardware Debugging.

UNIT IV EMBEDDED NETWORKING

Embedded Networking: Introduction, I/O Device Ports and Buses– Serial Bus communication protocols – RS232 standard – RS422 – RS485 – CAN Bus -Serial Peripheral Interface (SPI) – Inter Integrated Circuits (I2C) –need for device drivers.

UNIT V EMBEDDED FIRMWARE DEVELOPMENT ENVIRONMENT

Embedded Product Development Life Cycle- objectives - different phases of EDLC - Modelling of EDLC - issues in Hardware-software Co-design - Data Flow Graph - state machine model - Sequential Program Model - concurrent Model - object oriented Model.

Text Books

- 1. Mohamed Ali Mazidi, Janice Gillispie Mazidi, Rolin McKinlay, "The 8051 Microcontroller and Embedded Systems: Using Assembly and C", Second Edition, Pearson education, 2011
- 2. Marilyn Wolf, "Computers as Components Principles of Embedded Computing System Design", Third Edition —Morgan Kaufmann Publisher (An imprint from Elsevier), 2012.

Dr. A.Vijayalakshmi

B.Tech. Biomedical Engineering

(9 Hrs)

(9 Hrs)

(9 Hrs)

(9 Hrs)

(9 Hrs)



3. A.K. Singh "Microcontroller and Embedded System", New Age International (P) Limited ,2008

Reference Books

- 1. Doughlas V.Hall, "Microprocessors and Interfacing, Programming and Hardware", TMH, 2012.
- 2. Lyla B.Das, "Embedded Systems : An Integrated Approach", Pearson Education, 2013.
- 3. David. E. Simon, "An Embedded Software Primer ", First Edition, Fifth Impression, Addison Wesley Professional, 2007.
- 4. Gul N. Khan "Embedded and Networking Systems Design, Software, and Implementation", CRC Press, 2012.
- 5. Vincent Zimmer, Jiming Sun, Marc Jones, Stefan Reinauer,"Embedded Firmware Solutions Development Best Practices for the Internet of Things", Apress, 2015

Web References

- 1. https://www.tutorialspoint.com/embedded_systems/es_microcontroller.htm
- 2. https://www.elprocus.com/embedded-systems-real-time-applications/
- 3. https://onlinecourses.nptel.ac.in/noc20_ee98/preview

COs/POs/PSOs Mapping

COs	Prog	ram O	utcon	nes (P	Os)								Progra Outco	am Sp mes (PS	oecific Os)
	P01	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	P1SO2	PSO3
1	2	2	3	2	2	2	-	-	-	-	-	2	1	1	1
2	2	2	3	2	2	2	-	-	-	-	-	2	1	1	1
3	2	1	3	2	1	1	-	-	-	-	-	2	1	1	-
4	2	1	3	2	1	1	-	-	-	-	-	2	1	1	-
5	2	1	3	2	1	1	-	-	-	-	-	2	1	1	-

Correlation level: 1 - Low 2 - Medium 3 - High

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ARTIFICIAL INTELLIGENCE AND MACHINE	L	•
LEARNING IN MEDICINES	2	:

T P C Hrs 2 0 3 60

Course Objectives

U19BMT64

- To understand the various characteristics of Intelligent agents
- To learn the different search strategies in AI.
- To acquire knowledge in solving AI problems.
- To understand the different machine learning techniques.
- To learn the planning for Machine learning.

Course Outcomes

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

CO1 - Define the various characteristics of intelligent agents (K2)

- CO2 Describe the different search strategies in AI (K3)
- CO3 Apply the particular agent strategy to solve a given problem (K3)
- CO4 Classify the different machine learning techniques (K2)
- CO5 Understand the planning for Machine learning (K2)

UNIT I INTRODUCTION

Introduction–Definition - Future of Artificial Intelligence – Characteristics of Intelligent Agents–Typical Intelligent Agents – Problem Solving Approach, Artificial Intelligence in Medicine

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.

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 MACHINE LEARNING BASICS

Introduction - History of machine learning - Algorithm types for machine learning - the human touch, Uses for machine learning and Languages for machine learning.

UNIT V PLANNING FOR MACHINE LEARNING

Machine learning cycle - defining the process - building a data team - Data processing - data storage - Data privacy - data quality and cleaning, ML in Medical Applications.

Text Books

- 1. S. Russell and P. Norvig, "Artificial Intelligence: A Modern Approach", Third Edition, Prentice Hall, 2009,
- 2. Bratko, "Prolog Programming for Artificial Intelligence", Fourth edition, Addison-Wesley Educational Publishers, 2011.
- 3. Lei Xing, Maryellen L. Giger, James K. Min "Artificial Intelligence in Medicine Technical Basis and Clinical Applications" Elsevier Science 2020

(12 Hrs)

(12 Hrs)

(12 Hrs)

(12 Hrs)

(12 Hrs)

Reference Books

- 1. Gerhard Weiss, "Multi Agent Systems", Second Edition, 2013, MIT Press.
- 2. David L. Poole and Alan K. Mackworth, "Artificial Intelligence: Foundations of Computational Agents", Fourth Edition, Cambridge University Press, 2010
- 3. Richard Szeliski, "Computer Vision: Algorithms and Applications", First Edition, 2010, Springer
- 4. Simon J.D. Prince, "Computer vision: models, learning and inference", First edition, Cambridge University Press, 2012
- 5. E R Davies, "Computer and Machine Vision: Theory, Algorithms and Practicalities", Fourth Edition, Elsevier, 2012

Web References

- 1. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6616181/
- 2. https://sigmoidal.io/artificial-intelligence-and-machine-learning-for-healthcare/
- 3. https://link.springer.com/book/10.1007/978-981-16-0811-7

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

COs/POs/PSOs Mapping

Correlation level: 1 - Low 2 - Medium 3 - High



U19BMP61 DIAGNOSTIC AND THERAPEUTIC EQUIPMENT L T P C Hours LABORATORY 0 0 2 1 30

Course Objectives

- To familiarize students with ECG, EEG and EMG signal.
- To illustrate students with the simulation of ECG signals.
- To impart knowledge on Pace maker simulator.
- To describe the working of Defibrillator simulator.
- To analyse the protection equipments for electrical safety measures.

Course Outcomes

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

- CO1 Experiment the analysis of ECG, EEG and EMG signals. (K3)
- CO2 Simulate ECG signals and Pacemaker. (K4)
- CO3 Conduct investigation using Defibrillator simulator (K3)
- CO4 Describe shortwave and ultrasonic diathermy (K3)
- CO5 Demonstrate the protection equipment's for electrical safety measures.(K3)

List of Experiments

- 1. Recording and analysis of ECG signals
- 2. Recording and analysis of EEG signals
- 3. Recording Fatigue test of EMG signals
- 4. Simulation of ECG detection of QRS complex and heart rate
- 5. Study of Pacemaker simulator
- 6. Study of Defibrillator simulator
- 7. Study of shortwave and ultrasonic diathermy
- 8. Study of biotelemetry
- 9. Study of Endoscopy and Laparoscopy equipment's
- 10. Electrical safety measurements
- 11.Recording of Audiogram

Text Books

- 1. Leslie Cromwell, "Biomedical Instrumentation and Measurement", Second edition. Prentice Hall, 2015.
- 2. John G. Webster "Medical Instrumentation Application and Design", John Willey and sons, Fifth Edition 2020.
- 3. Joseph J. Carr and John M. Brown "Introduction to Biomedical equipment technology", John Wiley and sons, New York, 2001.

Reference Books

- 1. Richard Aston, "Principles of Biomedical Instrumentation and Measurement", Merril Publishing Company, 2007.
- 2. Khandpur R.S, "Handbook of Biomedical Instrumentation", Tata McGraw Hill, Third edition, New Delhi, 2003.
- 3. Myer Kutz, "Standard Handbook of Biomedical Engineering and Design", Mc Graw Hill, 2003.
- 4. L.A Geddes and L.E.Baker, "Principles of Applied Biomedical Instrumentation", Third edition, 2008.
- 5. Antony Y.K.Chan, "Biomedical Device Technology, Principles and design", Charles Thomas Publisher Ltd, Illinois, USA, 2008.

Dr. A.Vijayalakshmi



Web References

- 1. https://www.nap.edu/read/21794/chapter/7
- 2. https://www.embs.org/about-biomedical-engineering/our-areas-of-research/diagnostic-therapeutic-systems.
- 3. https://www.wsh.nhs.uk/CMS-Documents/Trust-policies/201-250/PP19206

COs/POs/PSOs Mapping

COs	Prog	ram C)utcor	nes (F	POs)								Progra Outco	am Sp mes (P	oecific SOs)
	P01	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSÓ3
1	3	3	3	2	2	1	-	-	3	3	-	2	2	2	1
2	3	3	2	2	2	1	-	-	3	3	-	2	2	2	1
3	3	3	2	2	2	-	-	-	3	3	-	2	1	2	1
4	3	3	2	2	2	-	-	-	3	3	-	2	1	2	1
5	3	3	2	2	2	-	-	-	3	3	-	2	1	2	1

Correlation level: 1 - Low 2 - Medium 3 - High

A. M

U19BMP62

MEDICAL INTERNET OF THINGS LABORATORY

L T P C Hrs 0 0 2 1 30

Course Objectives

- To study Embedded programming, REST API and its commands.
- To realize human fall detection, ECG system, surgical system.
- To understand ThingSpeak.cloud.
- To integrate Raspberry pi and ThingSpeak.
- To investigate smart systems.

Course Outcomes

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

- CO1 Gain knowledge in Programming for embedded applications. (K3)
- CO2 Realize human fall detection, ECG system, and surgical system. (K4)
- CO3 Familiarize with ThingSpeak cloud. (K3)
- CO4 Integrate Raspberry pi and ThingSpeak. (K3)
- CO5 Analyze smart systems (K4)

List of Experiments

Conduct the Experiments using Arduino / Raspberry pi

- 1. Study of Raspberry pi, UART Communication
- 2. Study of REST and HTTP protocols, PUSH, PUT and GET commands, Linux CLI, Raspbian OS
- 3. Human Fall detection system using an Accelerometer sensor
- 4. Study of ECG system, which gets Heart beat sensor reading from different nodes
- 5. Surgical automation system, which runs 2 motor using a Servo Motor based inputs given on console in pc and operates the motor operation.
- 6. Baby Monitoring system, to prevent sudden infant death syndrome
- 7. Clinical Management system consisting of RFIDs tags and cards which constantly uploads inpatient and outpatient details to ThingSpeak. server
- 8. Smart Ventilator system to control through various modes of ventilator connected to ThingSpeak. server, and remotely operated.
- 9. Waste Management system consisting of moisture and Gas sensor connected to server and remotely indicating the recycle process of medical waste
- 10. Smart watch system, to indicate and alert users of their routine works and also monitor the pulse and temperature readings.

Text Books

- 1. Hands-on Artificial Intelligence for IoT, Packet Publishing, 2019.
- 2. Smart Medical Data Sensing and IoT Systems Design in Healthcare, Business Science Reference, 1st edition, 2020.
- 3. Joseph D. Bronzino, "The biomedical engineering handbook", Volume 2, CRC Press, USA, 2000.

Reference Books

1. Medical Big Data and Internet of Medical Things, CRC Press, 1st edition, 2018.

2. P. Venkata Krishna, Sasikumar Gurumorthy, Mohammad S.Obaidat, Internet of Things and Personalized Healthcare systems, Springer, 1st edition, 2019.

Academic Curriculum and syllabi R-2019

Web References

- 1. https://nptel.ac.in/noc/courses/noc19/SEM1/noc19-cs31/
- 2. https://www.digimat.in/nptel/courses/video/108105091/L01.html

COs/POs/PSOs Mapping

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

Correlation level: 1 - Low 2 - Medium 3 - High

A. M

U19BMP63

MICROCONTROLLER AND EMBEDDED L T P C Hours SYSTEMS LABORATORY 0 0 2 1 30

Course Objectives

- To learn about the various modules of microcontroller kit.
- To provide training on Basic programs using microcontroller
- To acquire knowledge on interfacing with ADC /DAC converters.
- To learn the working of ARM processor.
- To write programs to interface memory, I/Os with processor

Course Outcomes

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

- **CO1-** Understand the assembly language program of microcontroller. **(K2)**
- CO2- Analyze microcontroller interfacing with external devices. (K3)

CO3- Gain knowledge in ARM processor (K3)

CO4- Interface A/D and D/A converters with ARM system (K3)

CO5- Interface memory, I/Os with processor. (K3)

List of Experiments

Part A: Conduct the following experiments using 8051 microcontroller kits.

- 1. Study of 8051 Microcontroller trainer kit.
- 2. Assembly Language Program for addition of 8-bit numbers stored in an array.
- 3. Assembly Language Program for Multiplication by successive addition of two 8-bit numbers.
- 4. Assembly Language Program for finding largest no. from a given array of 8-bit numbers.
- 5. Assembly Language program to arrange 8-bit numbers stored in an array in ascending order.
- 6. Stepper motor control by 8051 Microcontroller.
- 7. Interfacing of 8-bit ADC 0809 with 8051 Microcontroller.
- 8. Interfacing of 8-bit DAC 0800 with 8051 Microcontroller and Waveform generation using DAC.

Part B: Conduct the following experiments using ARM7TDMI/LPC2148 evaluation board

9. Display "Hello World" message using Internal UART.

10. Interface and Control a DC Motor.

- 11. Interface a Stepper motor and rotate it in clockwise and anti-clockwise direction.
- 12. Determine Digital output for a given Analog input using Internal ADC of ARM controller.
- 13. Interface a DAC and generate Triangular and Square waveforms.
- 14. Interface a 4x4 keyboard and display the key code on an LCD.

Text Books

- 1. Mohamed Ali Mazidi, Janice Gillispie Mazidi, Rolin McKinlay, "The 8051 Microcontroller and Embedded Systems: Using Assembly and C", Second Edition, Pearson education, 2011
- 2. Marilyn Wolf, "Computers as Components Principles of Embedded Computing System Design", Third Edition —Morgan Kaufmann Publisher (An imprint from Elsevier), 2012.
- 3. A.K. Singh "Microcontroller and Embedded System", New Age International (P) Limited ,2008

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- 2. Lyla B.Das, "Embedded Systems : An Integrated Approach", Pearson Education, 2013.
- 3. David. E. Simon, "An Embedded Software Primer ", First Edition, Fifth Impression, Addison Wesley Professional, 2007.

Academic Curriculum and syllabi R-2019



- 4. Gul N. Khan "Embedded and Networking Systems Design, Software, and Implementation", CRC Press, 2012.
- 5. Vincent Zimmer, Jiming Sun, Marc Jones, Stefan Reinauer ",Embedded Firmware Solutions Development Best Practices for the Internet of Things", Apress, 2015

Web References

- 1. https://www.tutorialspoint.com/embedded_systems/es_microcontroller.htm
- 2. https://www.elprocus.com/embedded-systems-real-time-applications/
- 3. https://onlinecourses.nptel.ac.in/noc20_ee98/preview

COs/POs/PSOs Mapping

COs					Progr	am O	utcom	es (P	Os)				Prog Outco	ram Sp omes (F	ecific PSOs)
	P01	PO2	PO3	PO4	PO5	P06	P07	P08	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	3	2	1	1	-	-	2	2	-	-	2	2	1
2	3	3	2	2	1	1	-	-	2	2	-	-	2	2	1
3	3	3	2	2	1	1	-	-	2	2	-	-	1	2	1
4	3	3	2	2	1	1	-	-	2	2	-	-	1	2	1
5	3	3	2	2	1	1	-	-	2	2	-	-	1	2	1

Correlation level: 1 - Low 2 - Medium 3 - High

U19BMC6X	CERTIFICATION COURSE - IV	L	т	Ρ	С	Hrs
		0	0	4	-	50

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

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

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	SKILL DEVELOPMENT COURSE 7	L	т	Ρ	С	Hrs
0196101301	(Foreign Language / IELTS – II)	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



С

Hrs

SKILL DEVELOPMENT COURSE 8

U19BMS62

(Technical Seminar)

0 0 2 - 30

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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 pointpresentation 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 aregiven based on the report.
- A Faculty guide is to be allotted and he / she will guide and monitor the progress of the student andmaintain attendance also.
- Evaluation is 100% internal. The marks attained for this course is not considered for CGPA calculation.

	SKILL DEVELOPMENT COURSE 9	L	Т	Ρ	С	Hrs
019011303	(NPTEL/MOOC-I)	0	0	2	-	30

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

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2	0	0	-	30

U19BMM61

Course Objectives

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.

PROFESSIONAL ETHICS

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

(6 Hrs)

(6 Hrs)

(6 Hrs)

(6 Hrs)

(6 Hrs)

Reference Books

- 1. Mike W. Martin and Roland Schinzinger, "Ethics in Engineering", Tata McGraw Hill, New Delhi, 2003.
- 2. Govindarajan M, Natarajan S, Senthil Kumar V. S, "Engineering Ethics", Prentice Hall of India, New Delhi, 2004.
- 3. Charles B. Fleddermann, "Engineering Ethics", Pearson Prentice Hall, New Jersey, 2004.
- 4. Charles E. Harris, Michael S. Pritchard and Michael J. Rabins, "Engineering Ethics –Concepts and Cases", Cengage Learning, 2009
- 5. John R Boatright, "Ethics and the Conduct of Business", Pearson Education, New Delhi, 2003
- 6. Edmund G Seebauer and Robert L Barry, "Fundametals of Ethics for Scientists and Engineers", OxfordUniversity Press, Oxford, 2001
- 7. Laura P. Hartman and Joe Desjardins, "Business Ethics: Decision Making for Personal Integrity and Social Responsibility" Mc Graw Hill education, India Pvt. Ltd., New Delhi 2013.

Web References

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

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	L	Т	Ρ	С	Hrs
VICTORE BIOINSTROMENTATION	3	0	0	3	45

Course Objectives

- To Understand the fundamental concept of Virtual Instrumentation
- To gain knowledge in programming and dataflow in VI
- To impart adequate knowledge of Data acquisition for VI
- To illustrate the concept of various interfacing technique used in VI •
- To implement VI in medical applications

Course Outcomes

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

- CO1 Understand the basic concepts of Virtual instrumentation (K2)
- CO2 Realize the programming language used in VI (K2)
- CO3 Analyse the concept of data acquisition using VI (K2)
- CO4 Interpret the interfacing concept used in LabVIEW. (K3)
- CO5 Apply the concept of VI for medical applications. (K3)

UNIT I INTRODUCTION

History of Virtual Instrumentation, advantages, block diagram and architecture of a virtual instrument, dataflow techniques, LabVIEW basics - graphical programming, LabVIEW environment

UNIT II PROGRAMMING TECHNIQUES

VIS and sub-VIS, loops and charts, arrays, clusters, graphs, case and sequence structures, formula modes, local and global variable, string and file input. Publishing measurement data in the web.

UNIT III DATA ACQUISITION

Data acquisition basics: Introduction to data acquisition on PC, Sampling fundamentals, Input / Output techniques and buses. ADC, DAC, Digital I/O, counters and timers, DMA, Software and hardware installation, Calibration, Resolution, Data acquisition interface requirements.

UNIT IV INSTRUMENT INTERFACES

Current loop, RS 232C/RS 485, GPIB, System basics, interface basics: USB, PCMCIA, networking basics for office and industrial application VISA and IVI, image acquisition and processing, Motion Control, waveform generator.

UNIT V BIOMEDICAL APPLICATIONS OF VI

Virtual applications for ECG, EEG, EMG signals, Air Flow and Lung Volume, Non-invasive Blood Pressure Measurement, Virtual Reality and 3D graphical modelling, Virtual Prototyping.

Text Books

- 1. Jon B. Olansen, Eric Rosow, "Virtual Bio-Instrumentation: Biomedical, Clinical, and Healthcare Applications in LabVIEW" Prentice Hall PTR, 2001
- 2. Gary Johnson, "LABVIEW Graphical Programming", 4th Edition, McGraw Hill, 2006.
- 3. Ronald W. Larsen, "LabVIEW for Engineers", Pearson, 1st Edition, 2010

Reference Books

1. Robert H. Bishop," Learning with LabVIEW", Pearson, First edition, 2014

2. Jerome, "Virtual Instrumentation Using LabView", PHI, 2010.

Dr. A.Vijayalakshmi

B.Tech. Biomedical Engineering

(9 Hrs)

(9Hrs)

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- Sanjay Gupta and Joseph John, "Virtual Instrumentation using LabVIEW", Tata Mc Graw Hill Publishing Company Limited, New Delhi, 1st Edition, 2005.
- John Essick," Hands-on Introduction to LabVIEW for Scientists and Engineers ",Oxford University Press, 4th Edition,2018
- 5. Kevin James, "PC Interfacing and Data Acquisition: Techniques for Measurement, Instrumentation and Control", Newnes, 2000.

Web References

- 1. https://youtu.be/_2IZVC902kg
- 2. https://youtu.be/78dZ8ljJ52M
- 3. https://youtu.be/fly6XT3CdPQ
- 4. https://youtu.be/U0bQBOEiBQY
- 5. https://youtu.be/Q8rFSpaa84Q

COs					Prog	ram O	utcom	es (PC)s)				Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	
1	3	2	3	-	-	-	-	-	-	-	-	2	3	2	-	
2	3	2	1	1	3	-	-	-	-	-	-	2	2	2	-	
3	3	1	1	1	3	2	-	-	-	-	-	2	3	3	2	
4	3	2	3	-	3	2	-	-	-	-	-	2	3	3	2	
5	3	2	2	-	3	2	-	-	-	-	-	2	3	3	2	

COs/POs/PSOs Mapping

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

1119BMT72	MEDICAL IMAGE PROCESSING	L	Т	Р	С	Hrs
		3	0	0	3	45

Course Objectives

- To acquire a knowledge on the basic of digital image processing
- To gain knowledge about frequency domain enhancement in digital image processing
- To get an adequate knowledge of image restoration and segmentation in medical image technique.
- To study the compression techniques in medical images
- To understand the representation and recognition of medical images

Course Outcomes

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

- CO1 Gain knowledge in fundamentals of digital image processing. (K2)
- CO2 Examine image enhancement techniques in medical images. (K3)
- CO3 Execute restoration and segmentation techniques in medical images. (K3)
- CO4 Apply the compression Techniques in medical images. (K3)

CO5 - Describe the representations of features and recognize the images. (K2)

UNIT I FUNDAMENTAL OF DIGITAL IMAGE PROCESSING

Introduction, Steps in Digital Image Processing -Components –Elements of Visual Perception - Image Sensing and Acquisition - Image Sampling and Quantization -Relationships between pixels - colour models. Basics of Spatial Filtering– Smoothing and Sharpening Spatial Filtering.

UNIT II FREQUENCY DOMAIN ENHANCEMENT

Introduction to Fourier Transform – Smoothing and Sharpening frequency domain filters – Ideal, Butterworth and Gaussian filters, Wavelets -Sub band coding-Multi resolution expansions, Wavelets based image processing.

UNIT III MEDICAL IMAGE RESTORATION AND SEGMENTATION

Image Restoration: Noise Model – Notch Filters– Inverse Filtering – Wiener filtering.

Image Segmentation: Detection of Discontinuities–Edge Linking and Boundary detection – Region based segmentation- Region Growing, Region Splitting, Morphological processing- erosion and dilation, Basic Concept – Watershed segmentation algorithm – K-Means and Fuzzy Clustering.

UNIT IV MEDICAL IMAGE COMPRESSION

Image Compression models – Error Free Compression – Variable Length Coding – Bit-Plane Coding – Lossless Predictive Coding – Lossy Compression – Lossy Predictive Coding – Compression Standards - JPEG, JPEG2000.

UNIT V MEDICAL IMAGE REPRESENTATION AND RECOGNITION

Boundary representation - Chain Code- Polygonal approximation, signature, boundary segments -Boundary description –Shape number -Fourier Descriptor, moments- Regional Descriptors – Topological feature, Texture - Patterns and Pattern classes.

Image Recognition: Digital Imaging and Communication (DICOM) in Medicine, Various modalities of Medical Imaging-CT, MRI, PET, Thermography, Angiography.

Text Books

- 1. G.R. Sinha, Bhagwati Charen Patel, "Medical Image Processing: Concepts and Applications", PHI Learning private limited.2014
- 2. Rafael C. Gonzalez, Richard E. Woods, Steven L. Eddins, "Digital Image Processing Using MATLAB", Third Edition Tata McGraw Hill Pvt. Ltd., 2011

B.Tech. Biomedical Engineering

(9 Hrs)

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(9 Hrs)



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 Kayvan Najarian and Robert Splinter, "Biomedical Signal and Image Processing", 2nd Edition, CRC Press, 2005.

Reference Books

- 1. Anil Jain K. "Fundamentals of Digital Image Processing", PHI Learning Pvt. Ltd., 2011.
- 2. E. R. Davies, "Computer & Machine Vision", Fourth Edition, Academic Press, 2012.
- 3. Malay K. Pakhira, "Digital Image Processing and Pattern Recognition", 1st Edition, PHI Learning Pvt. Ltd., 2011.
- 4. Geoff Dougherty, "Medical Image Processing: Techniques and Applications", Springer Science & Business Media, 2011
- 5. Isaac N. Bankman, "Handbook of Medical Image Processing and Analysis", Science Direct, 2nd Edition, 2009.

Web References

- 1. https://youtu.be/xUCsfKA8bi0
- 2. https://youtu.be/0SIPA8TvCbU
- 3. https://youtu.be/8fBZFjiHw3I
- 4. https://youtu.be/PqBS3tFZYI8
- 5. https://m.youtube.com/watch?v=i8a2LdyenoY

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

COs/POs/PSOs Mapping

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



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

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Reference Books

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

Web References

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

COs/POs/PSOs Mapping

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

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

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U19BMP72 VIRTUAL BIOINSTRUMENTATION L T P C Hrs LABORATORY 0 0 2 1 30

Course Objectives

- To learn about LabVIEW tool and Acquisition of Biopotentials
- To study how to simulate the Biosignals
- To learn about how to simulate analog EEG and Biosignals logger
- To simulate heart rate analysis
- To Analyse the ECG and PCG signals

Course Outcomes

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

- CO1 Familiarize with LabVIEW tool and Acquisition of Biopotentials (K3)
- CO2 Analyse Time domain and Frequency Domain Measurements on Biosignals (K4)
- CO3 Simulate EEG and Biosignals logger (K4)
- CO4 Simulate heart rate analysis (K4)
- CO5 Analyse the ECG and PCG signals (K4)

LIST OF EXPERIMENTS

Experiments can be done using LabVIEW or equivalent Software tools.

- 1. Introduction to NI LabVIEW and Data Acquisition
- 2. Acquisition of Biopotentials
- 3. Time domain and Frequency Domain Measurements on Biosignals.
- 4. Simulation of EEG
- 5. Design of an Analog ECG Signal Generator.
- 6. Design of a Biosignal Logger.
- 7. Design of a Heart Rate Analyzer.
- 8. Spectrum Analysis of ECG and PCG signals.
- 9. Extraction of Brainwaves from EEG.
- 10. Design of a Demand type Pacemaker
- 11. GPIB Communication
- 12. VISA and Serial Communication

Text Books

- 1. Jon B. Olansen, Eric Rosow, "Virtual Bio-Instrumentation: Biomedical, Clinical, and Healthcare Applications in LabVIEW" Prentice Hall PTR, 2001
- 2. Gary Johnson, "LABVIEW Graphical Programming", 4th Edition, McGraw Hill, 2006.
- 3. Ronald W. Larsen ,"LabVIEW for Engineers", Pearson ,First edition, 2010

Reference Books

- 1. Robert H. Bishop," Learning with LabVIEW", Pearson, 1st Edition, 2014
- 2. Jerome, "Virtual Instrumentation Using LabView", PHI, 2010.
- 3. Sanjay Gupta and Joseph John, " Virtual Instrumentation using LabVIEW", Tata Mc Graw Hill Publishing Company Limited, New Delhi, 1st Edition, 2005.
- 4. John Essick," Hands-on Introduction to LabVIEW for Scientists and Engineers ", Oxford University Press, 4th Edition,2018
- 5. Kevin James, "PC Interfacing and Data Acquisition: Techniques for Measurement, Instrumentation and Control", Newnes, 2000.

Dr. A.Vijayalakshmi

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- 1. https://youtu.be/_2IZVC902kg
- 2. https://youtu.be/78dZ8ljJ52M
- 3. https://youtu.be/fly6XT3CdPQ
- 4. https://youtu.be/U0bQBOEiBQY
- 5. https://youtu.be/Q8rFSpaa84Q

COs/POs/PSOs Mapping

COs					Prog	ram O	utcom	es (PC)s)				Program Specific Outcomes (PSOs)				
	PO1	PO2	PO3	PO4	PO5	PO6	P07	P08	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3		
1	3	2	2	1	3	-	-	-	3	-		2	3	2	1		
2	3	1	1	2	3	-	-	-	2	-		2	2	2	1		
3	3	2	2	-	3	-	-	-	2	-		2	3	2	1		
4	3	2	-	-	3	-	-	-	3	-		2	3	2	1		
5	3	2	1	-	3	-	-	-	3	-		2	3	2	1		

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

A. M _



Т Ρ С Hrs MEDICAL IMAGE PROCESSING LABORATORY U19BMP73 0 2 1 30

Course Objectives

- To learn about basic functions of digital image fundamentals.
- To Understand various image enhancement techniques
- To Understand various segment techniques
- To understand various transforms
- To represent the features and recognize the images

Course Outcomes

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

CO1 - Describe digital image fundamentals. (K3)

- CO2 Examine image enhancement techniques in medical images. (K4)
- CO3 Execute restoration and segmentation techniques in medical images. (K4)
- CO4 Apply various transforms to the images. (K3)
- CO5 Describe the representations of features and recognize the images. (K3)

LIST OF EXPERIMENTS

Simulation using MATLAB (Image processing Tool Box) or equivalent software

- 1. Image sampling and quantization
- 2. Analysis of spatial and intensity resolution of images.
- 3. Intensity transformation of images.
- 4. DFT analysis of images
- 5. Transforms (Walsh, Hadamard, DCT, Haar)
- 6. Histogram Processing
- 7. Image Enhancement-Spatial filtering
- 8. Image Enhancement- Filtering in frequency domain
- 9. Image segmentation Edge detection, line detection and point detection
- 10. Basic Morphological operations.
- 11. Basic Thresholding functions
- 12. Analysis of images with different color models.

Text Books

- 1. G.R. Sinha, Bhagwati Charen Patel, "Medical Image Processing: Concepts and Applications", PHI Learning private limited, 2014.
- 2. Rafael C. Gonzalez, Richard E. Woods, Steven L. Eddins, "Digital Image Processing Using MATLAB", 3rd Edition, Tata McGraw Hill Pvt. Ltd., 2011.
- 3. Kayvan Najarian and Robert Splinter, "Biomedical Signal and Image Processing", 2nd Edition, CRC Press, 2005.

Reference Books

Anil Jain K. "Fundamentals of Digital Image Processing", PHI Learning Pvt Ltd, 2011.

E. R. Davies, "Computer & Machine Vision", 4th Edition, Academic Press, 2012. Malay K. Pakhira, "Digital Image Processing and Pattern Recognition", 1st Edition, PHI Learning Pvt Ltd, 2011. Geoff Dougherty, "Medical Image Processing: Techniques and Applications", Springer Science & Business Media, 2011.

Isaac N. Bankman, "Handbook of Medical Image Processing and Analysis", Science Direct, 2nd Edition. 2009.

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https://youtu.be/xUCsfKA8bi0 https://youtu.be/0SIPA8TvCbU https://youtu.be/8fBZFjiHw3I https://youtu.be/PqBS3tFZYI8 https://m.youtube.com/watch?v=i8a2LdyenoY

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

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

A. Or

	L	Т	Ρ	С	Hrs
UI9BINF/4	0	0	2	1	30

The student will be tested for his understanding of the basic principles of the core engineering subjects. The internal assessment for a total of 50 marks will be made by a committee comprising of the faculty members of the department. The committee will conduct three written examinations of short questions type or multichoice questions type from the subjects. The end semester examination which carries a total of 50 marks, will have viva voce examination conducted by a committee of one external examiner and one internal examiner.

	L	Т	Ρ	С
	0	0	4	2

Each batch of 2 or 3 students will be assigned an experimental or a theoretical project to be carried out under the supervision of a guide. The project work has to be carried out in the 7th and 8th semesters and has to be completed by the end of the 8th semester.

In the phase I of the project work, the progress of the work carried out in the 7th semester will be monitored and assessed. A committee of departmental faculty members comprising the project guide, the Head of the Department and one more faculty member will conduct the internal assessment. The project work and the report will be evaluated by the internal assessment committee by conducting three reviews for a total of 50 marks. The end semester examination which carries a total of 50 marks, will have report evaluation and viva voce examination conducted by a committee of one external examiner and one internal examiner.

1	5	1
I	5	T

	L	Т	Ρ	С
INTERNOTIF/INFLANT TRAINING	0	0	0	2

Students may undergo Inplant training or internship during summer / winter vacation at Industry/ Research organization for a period of two weeks to four weeks. Students are also permitted to undergo internships during their seventh semester after the theory classes are over. Each student has to submit a detailed report on In-Plant Training which He/ She has undergone. The department committee will assess the progress of the student and recommend the grade (100% Continuous Assessment pattern) based on the completion of Inplant training or internship.

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Course Objectives

U19BMT81

- To gain knowledge about biomaterials
- To study the types of biomaterials used in medical field.
- To learn about the tissue materials and tissue replacement used in medical field

BIOMATERIALS AND ARTIFICIAL ORGANS

- To get an adequate knowledge about artificial organs
- To understand about artificial organs implants in medical application.

Course Outcomes

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

- CO1 Understand the basic knowledge about the biomaterials. (K2)
- CO2 Distinguish the types of Biomaterials (K2)
- CO3 Analyze the tissue implant materials used in the medical applications. (K3)
- CO4 Gain adequate knowledge of artificial organs. (K2)
- CO5 Explain how the artificial organs implanted in the human body. (K3)

UNIT I OVERVIEW OF BIOMATERIALS

Introduction to biomaterials – uses of biomaterials – biomaterials in organ and body systems – materials used in the body – performance of biomaterials. Metallic biomaterials – Introduction – stainless steel – Cobalt – chromium alloy - Titanium alloy – Titanium nickel alloy - dental metals – Corrosion of metallic implant, manufacturing of implant.

UNIT II TYPES OF BIOMATERIALS

Biomaterials types – Ceramic - non absorbable/relatively bioinert, bio ceramics, biodegradable, bio reactive ceramic – deterioration of ceramics, **Polymeric** –basic structure, polymers used as biomaterials, sterilization, **Composite** – Structure - bounds on properties an isotropy of composites - particulate composites - fibrous composites, porous materials and biocompatibility ,biodegradable polymer materials.

UNIT III TISSUE MATERIALS AND TISSUE REPLACEMENT

Structure and properties of collagen and collagen rich tissue – biotechnology of collagen – design of resorbable collagen based medical implant – bone repair and joint implant – dental implants – effect of materials selection – effect of surface properties. Preservation techniques – Phase behaviour – non-freezing storage – freeze thaw technology – freeze drying.

UNIT IV ARTFICIAL ORGANS

Introduction – Outlook of organ replacement – Design, consideration and evaluation process – overview – immunological consideration – blood transfusion – individual organs – kidney, liver, heart, lungs, bone marrow, cornea.

UNIT V ARTIFICIAL ORGAN IMPLANT

Neural and neuromuscular implants – heart valves implant – heart and lungs assist devices – artificial heart, cardiac pacemakers – artificial kidney – dialysis membrane and artificial blood - gastrointestinal system – dentistry – maxillofacial and craniofacial replacement – soft tissue replacement and augmentation.

Text Books

- 1. Lysaght M, Webster T J., "Biomaterials for artificial organs", Woodhead Publishing Limited, 1st edition, 2011
- 2. Hench L, Jones J., "Biomaterials, artificial organs and tissue engineering", Woodhead Publishing Limited, 1st edition, 2005.

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B.Tech. Biomedical Engineering

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3. Monika Saini, Yashpal Singh, Pooja Arora, Vipin Arora, and Krati Jain., "Implant biomaterials: A comprehensive review", World Journal of Clinical Cases, 2015

Reference Books

- 1. Joseph D. Bronzino, Donald R. Peterson., "Biomedical engineering fundamentals", CRC Press, 4th edition, 2014.
- 2. R S Khandpur, "Handbook of Biomedical Instrumentation", Tata McGraw Hill, 2003
- 3. David Williams, "Essential biomaterials science", Cambridge University Press, 1st edition, 2014
- 4. Yannas, I. V, "Tissue and Organ Regeneration in Adults", New York, NY: Springer, 2001.
- 5. Donatella Duraccio, Federico Mussano, Maria Giulia Faga., "Biomaterials for dental implants: current and future trends", Journal of Materials Science, 2015.

Web References

- 1. https://youtu.be/jVj1xE5FUMI
- 2. https://youtu.be/XqFSIG6WKO0
- 3. https://youtu.be/DsAvyyykwB8
- 4. https://nptel.ac.in/courses/106/105/106105077/
- 5. https://nptel.ac.in/courses/102/101/102101068/

COs/POs/PSOs Mapping

COs					Prog	ram O	utcom	es (PC)s)				Program Specific Outcomes (PSOs)				
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2	3	2	2	-	-	-	-	-	-	-	2	3	3	2	-		
3	3	1	1	-	-	-	-	-	-	-	1	3	3	1	-		
4	3	1	2	-	-	-	-	-	-	-	1	3	3	3	2		
5	3	1	1	-	-	-	-	2	-	-	2	2	3	1	2		

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

U19BMP81 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.

- CO2 Practice cash management, brand building and enhancing turnover.
- **CO3** Understand various schemes and subsidies that are offered by various Government agencies.
- CO4 Effectively tackle growth challenges of their venture.
- CO5 Manage and grow their business in terms of expansion and look for partnerships.

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, "Small business and entrepreneurship", Financial Times/Prentice Hall, 2010.
- 2. Scarborough, N. M, "Essentials of entrepreneurship and small business management", Prentice Hall, 2011.
- 3. Gupta C.B., & Srinivasan N.P, "Entrepreneurial Development", Sultan Chand and Sons, 2020.

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Reference Books

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

Web References

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

COs/POs/PSOs Mapping

COs					Prog	ram Ou	utcom	es (PC)s)				Program Specific Outcomes (PSOs)			
	P01	PO2	PO3	PO4	P05	PO6	P07	P08	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	
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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.

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PROJECT PHASE - II	L 0	Т 0	Р 16	C 8	

Extension and completion of project work started in the previous semester. On completion of the project work, each student has to prepare a project report and submit the same to the department.

In the Phase II, the project work and the report will be evaluated by the internal assessment committee by conducting two reviews and one demo for a total of 40 marks. The end semester examination which carries a total of 60 marks, will have report evaluation and viva voce examination conducted by a committee of one external examiner and one internal examiner.



U19BMS81

SKILL DEVELOPMENT COURSE 10 (NPTEL / MOOC - II)

L T P C

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

PROFESSIONAL ELECTIVE – I

		L	Т	Ρ	С	Hrs
UT9DIVIE41	PATHOLOGY AND MICROBIOLOGY	3	0	0	3	45

Course Objectives

- To Gain knowledge on the structural and functional aspects of living organisms.
- To know the etiology and remedy in treating the pathological diseases.
- To study the structure of Bacteria and virus •
- To know the functions of microscope •
- To study about immune system and disorders

Course Outcomes

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

CO1 - Understand the structural and functional aspects of living organisms (K2)

CO2 - Understand the importance of Fluid related disorders (K2)

CO3 - Describe the structure of Bacteria and virus (K3)

CO4 - Knowledge about the function of microscope. (K3)

CO5 - Define methods involved in easing the pathological diseases. (K3)

UNIT I CELL DEGENERATION, REPAIR AND NEOPLASIA

Cell injury - Reversible cell injury and Irreversible cell injury and Necrosis, Apoptosis, Intracellular accumulations, Pathological calcification - Dystrophic and Metastatic.Cellular adaptions of growth and differentiation, Inflammation and Repair including fracture healing, Neoplasia, Classification, Benign and Malignant tumours, carcinogenesis, spread of tumours Autopsy and biopsy.

UNIT II FLUID AND HEMODYNAMIC DERANGEMENTS

Edema, Hyperemia/Ischemia, normal hemostasis, thrombosis, disseminated intravascular coagulation, embolism, infarction, shock, chronic venous congestion. Hematologica disorders-Bleeding disorders, Leukaemia's, Lymphomas Haemorrhage.

UNIT III MICROBIOLOGY

Structure of Bacteria and Virus: Routes of infection and spread; endogenous and exogenous infections, Morphological features and structural organization of bacteria and virus, growth curve, identification of bacteria, culture media and its types, culture techniques and observation of culture. Disease caused by bacteria, fungi, protozal, virus and helminthes.

UNIT IV MICROSCOPES

Light microscope – bright field, dark field, phase contrast, fluorescence, Electron microscope (TEM and SEM). Preparation of samples for electron microscope. Staining methods - simple, gram staining and AFB staining

UNIT V IMMUNOPATHOLOGY

Natural and artificial immunity, types of Hypersensitivity, antibody and cell mediated tissue injury; opsonization, phagocytosis, inflammation, Secondary immunodeficiency including HIV infection. Auto immune disorders: Basic concepts and classification, SLE. Antibodies and its types, antigen and antibody reactions, immunological techniques; immune diffusion, immune electrophoresis, RIA and ELISA, monoclonal antibodies.

A. M

B.Tech. Biomedical Engineering

(9 Hrs)

(9 Hrs)

(9 Hrs)

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Text Books

- 1. Robbins and Cotran, "Pathologic Basis of Disease", Ninth edition Saunders, 2014
- 2. Ananthanarayan and Paniker's, "Textbook of Microbiology", Tenth Revised edition, The Orient Blackswan, 2017.
- 3. Harsh Mohan, "Text book of Pathology", Seventh Edition, Jaypee Brothers Medical publishers private Limited, 2014.

Reference Books

- 1. James Underwood Simon Cross," General and Systematic Pathology", Churchill Livingstone, 2009
- 2. R C Dubey and D K Maheshwari, "A Textbook of Microbiology", Third edition, S.Chand Publishing, 2013.
- 3. Prescott, Harley and Klein, Microbiology, Tenth edition, McGraw Hill, 2017.
- 4. Ramzi S Cotran, Vinay Kumar & Stanley L Robbins, "Pathologic Basis of Diseases", Seventh edition, WB Saunders Co. 2010
- 5. Kanika Sharma Ane's student edition, "Manual of Microbiology tools and techniques", 2010.

Web References

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- 2. http://www.rkmyat.in/up1/34/1629.pdf
- 3. http://moscmm.org/pdf/Ananthanarayan%20microbio.pdf

				r												
COs					Prog	ram O	utcom	es (PC)s)				Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	
1	3	3	3	1	-	-	1	1	-	-	-	1	2	-	-	
2	3	3	3	1	-	-	1	1	-	-	-	1	2	-	-	
3	3	3	3	1	-	-	1	1	-	-	-	1	2	-	-	
4	3	3	3	3	3	-	1	1	-	-	2	1	2	1	1	
5	3	2	2	1	3	-	1	1	-	-	-	1	2	-	1	

COs/POs/PSOs Mapping

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

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HOSPITAL EQUIPMENT SAFETY AND L Т Ρ С Hrs **U19BME42** MANAGEMENT 3 0 0 3 45

Course Objectives

- To provide a safe, functional, supportive, and effective environment
- To preserve the quality of the service by providing training and appraisal
- To effectively manage the accreditations of the hospitals
- To effectively manage the hospitals and its functions using Strategic tools •
- To control known and potential safety hazards to patients, personnel and visitors

Course Outcomes

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

CO1 - Assess practice-based learning and improvement in guality and health policies for patients (K2)

- CO2 Increase the trend for developing educational interventions in patient safety (K2)
- CO3 Know the necessity of improving standard and quality of the hospital (K2)
- CO4 Gain the roles and responsibilities of hospital staffs in various functions of hospital (K3)
- CO5 Able to reach the hospital management standard for the patient safety (K4)

UNIT I CLINICAL ENGINEERING

Clinical engineering program, educational responsibilities, role to be performed by them in hospital, staff structure in hospital - HIS. Need for evolving health policy, health organization in state, health financing system, health education, health insurance, health legislation

UNIT II HOSPITAL AND INDUSTRIAL ORGANIZATION

Difference between hospital and industrial organization, levels of training, steps of training, developing training program, evaluation of training, wages and salary, employee appraisal method.

UNIT III STANDARDIZATION

Necessity for standardization, FDA, AERB, Joint Commission of Accreditation of hospitals, ICRP and other standard organization, methods to monitor the standards.

UNIT IV STRATEGIC MANAGEMENT IN HOSPITALS

Nature and value of strategic management in hospitals - Awareness on the application of IT in Various functions of Hospital.Application of statistical tools in the areas of Health services. Introduction to support services - Disaster management, Ambulance services, Laundry services, Civil Assets.

UNIT V SAFETY MEASURES

Dr. A.Vijayalakshmi

Elements of Safety - Safety Publications and Standards Organizations - Orientation to Laboratory Safety -Types of risks in the hospitals - factors of environment - Safety showers and Eye Washes – Radiation hazards - radiation detection - safety measures - standards. Ergonomics - Flammables and Explosives -Formaldehydes - PEL Standards and Calculations - Material Safety - Organization of Safety in the hospitals.

Text Books

1. Joydeep Das Gupta, "Hospital Administration and Management: A Comprehensive Guide", Jaypee Brothers Medical Publishers, 2015.

2.Saxena.M, "Hospital Management", CBS Publishing, First edition, 2016.

3. Girdhar J Gyani and Alexander Thomas, "Handbook of Healthcare quality and patient safety" Second edition, Jaypee brothers medical publisher, 2019.

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Reference Books

- 1. Sonu Dr. Goel, "Textbook of Hospital Administration", Elsevier, 2014.
- 2. William Charney,"Handbook of Modern Hospital Safety", CRC press, Second edition, 2010.
- 3. Ramani. K. V, "Hospital Management", Pearson, 2011.
- 4. Arnold D. Kalcizony & Stephen M. Shortell, "Health Care Managementll", Sixth Edition, Cengage Learning, 2011.
- 5. Cindy Taylor, "The Hospital Safety Professional's Handbook", Fifth Edition, 2015.

Web References

- 1. https://en.wikipedia.org/wiki/Medical_equipment_management
- 2. http://www.who.int/hac/techguidance/preparedness/hospital_safety_index_forms.pdf
- 3. https://www.who.int/news-room/fact-sheets/detail/patient-safety
- 4. https://www.coursera.org/browse/health/healthcare-management
- 5. https://www.who.int/management/newitems/en/index1.html

COs					Prog	ram O	utcom	es (PC	s)				Program Specific Outcomes (PSOs)		
	P01	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	P011	PO12	PSO1	PSO2	PSO3
1	3	3	-	-	-	-	-	3	-	-	-	-	3	-	-
2	3	3	2	2	-	-	-	3	-	-	-	-	3	-	-
3	3	3	2	2	-	-	-	3	-	-	-	-	3	-	-
4	3	3	2	2	-	-	-	3	-	-	-	-	3	-	-
5	3	3	3	3	3		3	3	-	-	-	-	3	2	2

COs/POs/PSOs Mapping

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

A. MI

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Course Objectives

- To study effects of sound and light in human body
- To understand the effects of radiation in matter and how isotopes are produced
- To explore the interaction of the radiation particles with matter
- To understand the various detectors of detecting the presence of ionizing radiation
- To study the effects of radiation to the human body

Course Outcomes

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

CO1 - Comprehend the significance and role of non-ionizing radiation in Medical Applications (K2)

- CO2 Understand radioactive decay and production of radio nuclides (K2)
- CO3 Understand the concepts of different interaction of radiation with matter (K2)
- CO4 Discuss the measurement of ionizing radiation (K3)
- CO5 Enumerate the effect of ionizing radiation in human body (K3)

UNIT I NON IONIZING RADIATION AND ITS MEDICAL APPLICATION

Light- Physics of light, Intensity of light color vision and limits of vision sound - Normal sound levels – Ultrasound fundamentals- Generation of ultrasound (Ultrasound Transducer) Interaction of Ultrasound with Materials-Reflection and Refraction – Absorption and Scattering Non ionizing Electromagnetic Radiation, Tissue as a leaky dielectric – Relaxation process- overview of non-ionizing radiation effects- low frequency effect- high frequency effect

UNIT II PRINCIPLES OF RADIOACTIVE NUCLIDES

Radioactive Decay – Spontaneous Emission – Isometric Transition – Gamma ray emission, alpha, beta, Positron decay, electron capture, Sources of Radioisotopes Natural and Artificial radioactivity, Radionuclide used in Medicine and Technology ,Decay series, Production of radionuclides – Cyclotron produced Radionuclide-Reactor produced Radionuclide-fission and electron Capture reaction, radionuclide Generator-Milking process – Linear accelerator, Radionuclide used in medicine and Technology.

UNIT III INTERACTION OF RADIATION WITH MATTER

Interaction of charged particles with matter –Specific ionization, Linear energy transfer range, Bremsstrahlung, Annihilation, Interaction of Gamma radiation with matter- Photoelectric effect, Compton Scattering, Pair production, Attenuation of Gamma Radiation, Interaction of neutron with matter and their clinical significance.

UNIT IV PRINCIPLES OF RADIATION DETECTION AND DOSIMETERS

Principles of radiation detection, Properties of dosimeters, Theory of gas filled detectors, Ionization Chamber, Proportional chamber, G.M. Counter, Film dosimetry, luminescence dosimetry, scintillation detectors, Radiation detection instruments, Area survey meters, Personal Radiation monitoring device, Film badge.

UNIT V RADIATION EFFECTS

Acute Radiation Effects - The concept of LD 50 – Radiation syndromes- Central nervous systemsyndrome - Gastro-intestinal syndrome –Bone Marrow syndrome Delayed Effects of Radiation -Stochastic and Deterministic effects – Late Deterministic effect in different organs and tissues.

Text Books

1. Gopal B. Saha "Physics and Radiobiology of Nuclear Medicine", Fourth Edition, Springer, 2013.

B.Tech. Biomedical Engineering

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3. Kwan Hoong Ng, "Problem and solutions in Medical Physics: Diagnostic imaging Physics", Third volume, CRC press, 2011.

Reference Books

- 1. Muhammad Maqbool," An Introduction to Medical Physics", Springer, 2018.
- 2. Slavik Tabakov, "Encyclopedia of Medical Physics", volume 1, CRC press, 2012.
- 3. Andrew Webb, Nadrine Barrie Smith, "Introduction to Medical Imaging:Physics, Engineering and Clinical Applications, Cambridge University press, 2010.
- 4. Faiz M Khan,"Khan's Lecture: Handbook of the Physics of Radiation Therapy", 2011.
- 5. Faiz M Khan, John P Gibbons, "Khan's the physics of Radiation Therapy" Fifth Edition, 2014.

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- 1. https://g.co/kgs/CBBKUU
- 2. https://en.m.wikipedia.org/wiki/Medical_physics
- 3. https://www.medphys.org/
- 4. https://physicsworld.com/c/medical-physics/
- 5. https://www.classcentral.com/course/medical-applications-particle-accelerato-12557

COs					Prog	ram O	utcom	es (PC)s)				Prog Outco	ram Spe omes (P	ecific /SOs)
	P01	01 PO2 PO3 PO4 PO5 PO6 PO7 PO8 PO9 PO10 PO11 F											PSO1	PSO2	PSO3
1	3	2	-	-	-	-	2	1	-	-	-	-	3	-	-
2	3	3	-	-	-	-	2	1	-	-	-	-	3	-	-
3	3	3	2	-	-	-	2	1	-	-	-	-	3	-	-
4	3	3	2	3	3	-	2	1	-	-	-	-	3	-	2
5	3	3	2	3	3	-	2	1	-	-	-	-	3	-	-

COs/POs/PSOs Mapping

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

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Course Objectives

- To understand the various Analog modulation techniques
- To learn the concepts of various Digital modulation techniques.
- To study fiber optic and satellite communication systems.
- To understand the Spread spectrum and multiple access techniques.
- To Gain knowledge on radio communication.

Course Outcomes

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

CO1 - Understand the various Analog modulation techniques (K1)

CO2 - Gain knowledge in Digital modulation techniques (K2)

CO3 - Knowledge about fiber optic and satellite communication systems (K2)

CO4 - Analyze spread spectrum and multiple access techniques (K3)

CO5 - Asses the importance of radio communication system (K3)

UNIT I ANALOG MODULATION

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

UNIT II DIGITAL MODULATION

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

UNIT III FIBER OPTIC AND SATELLITE COMMUNICATION

Need for fiber optics- principle of light transmission through a fiber- fiber classification-fiber losses- Light sources and photo detectors- Block diagram of a fiber optic system - Power budget analysis for an optical link-Recent medical application of fiber optics.

Block diagram of a satellite communication system, Satellite Orbits, satellite parameters, satellite link model, GPS services.

UNIT IV SPREAD SPECTRUM AND MULTIPLE ACCESS TECHNIQUES

Pseudo-noise sequence, DS spread spectrum, FH spread spectrum, multiple access techniques -TDMA and FDMA, source coding of speech for wireless communication.

UNIT V RADIO COMMUNICATION

Advanced Mobile Phone System (AMPS) - Global System for Mobile Communications (GSM) - Code division multiple access (CDMA) - Cellular Concept and Frequency Reuse - Channel Assignment and Hand off.

Text Books

- 1. Wayne Tomasi, "Advanced Electronic Communication Systems", Sixth Edition, Pearson Education, 2010.
- 2. Kennedy Davis, "Electronic Communication Systems", Fifth Edition, Tata McGraw Hill Publishing Company Limited, New Delhi, 2011.
- 3. William C.Y. Lee, "Mobile Cellular Telecommunication Systems", McGraw Hill International Edition, Third edition, 2008.



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Reference Books

- 1. Simon Haykin, "Communication Systems", Fourth Edition, John Wiley and Sons, 2009.
- 2. Rappaport T.S, "Wireless Communications: Principles and Practice", Second Edition, Pearson Education, 2010
- 3. H.Taub, D L Schilling and G Saha, "Principles of Communication", Third Edition, Pearson Education, 2010
- 4. B. P.Lathi, "Modern Analog and Digital Communication Systems", Third Edition, Oxford University Press, 2009
- 5. Martin S.Roden, "Analog and Digital Communication System", Fifth Edition, Prentice Hall of India, 2012.

Web References

- 1. https://nptel.ac.in/courses/108104091/
- 2. https://www.docsity.com/en/lecture-notes-of-intro-to-communication-systems/4580827/
- 3. https://nptel.ac.in/courses/117/101/117101051/
- 4. https://nptel.ac.in/courses/117/105/117105143/

COs/POs/PSOs Mapping

COs					Prog	ram O	utcome	es (PO	s)				Prog Outco	ram Spe omes (P	ecific 'SOs)
	P01	PO2	PO3	PO4	PO5	P06	P07	P08	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	2	1	2	-	-	-	-	3	1	1	3	2	-
2	3	2	2	1	2	-	-	-	-	3	1	1	3	2	-
3	3	3	-	1	1	-	-	-	-	3	1	1	3	2	-
4	3	2	-	1	1	-	-	-	-	3	1	1	3	2	-
5	3	3	2	1	2	-	-	-	-	3	1	1	3	2	-

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

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Course Objectives

- To Study the fundamentals of CMOS circuits and its characteristics
- To Learn the design and realization of combinational & sequential digital circuits
- To perform tradeoffs involved in designing and realizing the circuits in CMOS technology
- To create different FPGA architectures and testability of VLSI circuits.
- To provide designing environment for the FPGA architecture

Course Outcomes

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

CO1 - Understand the analysis of CMOS digital electronics circuits (K1)

CO2 - Knowledge about moderately sized CMOS circuits that realize specified digital functions (K2)

CO3 - Apply CMOS technology in sequential circuit design (K3)

CO4 - Apply the concepts of CMOS in designing Memory structures (K3)

CO5 - Implement different testing methods for CMOS 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, Cascade 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 (9 Hrs)

Arithmetic Building Blocks: Data Paths, Adders, Multipliers, Shifters, ALUs, power and speed tradeoffs, Case Study: Design as a tradeoff. 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, Pearson, 2016.

2.Wayne wolf, "Modern VLSI Design: System on Chip Design", Prentice Hall of India, 2012. 3.N.Weste, K.Eshraghian, "Principles of CMOS VLSI Design", A system Perspective, Addision Wesley, Second Edition, 2004.

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Reference Books

1.Neil H. E. Weste, Kamran Eshraghian, "CMOS Digital Integrated Circuits Analysis and Design", Fourth Edition, 2011, McGraw-Hill.

2.E.Eshranghian, D.A.Pucknelland S.Eshraghian, "Essentials of VLSI circuits and systems", PHI, 2005.

3.A.Pucknell, Kamran Eshraghian, "BASIC VLSI DESIGN", Prentice Hall of India, Third Edition, 2007. 4.R.Jacob Baker, Harry W.LI., David E.Boyee, "CMOS Circuit Design, Layout and Simulation", Prentice Hall of India, 2005.

5.Deba Prasad Das, "VLSI Design", Oxford University Press, 2012

Web References

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- 2. www.vlsi-world.com
- 3. www.creativeworld9.com/2011/12/learning-videos-of-vlsi-design-1
- 4. www.btechbunks.com/2011/03/vlsi-design-study-material

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)														ecific 'SOs)
	PO1 PO2 PO3 PO4 PO5 PO6 PO7 PO8 PO9 PO10 PO11 PO												PSO1	PSO2	PSO3
1	3	2	-	1	2	-	-	1	-	-	-	-	3	-	-
2	3	2	-	1	2	-	-	1	-	-	-	-	3	-	-
3	3	2	-	1	2	-	-	1	-	-	-	-	3	-	-
4	3	2	3	2	2	-	-	1	-	-	-	-	3	-	-
5	3	2	3	1	2	-	-	1	-	-	-	-	3	-	-

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

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PROFESSIONAL ELECTIVE – II

U19BME51 BIOTELEMETRY AND TELEMEDICINE 3 0 0 3

Course Objectives:

- To understand the classification of Telemetry systems.
- To gain knowledge about telemetry in comparison with telemedicine
- To know about the applications of telemetry in various fields
- To provide the idea about the value of telemedicine
- To know the various applications in telemedicine area

Course Outcomes:

After completion of the course, the students will be able to **CO1** -Understand telemetry basics and its classification **(K2)**

CO2- Gain knowledge about telemetry and telemedicine applications **(K2)**

CO3- Describe the applications of Biotelemetry **K3**)

CO4- Acquire clear idea about the fundamentals of telemedicine (K2)

CO5- Explain the Applications of telemedicine in various fields **(K3)**

UNIT - I INTRODUCTION TO TELEMETRY

Basic system - Classification - Non electrical telemetry systems - Mechanical and Pneumatic type, Voltage and Current telemetry systems - Local transmitters and Converters - Frequency telemetry system - Power Line carrier communication (PLCC).

UNIT - II BIOTELEMETRY

Radio Telemetry principles, FM, AM, PCM. Transmission of biological data through radio telemetry.

UNIT - III APPLICATION OF BIOTELEMETRY

Wireless Telemetry - Single Channel and Multi-channel Telemetry systems - Multi Patient Telemetry - Implantable Telemetry Systems - Ambulatory patient monitoring.

UNIT - IV FUNDAMENTALS OF TELEMEDICINE

History and advancements in telemedicine - Benefits of telemedicine – Functional Block of a telemedicine system - Use of computers in distance mode of healthcare delivery - Familiarizing with technology of telemedicine – scanner, electro stethoscope - data reception equipment - Scope for telemedicine - Limitations of telemedicine.

UNIT - V APPLICATIONS OF TELEMEDICINE

Telemedicine in Neuroscience - Telecardiology –Telepathology –- Telepediatrics – Telepharmacy – Telepsychiatry and mental health – Veterinary.

Text Books

- 1. Olga (EDT), Ferre Roca, M. Sosa (EDT, "Handbook of Telemedicine", 3rd Edition, 1998, IOS press.
- 2. Marilyn J. Field, "A Guide to Assessing Telecommunications in Health Care", 4th Edition, 1996, Academy Press.
- 3. Bashshur , R. L. , Sanders, J. H and Shannon, G, "Telemedicine: Theory and Practice", 6th Edition, 1999, Springer.
- 4. Wootton, R., Craig, J., Patterson, V. (Eds.), "Introduction to Telemedicine", 5th Edition, 2006, Royal Society of Medicine Press Ltd.

Reference Books

1. Bemmel, J.H. van, Musen, M.A. (Eds.), "Handbook of Medical Informatics", 2nd Edition, 2002, Springer.

Dr. A.Vijayalakshmi

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- 2. Simpson, W, "Video over IP. A practical guide to technology and applications", 9th Edition, 2006, Focal Press, Elsevier.
- 3. Ferrer-Roca, O., Sosa-Iudicissa, , "Handbook of Telemedicine", 12th Edition, 2002, IOS Press
- 4. Norris, A.C, "Essentials of Telemedicine and Telecare", 8th Edition, 2002, Wiley.

Web References

- 1. https://en.wikipedia.org/wiki/Biotelemetry
- 2. https://www.who.int/goe/publications/goe_telemedicine_2010.pdf
- 3. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5927731/

COs					Prog	ram O	utcom	es (PC	s)				Prog Outce	ram Spe omes (P	ecific 'SOs)
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	-	-	-	1	-	2	1	2	1	1	2	-	-
2	3	2	1	-	1	2	-	2	1	2	1	1	2	-	-
3	3	2	2	-	2	2	-	2	1	2	2	1	3	1	-
4	3	1	-	-	1	1	-	1	1	2	1	1	3	-	-
5	3	1	1	-	1	2	-	1	1	2	1	1	3	1	1

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



Biotechnology in the reduction of carbon dioxide emission- Microbial flora of soil - Microbial treatment of heavy Metal - bioleaching, bioaccumulation, biosorption and bioprecipitation Understand the various bioproducts production and composting technology of heavy metals - Soil, water and air - sources and effects - Removal of Pollutants.

UNIT II BIODEGRADATION AND BIOREMEDIATION

Aerobic degradation of aliphatic and aromatics compounds - Anaerobic degradation of aromatic compounds - Biodegradation of herbicides and pesticides - Remediation Technologies - Bioventing, biosparging and bioslurping, phytoremediation - Biodesulphurization of coal and oil - microbial treatment of oil pollution.

UNIT III MICROBIAL TREATMENT OF WASTE AND WASTE WATER (9 Hrs)

Biological treatment of anaerobic and aerobic- methanogenesis, methanogenic, acetogenic- Use of genetically engineered organisms - Biotechnological Processes in waste - water treatment; Applications include treatment of municipal and industrial wastewaters.

UNIT IV BIOCATALYSTS AND BIOREACTORS

Enzymes isolation, whole cell systems - Biocatalytic Application - Advantages & Disadvantages- Design of activated sludge process and anaerobic digestion system - Trickling Filter - Rotating biological contactors - Fluidized bed reactor - Up-flow anaerobic sludge blanket reactor (UASB) - High-rate anaerobic wastewater treatment.

UNIT V BIOPRODUCTS AND RENEWABLE SOURCES

Biofertilizers - Biopesticides - Biofuel production - Bioethanol - Biohydrogen - Biodiesel - Bioplastics and biopolymers - Composting technologies, composting systems, compost quality.

To gain knowledge on microbiological treatment technologies To replace conventional treatment methodologies by using biocatalyst and bioreactors

Course Objectives

U19BME52

To understand bioproducts production and composting technology

To learn about the basic concepts of environmental biotechnology To understand about the biodegradation and bioremediation

Course Outcomes

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

- CO1 -Gain knowledge in the basic concepts of environmental biotechnology (K2)
- CO2 Familiarize with the biodegrading and bioremediation modules and its functions (K2)
- CO3 Describe the principles of microbiological treatment technologies to clean up contaminated environments. (K3)

ENVIRONMENTAL BIOTECHNOLOGY

- CO4 Explain the replacement of conventional treatment methodologies using biocatalyst and bioreactors (K3)
- CO5 Understand bioproducts production and composting technology (K2)

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Text Books

- 1. Bhattacharya B. C. and Banerjee R, "Environmental Biotechnology", Oxford University Press, 2017.
- 2. Jordening H. J. and Winter J., "Environmental Biotechnology: Concepts and Application", Wiley , 2015.
- 3. Bruce Rittmann and Perry McCarty," Environmental Biotechnology", McGraw-Hill, 2011.

Reference Books

- 1. W.D. Grant & P.E. Long, Blakie, Environmental Microbiology, Springer, 2019.
- 2. H. Polasa, Microbial Gene Technology, South Asian Publishers, 2011.
- 3. D. L. Wise, Biotreatment Systems.CRC Press, 2010.
- 4. A.K. Chatterji," Introduction to Environmental Biotechnology", Prentice Hall of India Pvt. Ltd., 2003 5.Pramod Kumar, Vipin Kumar, Pravin Kumar Sacha, "Textbook of Environmental Biotechnology ", Woodhead Publishing India, 2019.

Web References

- 1. https://en.wikipedia.org/wiki/Environmental_biotechnology
- 2. http://dbtindia.gov.in/schemes-programmes/research-development/energy-environment-and-bioresource-based-applications-0
- 3. https://www.hindawi.com/journals/scientifica/si/269412/

COs/POs/PSOs Mapping

со					Prog	ram O	utcom	nes (Po	Os)				Progra Outco	am Sp mes (P	oecific SOs)
S	PO	PO PO PO PO PO PO PO PO PO PO1 PO1 I										PO1	PSO	PSO	PSO
	1	2	3	4	5	6	7	8	9	0	1	2	1	2	3
1	2	2	2	-	-	2	-	-	-	-	-	2	2	-	-
2	2	2	2	-	-	2	-	-	-	-	-	2	2	-	-
3	2	2	3	2	-	2	-	-	-	-	-	2	2	-	-
4	2	2	2	2	2	2	-	-	-	-	-	2	2	-	-
5	2	2	2	2	2	2	-	-	-	-	-	2	2	-	-

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

	LASER AND FIBER OPTICS IN	L	Т	Ρ	С	Hrs
UI9DIVIE55	MEDICINE	3	0	0	3	45

Course Objectives:

- To expose the basic concepts of optical fibers
- To provide basic concepts of lasers.
- To understand how Lasers used in medical practice
- To provide adequate knowledge about application of optical fibers.
- To gain knowledge in the applications of laser in medicine

Course Outcomes:

After completion of the course, the students will be able to CO1 -Understand the basic principles of optical fibers (K2) CO2- Acquire knowledge on various types of lasers (K2) CO3- Familiarize with the use of laser systems in medicine (K2) CO4- Apply optical fiber technology for different applications (K3) CO5 - Analyse the applications of laser in medicine (K3)

UNIT I OPTICAL FIBERS AND THEIR PROPERTIES

Introduction to optical fiber - fiber characteristics - principles of light propagation through a fiber - Different types of fibers and their properties - Losses in the optical fiber - Dispersion - advantages and disadvantages of optical fibers

UNIT II LASER FUNDAMENTALS

Laser Fundamentals: Introduction to lasers - Laser characteristics – Laser configuration – Three level and four level lasers – Q-switching – Mode locking – Types of lasers: Gas lasers, Solid lasers, Liquid lasers and Semiconductor lasers.

UNIT III LASER SYSTEMS

Lasers used in medical practice: Ruby laser, CO2 laser, Nd-Y AG laser and related solid-state laser. Laser -Tissue Interaction: Terminology, spectral band designations, energy & power, irradiant & radiant exposure.

UNIT IV APPLICATIONS OF OPTICAL FIBERS

Interferometer method of measurement of length – Moire fringes – Measurement of pressure, Temperature, Current, Voltage, Liquid level and strain - fiber optic Gyroscope – Polarization maintaining fibers - Applications.

UNIT V LASER APPLICATIONS IN MEDICINE

Application in general surgery-Dermatology, Ophthalmology, Cardiovascular &chest surgery, Dentistry, Neuro surgery, Otolaryngology & head and neck surgery, Tumor surgery, Gynecologic laser, Endoscopy, Laparoscopy.

Text Books

- 1. Abraham Katzir, "Lasers and Optical Fibers in Medicine", Academic press Inc, 2012.
- 2. Helena Jelinkova, "Lasers for medical Applications", Woodhead Publishing, 2013.
- 3. David A Boas, "Handbook of Biomedical Optics", CRC Press, 2011.

Reference Books

- 1. Jeff Hecht, "Understanding Fiber Optics", fourth edition, Prentice Hall publishers, 2015.
- 2. Tuan Vo-Dinh, "Biomedical Photonics Handbook", 3 volume set, 2018.

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- 3. Tosi Daniele, "Fiber optics Sensor for Biomedical Applications", 2010.
- 4. KeyvanNouri, "Laser in Dermatology and Medicine", Springer, 2011.
- 5. Nagabhushana, "Laser and Optical Instrumentation", I.K International House Pvt Ltd. 2010.

Web References

- 1. https://en.wikipedia.org/wiki/Fiber_laser
- 2. https://en.wikipedia.org/wiki/Optical_fiber
- 3. https://ethw.org/Fiber_Optics
- 4. https://www.classcentral.com/course/swayam-fiber-optics-7913
- 5. https://ocw.mit.edu/resources/res-6-005-understanding-lasers-and-fiberoptics-spring-2008/

COs/POs/PSOs Mapping

COs					Prog	ram O	utcom	es (PO	s)				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	-	1	-	-	1	-	-	-	-	-	1	2	-	1
2	3	1	2	-	1	1	-	-	-	-	-	1	2	1	1
3	3	2	2	-	1	1	-	-	-	-	-	1	2	2	1
4	3	2	2	2	2	1	-	-	-	-	-	1	2	2	1
5	3	2	2	2	2	1	-	-	-	-	-	1	2	2	1

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

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U19BME54	MEDICAL INFORMATICS	L	I	F	C	
		3	0	0	3	45

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Course Objectives

- To understand the functional capabilities of hospital information systems
- To give a deep insight of the medical standards and ethics to be followed
- To enable the understanding of the theories and practices adopted in Hospital Information Systems standards
- To gain knowledge on various domains of informatics
- To understand medical data formats and recent trends in Hospital Information Systems

Course Outcomes

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

- CO1 Discuss about health informatics and the function of Hospital Information Systems (K2)
- CO2 Analyze medical standards (K4)
- CO3 Explain about storage of medical data (K2)
- CO4 Understand the basic concepts of bioinformatics (K2)
- CO5 Discuss about the application of medical informatics (K4)

UNIT I MEDICAL INFORMATICS

Introduction, Medical Informatics, Bioinformatics, Health Informatics, Structure of Medical Informatics, Functional capabilities of Hospital Information System, On-line services and off-line services, History taking by computer, Dialogue with the computer

UNIT II MEDICAL STANDARDS

Evolution of Medical Standards, IEEE 11073, HL7, DICOM, IRMA, LOINC, HIPPA, Electronics Patient Records, Healthcare Standard Organizations, JCAHO (Join Commission on Accreditation of Healthcare Organization), JCIA (Joint Commission International Accreditation), Evidence Based Medicine, Bioethics.

UNIT-III MEDICAL DATA STORAGE AND AUTOMATION

Plug in Data Acquisition and Control Boards, Data Acquisition using Serial Interface, Medical Data formats, Signal, Image and Video Formats, Medical Databases, Automation in clinical laboratories, Intelligent Laboratory Information System, PACS, Data mining.

UNIT IV HEALTH INFORMATICS

Bioinformatics Databases, Bio, information technologies, Semantic web and Bioinformatics, Genome projects, Clinical informatics, Nursing informatics, Public health informatics, Education and Training

UNIT V RECENT TRENDS IN MEDICAL INFORMATICS

Medical Expert Systems, Virtual reality applications in medicine, Virtual Environment, Surgical simulation, Radiation therapy and planning, Telemedicine, virtual Hospitals, Smart Medical Homes, Personalized ehealth services, Biometrics, GRID and Cloud Computing in Medicine

Text Books

- 1. R.D.Lele,Computers in medicine progress in medical informatics, Tata McGraw Hill Publishing computers Ltd, 2005, New Delhi
- 2. H. K. Huang, "PACS and Imaging Informatics: Basic Principles and Applications", 2010
- 3. Oleg S. Pianykh, "Digital Image Quality in Medicine", Springer. 2014

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Reference Books

- 1. Mohan Bansal, "Medical informatics", Tata McGraw Hill Publishing Computers Ltd, 2003 New Delhi
- 2. N.Mathivanan, "PC-Based Instrumentation", Prentice Hall of India Pvt Ltd , New Delhi , 2007
- 3. Orpita Bosu and Simminder KaurThukral, Bioinformatics Databases, Tools and Algorithms, Oxford University press, 2007, New Delhi
- 4. Yi , Ping Phoebe Chen, "Bioinformatics Technologies", Springer International Edition, 2007, New Delhi
- 5. Wager, K. A., Lee, F. W., & Glaser, J. P, "Health care information systems: A practical approach for health care management",4th Edition, 2017

COs					Prog	ram O	utcom	es (PO	s)				Prog Outco	ram Spe omes (P	ecific SOs)
	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	1	-	-	-	-	1	1	-	-	-	-	3	1	1
2	3	1	-	-	-	-	1	1	-	-	-	-	3	1	1
3	3	1	-	-	2	-	2	3	-	-	-	1	3	1	1
4	3	1	1	-	2	-	2	2	-	-	-	2	3	2	2
5	3	1	1	-	2	-	2	2	-	-	-	2	3	2	2

COs/POs/PSOs Mapping

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

A. MIL

1119BME55	COMPLITERS IN MEDICINE	LTPC			С	Hrs
UTJDIME UJ		3	0	0	3	45

Course Objectives

- To study the 8086 architectures, instruction sets and various units of PC-AT.
- Study the technique of data acquisition, storage, retrieval and transmission of bioinformation.
- To understand the application of computers in patient monitoring.
- To understand the application of computers in system modelling and pattern recognition, medical imaging and development of expert systems.

Course Outcomes

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

- **CO1** Able to have a clear understanding about computer hardware's (K2)
- CO2 Acquire the knowledge about computers in data acquisition, monitoring, system modeling. (K2)
- CO3 Gain the knowledge about patient monitoring using computers (K3)
- CO4 Design computers in medical systems (K3)
- CO5 Apply computers in research area in medicine (K3)

Unit - I OVERVIEW OF COMPUTER HARDWARE PC-AT

8086 architecture, system connections, Instruction set & programming, Microcontrollers, Motherboard and its logic, RS232-C and IEEE bus standards, CRT controllers, FDC, HDC and Post sequence, PC based video card, modems and networking.

Unit - II SYSTEM DESIGN

Multichannel computerized ECG, EMG and EEG data acquisition, storage and retrieval, transmission of signal and images.

Unit - III COMPUTERS IN PATIENT MONITORING

Physiological monitoring, automated ICU, computerized arrhythmia monitoring, information flow in a clinical lab, computerized concepts, interfacing to HIS.

Unit - IV COMPUTERS IN MEDICAL SYSTEMS MODELLING

Radiotherapy, drug design, drug delivery system, physiological system modeling and simulation.

Unit - V COMPUTERS IN MEDICAL RESEARCH

Role of expert systems, pattern recognition techniques in medical image classification, ANN concepts.

Text Books

- 1. R.D.Lee, "Computers in Medicine", Tata McGraw-Hill, New Delhi, 2010
- 2. Lele, "Computers In Medicine", McGraw Hill Education; 1st edition, 2006.
- 3. Eve Stwertka and Albet Swetka," Computer in Medicine", Franklin Watts, 1984.
- Dhiya Al-Jumeily Abir Hussain Conor Mallucci Carol Oliver, "Applied computing in medicine and health", 1st edition, 2015.

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Reference Books

- 1. Douglas V.Hall, "Microprocessors and Interfacing: Programming and hardware", McGraw-Hill, Singapore, 2011.
- 2. Susan Sandeson, "Computer in the medical office", McGrawHill, 9 th edition, 2016.
- 3. Jonathan Javitt MD, "Computer in Medicine: Applications and Possibilities", Saunders, 1986.
- 4. Naval Kishore, "Computer in medicine", S.Chand (G/L) & Company Ltd, 2003.

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- 1. https://www.techwalla.com/articles/10-ways-computers-are-used-in-medicine
- 2. https://www.techwalla.com/articles/10-ways-computers-are-used-in-medicine
- 3. https://www.online-sciences.com/computer/computers-in-medicine-uses-advantages-and-disadvantages/

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

COs/POs/PSOs Mapping

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

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PROFESSIONAL ELECTIVE -III

Hrs L т Ρ С HOSPITAL ENGINEERING AND **U19BME61** INFORMATION SYSTEMS 3 0 0 3 45

Course Objectives

- To enhance Medical Outcomes and Quality of Life
- To reduce Operations, Morbidity, Medical Errors and Cost
- To view a broad picture of hospital growth
- To maintain the clinical component for patient records, lab system, financial system
- To support high-quality, efficient, patient-centered care physicians

COURSE OUTCOMES

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

- Provide good academic ambience by adopting best information system (K2) CO1 -
- CO2 -Achieve the best possible support from patient and administration (K3)
- CO3 -Deliver efficient delivery of high quality health services (K2)
- CO4 -Develop decision support systems, health information standards and information systems acquisitions (K3)
- CO5 -Identify problems and alternate solutions related to records management in the healthcare environment (K3)

UNIT - I HEALTH SYSTEM

Concept of Hospital Management - Roles and Responsibilities of Administrator - Hospital Design - Health organization of the country, state, and cities, Health Financing System.

UNIT - II HOSPITAL ORGANISATION

Organization of Out-Patient Services - Problems encountered in functioning of O.P Department - Organization of In- Patient Services - Casualty & Emergency Services - Organization and management of Operation theatres

UNIT - III HOSPITAL SERVICES

Engineering department maintenance managementclinical engineeringelectrical svstemair conditioning systemwater supply and sanitary systemcentralized medical gas system-communication system

UNIT - IV INFECTION CONTROL AND WASTE MANAGEMENT

Importance of infection control-hand hygiene-clinical laboratory standards to infection control-health care workers safety-solid waste management and transportation

UNIT - V INTEGRATED MEDICAL INFORMATION SYSTEM

Integration of inter and intra hospital information system. Role of expert systems-web based Multimedia information system- introduction of a computerized HIS Automation of medical record-cost and Benefits of HIS-Modems and Networking in Hospitals.

Text Books

- Dr. L.L. Rao, "Hospital Management", Annamalai University Press, 2nd edition, 2013
 R. D. Lele, "Computers in Medicine", Tata McGraw Hill, 3rd edition, 2005
 Mohan Bansal, "Medical informatics", Tata McGraw Hill. 2nd Edition, 2005.

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Reference Books

- Gupta, Kant, Chandrashekhar, Satpathy, "Modern Trends in Planning and Designing of Hospitals Principles and Practice with CD-ROM", JaySpee Medical publishers, 1st edition, 2007.
 Sharma, "Essentials for Hospital Support Services and Physical Infrastructure", Jaypee Medical Publishers, 1
- 1st edition, 2003
- 3. Sakharkar, "Principles of Hospital Administration and Planning", Jaypee Medical, 1st edition, 2004.

Web References

- 1. https://en.wikipedia.org/wiki/Hospital_information_system
- 2. https://www.ncbi.nlm.nih.gov/books/NBK22862/
- 3. https://en.wikipedia.org/wiki/Healthcare engineering

COs/POs/PSOs Mapping

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

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

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U19BME62	TRANSPORTATION IN LIVING	L	Т	Ρ	С	Hrs
	SYSTEMS	3	0	0	3	45

Course Objectives

- To understand the ways of living organisms for transporting materials like food, water and oxygen to various organs.
- To provide the knowledge about the basics of human membrane system
- To acquire knowledge about the process of osmosis
- To study about the transportation of lymph through internal organs
- To have a clear idea about blood constituents of artificial organs

Course Outcomes

After completion of the course, the students are able to

- CO1 Develop and solve models of living system as a microvascular networks (K2)
- CO2 Analyse how the living system characteristics depend on the underlying network structure (K4)
- **CO3** Gives information about system of osmosis (K2)
- **CO4** Gain knowledge about transportation of lymph (K2)
- CO5 Provides clear idea about human system along with artificial organ (K2)

UNIT - I Introduction

Organization of the human body, cells, tissues, different organs, natural membrane system

UNIT - II Heat Transport

Body temperature regulation based on thermostate principle and its operation, transportation in tissues, muscle, skin and other organs in different environmental temperature.

UNIT - III Transportation of Fluids

Blood transport trough internal organs, urogenitary system, cardio pulmonary system, central nervous system, gastro intestine system, diffusion, osmosis, electroosmosis, ultrafiltration, reverse osmosis through natural membrane systems, reverse osmosis through artificial synthetic membranes.

UNIT - IV Transportation of Lymph

Transportation of lymph through internal organs, urogenitary system, cardio pulmonary system, central nervous system, gastro intestine system, problems on lymph transfer in human body.

UNIT - V Mass Transfer

Constituents of blood, urine, mass transfer in kidney, skeletal, nervous, gastro intestine system, cardio pulmonary system, comparison with artificial organs.

Text Books

- 1. David O.Cooney, "An introduction to fluid, heat & mass transport process-Principles", Marcel Dekker Inc., Vol.1, 2nd edition, 2007.
- 2. Richard P. Menninger, "Best and Taylor's Physiological Basis of Medical Practice", LippinCott Williams and Wilkins, 2008
- 3. RB Bird, WE Stewart and EN Lightfoot," Transport Phenomena", Second Edition, John Wiley and Sons, 2007.

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- 1. Kim Barrett, Susan Barman, Jason Yuan, Heddwen Brooks, "Ganong's Review of Medical Physiology", McGraw-Hill Education, 2019.
- 2. SujitK.Chaudhuri, "Concise Medical Physilogy" New Central Book agency, 6th edition, 2011.
- 3. Patrick Tabeling, "Introduction to Microfluidics", Oxford University Press, 2005.
- 4. Edwin N Lightfoot, "Transport phenomena and living systems; Biomedical aspects of momentum and mass transport", Wiley; First Edition, 1974.
- 5. Truskey and Yuan and Katz, "Transport Phenomena in Biological Systems", Pearson Prentice Hall 2009.

Web References

- 1. https://www.toppr.com/ask/question/transportation-in-the-living-organisms-is-necessary-because-of-the-following-reasons/
- 2. https://link.springer.com/content/pdf/10.1007/978-1-349-14068-8_6.pdf
- 3. https://secondarytwojyssscience.weebly.com/transport-system-in-living-things.html

COs					Prog	am O	utcom	es (PC	Ds)				Prog Outco	ram Spo omes (P	ecific 'SOs)
	PO1	PO2	PO3	PO4	PO5	P06	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	1	-	-	1			-	-	-	1	2	1	1
2	3	2	1	-	-	1			-	-	-	1	2	1	1
3	3	2	1	-	-	1			-	-	-	1	2	1	1
4	3	2	1	-	-	1			-	-	-	1	2	1	1
5	3	2	1	-	-	1			-	-	-	1	2	1	1

COs/POs/PSOs Mapping

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

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U19BME63

SOFT COMPUTING TECHNIQUES

Course Objectives

- To classify the various soft computing frame works and fuzzy set.
- To learn mathematical background for optimized genetic programming
- To familiar with the design of neural networks.
- To understand with the design of fuzzy logic and fuzzy systems.
- To be exposed to neuro-fuzzy hybrid systems and its applications

Course Outcomes

After completion of the course, the students are able to

- CO1 Classify the various soft computing frame works. (K2)
- CO2 Understand the concept of optimized genetic programming (K2)
- CO2 Understand the design of neural networks. (K3)
- **CO4** Understand with the design of fuzzy logic and fuzzy systems **(K2)**
- CO5 Understand the neuro-fuzzy hybrid systems and its applications (K3)

UNIT - I Introduction to Fuzzy Set

Fuzzy Sets – Basic Definition and Terminology – Set-theoretic Operations – Member Function Formulation and Parameterization – Fuzzy Rules and Fuzzy Reasoning – Extension Principle and Fuzzy Relations – Fuzzy If-Then Rules – Fuzzy Reasoning – Fuzzy Inference Systems – Mamdani Fuzzy Models – Sugeno Fuzzy Models – Input Space Partitioning and Fuzzy Modeling.

UNIT - II Optimization

Optimization - Derivative-based Optimization – Descent Methods – The Method of Steepest Descent – Classical Newton's Method – Step Size Determination – Derivative-free Optimization – Genetic Algorithms – Simulated Annealing – Random Search – Downhill Simplex Search.

UNIT - III Neural Networks

Introduction to Neural Networks - Supervised Learning Neural Networks – Perceptrons - Adaline – BackpropagationMutilayerPerceptrons – Radial Basis Function Networks – Unsupervised Learning Neural Networks – Competitive Learning Networks – Kohonen Self-Organizing Networks – Learning Vector Quantization – Hebbian Learning.

UNIT - IV Fuzzy Interface Systems

Adaptive networks based Fuzzy interface systems - Classification and Regression Trees - Data clustering algorithms - Rule based structure identification - Neuro-Fuzzy controls - Simulated annealing – Evolutionary computation.

UNIT - V Applications

Pattern Recognitions, Image Processing, Biological Sequence Alignment and Drug Design, Robotics and Sensors, Information Retrieval Systems, Natural Language Processing

Text Books

- 1. S.Rajasekaran and G.A.V.Pai, "Neural Networks, Fuzzy Logic and Genetic Algorithms", PHI, 2003.
- 2. Kumar S., "Neural Networks A Classroom Approach", Tata McGraw Hill, 2004.
- 3. Ross T. J., "Fuzzy Logic with Engineering Applications", McGraw Hill, 2016.

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- 1. J.S.R.Jang, C.T.Sun and E.Mizutani, "Neuro-Fuzzy and Soft Computing", PHI, 2004, Pearson Education 2004
- 2. R.Eberhart, P.Simpson and R.Dobbins, "Computational Intelligence PC Tools", AP Professional, Boston, 2007.
- 3. Timothy J.Ross, "Fuzzy Logic with Engineering Applications", McGraw- Hill, 2011.
- 4. Engelbrecht A. P., "Fundamentals of Computational Swarm Intelligence", John Wiley & Sons, 2006.
- 5. Konar. A, "Computational Intelligence: Principles, Techniques and Applications", Springer Verlag, 2005.

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- 1. https://www.sciencedirect.com/science/article/pii/S1877050916325467
- 2. https://www.elprocus.com/soft-computing/
- 3. http://airccj.org/CSCP/vol3/csit3206.pdf

COs/POs/PSOs Mapping

Cos					Progr	am O	utcom	es (PC	Ds)				Prog Outco	ram Spe omes (P	ecific 'SOs)
	P01	PO2	PO3	PO4	PO5	P06	P07	P08	PO9	PO10	P011	PO12	PSO1	PSO2	PSO3
1	3	1	1	1	1	1	-	-	-	-	-	1	3	1	1
2	3	1	1	1	1	1	-	-	-	-	-	1	2	1	1
3	3	1	1	1	1	1	-	-	-	-	-	1	3	1	1
4	3	2	1	2	2	1	-	-	-	-	-	1	3	1	2
5	3	2	1	2	2	1	-	-	-	-	-	2	3	1	2

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

MEDICAL IMAGE ACQUISITION	
TECHNIQUES	

U19BME64

- To learn the physics behind x-ray imaging
- To understand the hardware and techniques involved in CT imaging.
- To learn the properties and techniques in ultrasound imaging.
- To understand the physics behind magnetic resonance and the techniques in resonance imaging.
- To understand the different parts of medical imaging systems and its working principle.

Course Outcomes

After completion of the course, the students are able to

- **CO1** Understand the physics behind x-ray imaging **(K2)**
- CO2 Understand the hardware and techniques involved in CT imaging (K2)
- CO3 Describe the properties and techniques in ultrasound imaging (K2)
- CO4 Understand the physics behind magnetic resonance and the techniques in resonance-imaging (K2)
- **CO5** Understand the different parts of medical imaging systems and its working principle (K2)

UNIT - I X-RAY

Basic imaging principle image modalities, Image properties Projection radiography, interaction between X - Rays and matter, Intensity of an X - Ray, Attenuation, X - Ray Generation and Generators, Beam Restrictors and Grids, Intensifying screens, fluorescent screens and image intensifiers, X - Ray, detectors, Conventional X - Ray radiography, Fluoroscopy, Angiography, Digital radiography.

UNIT - II COMPUTED TOMOGRAPHY

Basic Principle, Generation of CT machines, Detectors & Detector arrays, Details of Acquisition, Digital image display Radiation Dose, Image quality.

UNIT - III ULTRASOUND

Acoustic propagation, Attenuation, Absorption and Scattering, Ultrasonic transducers, TransducerArrays, A mode, B mode, M mode scanners, Tissue characterization, Color Doppler flowimaging, Echocardiography.

UNIT - IV MRI

Angular momentum, Magnetic dipole moment, Magnetization, Larmor frequency Rotating frameof reference, free induction decay, Relaxation times, Pulse sequences, Generation and Detectionof NMR Imager, Slice selection, Frequency encoding, Phase encoding, Spin – Echo imaging, Gradient – Echo imaging, Imaging safety, Biological effects of magnetic field, Introduction toFMRI,EMRI.

UNIT - V OTHER IMAGING TECHNIQUES

Spectroscopy techniques: light source, optical fibers, monochromator, filters and polarizer- Real time spectroscopy techniques, fractional flow reserve measurement techniques-Magneto encephalography, optical coherence tomography-Infrared imaging: Thermal radiation, single photon detectors, Thermographic scanning systems, clinical thermography and its applications

Text Books

- 1. Rongguang Liang, "Biomedical optical imaging technologies: Design and applications", Springer Science & Business Media, 1st edition, 2012.
- 2. Steve Webb, "The physics of medical imaging", Adam Hilger, Bristol, England, Philadelphia, USA, 1988
- 3. John C Russ, "The image processing handbook", CRC and IEEE press 2016.

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4. Milan Sonka, Vaclav Hlavac, Roger Boyle, "Image processing, analysis and machine vision", 2nd Edition, Brooks Cole publishing Co.,2007.

Reference Books

- 1. K Kirk Shung, Michael B smith & Benjamim M W Tsui, "Principles of Medical Imaging", Academic press inc, 1992.
- 2. Jerry L Prince & Jonathan M Links, "Medical Imaging Signals and Systems", Pearson Prentice Hall, 2006.
- 3. Jerrold T. Bushberg "The essential Physics of Medical Imaging", Lippincott Williams and Wilkins, 2002.
- 4. R S Khandpur, "Hand Book of Biomedical Instrumentation", Tata McGraw Hill Publication, Second Edition. 2003.
- 5. Ray H. Hashemi , William G. Bradley, Christopher, J. Lisanti, MRI: The Basics, 2004.
- 6. Frederick W Kremkau "Diagnostic Ultrasound Principles & Instruments", Saunders Elsevier, 2005.

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- 1. https://en.wikipedia.org/wiki/Medical_imaging
- 2. https://www.acvr.org/page/types-imaging-therapy
- 3. https://study.com/academy/lesson/medical-imaging-techniques-types-uses.html

COs					Prog	ram O	utcom	es (PC	Ds)				Prog Outco	ram Spo omes (P	ecific PSOs)
	PO1	PO2	PO3	PO4	PO5	P06	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
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2	3	2	1	1	1	1	2	2	1	2	1	1	3	2	2
3	3	2	1	1	2	1	2	2	1	2	1	1	3	2	3
4	3	2	1	1	2	1	2	2	1	2	1	1	3	2	3
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COs/POs/PSOs Mapping

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

A. MIL



19BME65

С Hrs Т Ρ TROUBLE SHOOTING AND QUALITY L CONTROL IN MEDICAL EQUIPMENT 3 0 Λ 3 45

COURSE OBJECTIVES

- To understand the troubleshooting procedures in electronic equipment.
- To learn the testing procedures of active and passive components.
- To analyze the fault diagnosis in analog circuits and digital ICs. .
- To understand the problems in common biomedical equipment in hospitals when it is not working and provide a suitable solution.
- To learn the various quality measures & standards adapted for medical systems

COURSE OUTCOMES

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

- CO1 -Understand the troubleshooting procedures in electronic equipment (K2)
- CO2 -Describe the testing procedures of active and passive components.(K3)
- CO3 -Analyze the fault diagnosis in analog circuits and digital ICs. (K4)
- CO4 -Identify the problems in common biomedical equipment in hospitals when it is not working and provide a suitable solution. (K4)
- CO5 -Describe the various quality measures & standards adapted for medical systems (K2)

UNIT - I FUNDAMENTAL TROUBLESHOOTING TESTING PROCEDURES

Equipment failure and its cause-Functional block diagram of a troubleshooting system-Troubleshooting process & fault finding aids-Troubleshooting techniques and their correction action-Testing of active and passive components: resistor, capacitor, inductor, BJT, JFET, & MOSFET-

UNIT - II FAULT DIAGNOSIS IN ANALOG & DIGITAL INTEGRATED CIRCUITS (9Hrs)

Characteristics of ideal op-amps, typical op-amp based medical circuits-Fault diagnosis in op-amp circuits-Digital troubleshooting methods-Digital IC Troubleshooters, logic clip, logic probe, logic pulser, logic current tracer, logic comparator-Circuit board Troubleshooting.

UNIT - III BIOMEDICAL EQUIPMENT TROUBLESHOOTING

Troubleshooting- ECG Machine, EEG Machine-Troubleshooting- defibrillator, electrosurgical unit-Troubleshooting- anesthesia machine, autoclaves & sterilizers-Troubleshooting- endoscope, incubators, nebulizer-Troubleshooting- oxygen concentrators, sphygmomanometers, suction machine-Troubleshooting-X-ray machine.

UNIT - IV MEDICAL DEVICE DESIGN QUALITY

Definition of quality, essence of quality-Quality operating system and the device life cycle-Evolution of quality-Business excellence: a value proposition-Health care quality.

UNIT - V DESIGN FOR SIX SIGMA AND MEDICAL DEVICE REGULATION

Global Perspective on medical device regulations, medical device classification (USA, Europe & GHTF-Medical device safety, medical device quality management systems requirements-Medical device regulation throughout the product development life cycle-Purpose of ISO 9001:2001&ISO 13485.

Text Books

- 1. Khandpur R S, "Troubleshooting Electronic Equipment- Includes Repair & Maintenance", 2nd edition, Tata McGrawHill, 2009.
- 2. Basem S EL-Haik& Khalid S Mekki, "Medical Device Design for Six Sigma: A Road Map for Safety and Effectiveness", 1st edition, John Wiley & Sons 2008.

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3. Gopalakrishna, P. Purchasing and Materials Management, Tata MC.Graw Hill, New Delhi, 2017.

Reference Books

- 1. Nicholas Cram & Selby Holder, "Basic Electronic Troubleshooting for Biomedical Technicians", 2nd edition, 2010, TSTC Publishing.
- 2. Dan Tomal& Neal Widmer, "Electronic Troubleshooting", 3rd edition, McGraw Hill ,2004,.
- 3. Richard Fries, "Reliable Design of Medical Devices", 2nd edition, CRC Press., 2006
- 4. Joseph J Panichello, "X-Ray Repair: A Comprehensive Guide to the Installation & Servicing of Radiographic Equipment", 2nd edition, Charles C Thomas Publisher Ltd., 2005
- 5. Gopalakrishna, P., Materials Management, Prentice Hall, New Delhi, 2015.

Web References

- 1. https://www.who.int/medical_devices/publications/en/MD_Regulations.pdf
- 2. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2924127/
- 3. https://www.ncbi.nlm.nih.gov/pubmed/7613571

COs/POs/PSOs Mapping

COs					Progr	am O	utcom	es (PC	Ds)				Prog Outco	ram Spe omes (P	ecific 'SOs)
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Correlation Level: 1-Low, 2-Medium, 3- High

PROFESSIONAL ELECTIVE - IV

L Hrs Т Ρ С U19BME71 PHYSIOLOGICAL SYSTEM MODELLING 3 0 0 3 45

Course Objectives

- To understand the basic modelling of physiological system. •
- To get an adequate knowledge of mathematical modelling of static system.
- To perform the time domain analysis of physiological system. •
- To gain knowledge in Frequency domain analysis of physiological system. •
- To understand the technique of system identification of physiological system. •

Course Outcomes

After completion of the course, the students will be able to CO1 – Understand the basics of physiological system modelling. (K2) CO2 – Apply mathematical modelling of static system. (K3)

CO3 – Analyse physiological systems in time domain (K3)

CO4 – Explain the frequency domain analysis of the physiological system. (K3)

CO5 – Understand the technique of system identification of physiological system (K2)

UNIT-I INTRODUCTION

Introduction to physiological system - mathematical modelling of physiological system, classification of model - grey box and black box, characteristic model of physiological system - parametric and non-parametric, lumped versus distributed models, - Laplace transform and Transfer function model of the system, Linear model for respiratory system - derivation of transfer function – Linear model for muscle mechanism.

UNIT II MODELLING OF STATIC ANALYSIS SYSTEM

Static Modelling - Open and Close loop, steady state characteristic - determination of steady state characteristic of a simple model of muscle stretch reflex - steady state analysis of Human body Glucose & Insulin regulatory system - Human body chemical regulation of ventilator system - Respiratory control mathematical modelling - Heart and systemic circulation - Cardiac output - Mathematical Modelling.

UNIT III TIME DOMAIN ANALYSIS OF PHYSIOLOGICAL SYSTEMS

Time domain analysis introduction - Respiratory Mechanics - Linearized respiratory mechanics transient response - first order respiratory mechanics for impulse response of open loop & Close loop - Transient response analysis of step and impulse - Neuromuscular reflex action.

UNIT IV FREQUENCY MODELING OF THE SYSTEM

Frequency Response introduction - open and closed loop frequency response - Relation between transient and frequency response - graphical representation of frequency response - linearized Lungs Mechanics Model for Bode and Nyquist chart – Circulatory system – Frequency response and graphical Representation (Bode & Nyquist) - Frequency response of glucose - insulin model - graphical representation of glucose - insulin model.

UNIT V SYSTEM IDENTIFICATION OF PHYSIOLOGICAL SYSTEM

Basic problem in physiological system - Parametric and nonparametric identification methods - east square estimation - estimation in frequency domain, optimization techniques - parameter estimation problems identification of closed loop system.

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Text Books

- 1. Micheal C. K. Khoo, "Physiological Control Systems Analysis, Simulation and Estimation", 2nd Edition, Prentice Hall of India Private Ltd, 2018.
- 2. V. Z. Marmarlies, "Advanced Methods of physiological system Modelling", Vol. 3, Springer Science & Business Media, 2013.
- 3. Claudio Cobeli Ewart Carson, "Introduction to Modelling in Physiology & Medicine", 1st Edition, Academic press series, 2008.

Reference Books

- 1. Johny T. Ottesen, Melte S, Olufsen, Jesper K. Larsen, "Applied Mathematical Models in Human Physiology", Vol. 9, SIAM, 2004.
- 2. Dorf, "Modern Control Systems", Pearson Education India, 1st Edition 2008.

Web References

- 1. https://www.digimat.in/nptel/courses/medical/physiology/PY11.html
- 2. https://m.youtube.com/watch?v=jcA3s9gUAfw
- 3. https://youtu.be/uv91uHHNylg
- 4. https://youtu.be/ul-r7zrl_2w
- 5. https://www.digimat.in/nptel/courses/medical/physiology/PY12.html

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COs/POs/PSOs Mapping

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

B.Tech. Biomedical Engineering

UT19BME72 PATTERN RECOGNITION AND EXPERT SYSTEMS L T P C Hrs IN MEDICINE 3 0 0 3 45

Course Objectives

- To Understand the basic concept of pattern recognition.
- To get an adequate knowledge of types of pattern recognition statistical approach.
- To know the types of pattern recognition syntactic approach
- To get a basic knowledge of Artificial Intelligence.
- To gain a knowledge about how the expert system used in medical applications.

Course Outcomes

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

CO1 – Understand the basic concept of pattern recognition. (K2)

CO2 - Gain knowledge of pattern recognition using statistical approach. (K3)

- CO3 Recognize the pattern using syntactic approach. (K3)
- CO4 Gain knowledge on the basics of Artificial Intelligence. (K2)

CO5 – Apply the expert system in medical application. (K3)

UNIT I PATTERN RECOGNITION BASIC CONCEPT

Pattern Recognition Overview – Pattern Recognition feature Extraction – Training & Learning in Pattern Recognition – Different types of Pattern recognition – Statistical, Syntactic and Neural Discriminant function in Pattern Recognition system.

UNIT II STATISTICAL PATTERN RECOGNITION

Parametric estimation and supervised learning – Maximum likelihood estimation – Bayesian parameter estimation – Non parametric approach - Parzen window – k- NN estimation, unsupervised learning – Clustering concept.

UNIT III SYNTACTIC PATTERN RECOGNITION

Grammar based approaches – Elements of formal grammars, Parsing concepts – Parsing Algorithm – Transition networks in Parsing, Higher Dimensional Grammars, and Stochastic Grammars – Graphical Approach – Graph Isomorphism – Attributed Graphs.

UNIT IV ARTIFICIAL INTELLIGENCE

Artificial intelligence: Definition, importance, problem solving, searching – heuristic searching – basic architecture. Knowledge based representation: Production Rules – Frames – Database – Predictive calculus & semantic Nets – Temporal data representation – Experts input – Learned knowledge – Meta knowledge – knowledge base maintenance

UNIT V EXPERT SYSTEM APPLICATION IN MEDICAL FIELD

Expert system architecture - non production system architecture – study of medical expert system – MYCIN, EMYCIN – development of medical expert system – Diagnosis of Heart Disease – Categories of Heart Diseases – Knowledge based information – Data base information – Chaotic Data – Sample system.

Text Books

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1.Duda R.O. Hart P.E, "Pattern Classification & Scene Analysis",2nd Edition, Wiley, 2000.

2.Dann. W. Patterson, "Introduction to Artificial Intelligence and Expert Systems", Prentice Hall of India Pvt ltd, New Delhi, 2001.

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- 1. Robert Schalk off, "Pattern recognition, Statistical, Structural and neural approaches" John Wiley and Sons (Asia) Pvt Ltd., Singapore, 2005.
- 2. R. D. Lele, "Computers in Medicine", Tata McGraw Hill, NewDelhi-1989.
- 3. Watterman, "Expert Systems", Mc-Graw Hill, New York, 1991.

Web References

- 1. https://youtu.be/bMcS1JIUvVI
- 2. https://youtu.be/Z66_2_VG_k8
- 3. https://youtu.be/-vsCj0ijP4U
- 4. https://youtu.be/gXpi1czz5NA
- 5. https://youtu.be/C-ZmfZNP5ns

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4	3	2	2	-	-	2	-	-	-	-	-	3	3	1	1
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Correlation Level: 1-Low, 2-Medium, 3- High.

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UT19BME73	RADIOLOGICAL FOUIPMENT	L	I	Р	C	Hrs
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- Understand the basic generation of X-rays & its uses in imaging. •
- To gain knowledge and working principle of Computed Tomography.
- To get an adequate knowledge of magnetic resonance and its application in imaging. •
- To gain knowledge in physics behind nuclear radiation and the image modalities.
- To learn radiation therapy techniques and radiation safety .

Course Outcomes

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

CO1 - Understand the basic working principle of X-ray imaging. (K2)

CO2 - Gain adequate knowledge of computed tomography. (K2)

CO3 - Explain the magnetic imaging process in medical field. (K3)

CO4 - Understand the basic concept of nuclear radiation used in medical field. (K2)

CO5 - Explain the radiation therapy technique and radiation safety. (K3)

UNIT I MEDICAL X-RAY IMAGING

Principle of imaging in X-rays - X-Ray production, properties, tubes - X- Ray Equipment (Block Diagram) -Collimators - Grid - Causes of x-ray tube failure - Intensifying screen - electronic Intensifying screen - Image characteristic Digital Radiography Flat panel detector - Fluoroscopy - Digital Fluoroscopy. Angiographycontrast materials used - Cine Angiography, Digital subtraction Angiography. Mammography and Dental x-ray unit.

UNIT II COMPUTED TOMOGRAPHY

Computed Tomography – Historical Development – Instrumentation – basic principle – Tomographic reconstruction - back propagation algorithm - Filtered back propagation algorithm Digital image display -Radiation dose - Contrast Scale - CT number - Image quality - Helical CT - spiral CT - Detector configuration - Phase selective imaging introduction - Phase selective imaging applications - CT applications in cerebral scan – CT applications in pulmonary disease.

UNIT III MAGNETIC RESONANCE IMAGING

Fundamentals of magnetic resonance- Interaction of Nuclei with static magnetic field and Radio frequency wave- rotation and precession - Induction of magnetic resonance signals - bulk magnetization - Relaxation processes T1 and T2. Block Diagram approach of MRI system - Image reconstruction technique - sequential point method, sequential line method, sequential plane method - generations of gradient magnetic field coil, Radio Frequency coils (sending and receiving), and shim coils, Electronic components, contrast agents used, fMRI – clinical application.

UNIT IV NUCLEAR MEDICINE TECHNIQUES

General principle of Nuclear Medicine - Radioactivity basics - Production of radionuclides - types of radioactivity - The gamma camera - Multi crystal gamma camera - Nuclear tomography - Single Photon Emission Computer Tomography (SPECT) - Principle & Block diagram approach - Position Emission Tomography (PET) – Principle, image construction & image characteristics – Clinical Application of PET

UNIT V RADIATION THERAPY AND RADIATION SAFETY

Radiation therapy - linear accelerator, Tele gamma Machine. SRS - SRT, -Recent Techniques in radiation therapy - 3DCRT - IMRT - IGRT and Cyber knife- radiation measuring instruments- Dosimeter, film badges, Thermo Luminescent dosimeters- electronic dosimeter- Radiation protection in medicine- radiation protection principles.

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Text Books

- 1.Jerrold T. Bushberg, Edwin Marion Leidholdt, John M. Boone, Anthony Seibert, "The essential physics of medical imaging ", Lippincott Williams & Wilkins, 2002.
- 2. Muhhammad Maqbool, "An Introduction to Medical Physics ", Springer, Cham, 2017.
- 3. Frank H. Attix, "Introduction to Radiological Physics and Radiation Dosimetry", John Wiley & sons, 2008.

Reference Books

- 1. Gopal B. Saha "Physics and Radiobiology of Nuclear Medicine" 3rd Edition Springer, 2006.
- 2. Myer Kutz, "Standard handbook of Biomedical Engineering and design", McGraw Hill, 2003.

Web References

- 1. https://youtu.be/8_yV_1iNsMw
- 2. https://youtu.be/SdYUniRMtz4
- 3. https://youtu.be/rJ9gV4yFMi8
- 4. https://m.youtube.com/watch?v=XQ5ZQUdb5U4
- 5. https://youtu.be/x8UTGkCAQUQ

COs/POs/PSOs Mapping

COs					Prog	ram O	utcom	es (PC)s)				Prog Outco	ram Spe omes (P	ecific SOs)
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1	3	2	1	-	-	-	-	-	-	-	-	3	3	2	-
2	3	1	-	-	-	-	-	-	-	-	-	3	2	-	-
3	3	2	-	-	-	-	-	-	-	-	-	3	3	1	-
4	3	2	1	-	-	-	-	-	-	-	-	3	3	1	1
5	3	1	1	-	-	-	-	-	-	-	-	3	3	2	1

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

U19BME74	ACOUSTICS AND OPTICAL IMAGING	L	Т	Ρ	С	Hrs
		3	0	0	3	45

- To get a detailed review about the basic concept of acoustic.
- To get an idea about the principle of optics.
- To describe the necessity of bio imaging.
- To learn optical imaging in therapeutic applications.
- To get an adequate knowledge of diagnostic application in optical imaging.

Course Outcomes

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

CO1 - Understand the basic knowledge of acoustic (K2)

- CO2 Gain knowledge about the principle of optics. (K2)
- CO3 Explain about the necessity of bio imaging. (K3)
- CO4 Apply the concept of optical imaging in therapeutic application. (K3)
- CO5 Explain the diagnostic application in optical imaging. (K3)

UNIT I ACOUSTIC BASICS

Acoustics – Definition – Types of Acoustics – Application of Acoustics - Acoustic in healthcare environment – acoustic equipment – sound absorption – noise reduction – mechanotransduction effect – acoustic medical equipment – patient care teams – primary acoustics issues – acoustic measurements – Design strategy for improved acoustic design.

UNIT II PRINCIPLE OF OPTICS

Concept of light – interaction between light and molecules – interaction between light and bulk matters – Spectroscopy – Principle, Description, Types – Conventional, Fourier transform, Michelson – Electronic absorption – Types of electronic Transistors – Vibrational Spectroscopy – Fluorescence spectroscopy.

UNIT III BIO IMAGING

Introduction to optical imaging – Microscopy – Principle, Types – Fluorescence, Scanning Microscopy – Inverted and Upright Microscopy- Multi photon Microscopy- Total internal reflection Fluorescence – Fluorescence Resonance energy Transfer – Fluorescence lifetime imaging Microscope – Advantage and disadvantage of optical imaging – Application of bio imaging fluorophores – green fluorescent protein.

UNIT IV THERAPEUTIC APPLICATION

Phototherapy, Photodynamic therapy (PDT) - Principle and mechanism - Oncological and non- oncological applications of PDT - Biostimulation effect – applications.

UNIT V DIAGNOSTIC APPLICATION

Optical coherence tomography, Elastography, Raman Imaging, FLIM, X-Ray Diagnostic Techniques, Near-Field Imaging in Biological and Biomedical Applications

Text Books

- 1. Mark E. Brezinski, "Optical Coherence Tomography: Principles and ApplicationsII", Academic Press, 2006.
- 2. Markolf H.Niemz, "Laser-Tissue Interaction Fundamentals and Applicationsll", Springer, 2007.
- 3. Paras N. Prasad, "Introduction to Bio photonics, A. John Wiley and sons, Inc", Publications, 2003.

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- 1. R. Splinter and B.A. Hooper, "An Introduction to Bio-Medical Optics", Taylor and Francis, 2007.
- 2. Tuan Vo Dinh, "Biomedical photonics Handbookll", CRC Press LLC, 2003.

Web References

- 1. https://youtu.be/7FT5BN_Uw0Q
- 2. https://youtu.be/IU09BBXw-KE
- 3. https://youtu.be/U8Dx2BZimOg
- 4. https://youtu.be/AbjEDgAgj6E
- 5. https://youtu.be/SvkD0iHmd1k

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

COs/POs/PSOs Mapping

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

A. M

U19BME75	DYNAMICS OF BIOFLUIDS	L	Т	Ρ	С	Hrs
		3	0	0	3	45

- To get a detailed review about the basic concepts of bio fluid mechanics.
- To get an idea about the Vascular mechanics.
- To describe the rheology of blood and mechanics of blood vessels
- To learn the mathematical modelling of fluid biological systems.
- To understand computational simulations

Course Outcomes

After completion of the course, the students will be able to **CO1 –** Understand the basic knowledge of bio fluids. **(K2)**

- **CO2** Gain adequate knowledge about the Vascular Mechanics (K2)
- **CO3** Explain about the rheology of blood. **(K2)**
- CO4 Describe the mathematical modelling of fluid biological system. (K3)
- CO5 Gain adequate knowledge in computational simulations (K2)

UNIT I FUNDAMENTALS OF BIOFLUID MECHANICS

Intrinsic Fluid Properties: Density, Viscosity, Compressibility, Surface Tension, Hydrostatics - Macroscopic Balances of Mass and Momentum - Microscopic Balance of Mass and Momentum - The Bernoulli Equation - Dimensional Analysis - Fluid Mechanics in a Straight Tube - Flow Stability and Related Characteristics - Effect of Flow Pulsatility - Boundary Layer Separation.

UNIT II VASCULAR MECHANICS

Anatomical Organization of the Vasculature, Mechanical Properties of Blood Vessels, Functional Properties of Blood, Control Aspects of the Vascular System, Hemodynamic of Large Arteries, Ventricular Outflow and the Aorta, Pressure-Flow Relations and Vascular Impedance, Wave Propagation Phenomena- Wave Reflection Phenomena.

UNIT III RHEOLOGY OF BLOOD

Physical Properties of Blood - Viscous Behavior of Blood - Pressure–Flow Relationship for Non-Newtonian Fluids- Viscometry and Theory for Capillary - Capillary Viscometer - Coaxial Cylinder Viscometer - Cone and Plate Viscometer - Hemolysis and Platelet Activation with Fluid – Structural Components of the Blood Vessel - Material Behavior of Blood Vessels.

UNIT IV MODELING

Theory of Models - Computational fluid dynamics - Dimensional analysis and the Buckingham Pi theorem -Synthesizing Pi terms - Geometric Similarity - Dynamic Similarity - Kinematic Similarity - Common Dimensionless Parameters in Fluid Mechanics.

UNIT V COMPUTATIONAL SIMULATIONS

Computational fluid dynamics – Modeling Considerations for Biofluid Mechanical Simulations – 2D&3D modeling - Fluid Dynamic Simulations in the Human Circulation - Human Aorta - Carotid Arterial Bifurcation - Aortoiliac Bifurcation - Coronary Arteries - AAA and Cerebral - Interventional Treatment and Surgical Planning - Simulation of Valvular Dynamics - Future Directions: Multiscale Modelling.

A. M

B.Tech. Biomedical Engineering

(9 Hrs)

(9 Hrs)

(9 Hrs)

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(9 Hrs)

Text Books

- 1. Krishnan B. Chandran, Ajit P. Yoganathan, Stanley E. Rittgers, "Biofluid Mechanics: The human circulation", 2nd Edition, CRC Press, 2012.
- 2. Jeffery R. Davis et. Al., "Fundamentals of Aerospace Medicinell, Wolter Kluwer Health", Lippincott Williams and Wilkins, 2008.
- 3. Lee Waite, Jerry Fine, "Applied Biofluid Mechanicsl", McGraw Hill, 2007.

Reference Books

- 1. Jung Hee Seo, Vijay Vedula, Theodore Abraham and Rajat Mittal, "Multiphysics computational models for cardiac flow and virtual cardiographyll, Int. J. Numer. Meth. Biomed. Engineering", Published online in Wiley Online Library, 2013
- 2. John K-J Li, "Dynamics of Vascular Systeml", World Scientific, 2004.
- 3. C. Ross Ethier, Craig A Simmons, "Introduction to Biomechanics- From Cells to Organismsll", Cambridge Texts in Biomedical Engineering, 2007.

Web References

- 1. https://m.youtube.com/watch?v=hnWHM_MWCxI
- 2. https://youtu.be/meRLirTKkhQ
- 3. https://youtu.be/L4eZ0lOafvc
- 4. https://youtu.be/emmf2JYAD-0
- 5. https://youtu.be/NILy-u61yyk

COs					Prog	ıram O	utcom	es (PC)s)				Program Specific Outcomes (PSOs)			
	PO1 PO2 PO3 PO4 PO5 PO6 PO7 PO8 PO9 PO10 PO11 PO12										PSO1	PSO2	PSO3			
1	3	3	-	-	-	-	-	-	-	-	-	2	3	1	1	
2	³ 1 2 1 1 1 2										2	3	2	1		
3	3	2	2	1	1	1	-	-	-	-	-	2	3	1	1	
4	3	2	2	1	1	1	-	-	-	-	-	2	3	1	1	
5	3	1	2	1	1	1	-	-	-	-	-	2	3	2	1	

COs/POs/PSOs Mapping

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

PROFESSIONAL ELECTIVE – V

	L	Т	Ρ	С	Hrs
	3	0	0	3	45

COURSE OBJECTIVES

- To study the basic concept of nanomaterial synthesis.
- To get an adequate knowledge about the materials used in nanotechnology process
- To understand the properties of nanomaterials
- To learn the characterization techniques used in nanomaterials.
- To understand various environmental pollutants and its effects

COURSE OUTCOMES

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

- CO1 Understand the basic concept of nanomaterial synthesis. (K2)
- CO2 Gain knowledge about the materials used in nanotechnology process. (K2)
- CO3 Understand the properties of nanomaterials (K2)
- CO4 Explain the characterization techniques used in nanomaterials (K2)
- CO5 Investigate various environmental pollutants and its effects (K3)

UNIT I SYNTHESIS OF NANOMATERIALS

Chemical processes: Chemical precipitation and co-precipitation, polyol, and borohydrate reduction methods, Sol-Gel synthesis; Microemulsions synthesis, Hydrothermal, Solvothermal synthesis methods, Microwave assisted synthesis; Sonochemical assisted synthesis, Core-Shell nanostructure, Organic-Inorganic hybrid nanocomposites, Quantum dot (QDs) synthesis.

UNIT II NANOMATERIALS PROCESSES

Physical Methods: Inert gas condensation, Arc discharge, RF- plasma, Plasma arc technique, Ion sputtering, Laser ablation, Laser pyrolysis, Ball Milling, Molecular beam epitaxy (MBE), Chemical vapour deposition (CVD) method. Template assisted synthesis, Catalyst assisted chemical vapour deposition (CCVD).

UNIT III NANOMATERIALS PROPERTIES

Size effect of Nanomaterials: Size, shape, density, melting point, wet ability and specific surface area. Properties: Diffusion properties - Thermal properties - Electrical properties - Dielectric properties - Piezo electric and ferro electric materials - applications. Magnetic properties - Optical properties Photoconductivity, Electroluminescence, Photoluminescence, Optical properties of nanostructures.

UNIT IV CHARACTERIZATION TECHNIQUES

XRD, SEM, EDAX, TEM, Elemental mapping, FTIR, UV-Visible spectrophotometer, Laser Raman Spectroscopy, Differential Scanning Calorimeter (DSC), Differential Thermal Analyzer (DTA), Thermo gravimetric Analysis (TGA), X-ray Photoelectron Spectroscopy (XPS), Electrochemical Characterization measurements.

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(9 Hrs)

(9 Hrs)

(9 Hrs)

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UNIT V ENVIRONMENTAL AND HEALTH EFFECTS

Environmental pollutants in air, water, soil, hazardous and toxic wastes, application of nanotechnology in remediation of pollution. - The challenge to occupational health and hygiene, toxicity of nanoparticles, effects of inhaled nanosized particles, skin exposure to nanoparticles, impact of CNT on respiratory systems, hazards and risks of exposure to nanoparticles, monitoring nanoparticles in work place and sensors.

Text Books

- 1. Harry F. Tibbals, "Medical Nanotechnology and Nanomedicine", 1st Edition, CRC Press, 2011.
- 2. Hossein Hosseinkhani, "Nanomaterials in Advanced Medicine", Wiley-VCH Verlag GmbH & Co, 2019.
- 3. Kirthi, A. Vishnu, Karthik, L., Janarthanan, Pushpamalar, "Nanotechnology in Medicine", Springer, 2021.

Reference Books

- 1. Z.L Wang ," Characterization of Nanophase materials", 1st Edition, Wiley-VCH, 2000.
- G. Schmidt, "Nanoparticles: From theory to applications", 2nd Edition, Wiley Weinheim, 2004.
- 3. Gould, Tobochnik, "Introduction to Computer simulation methods", 2nd Edition, Addition Weekly. 2006
- 4. Zoraida Aguilar, "Nanomaterials for Medical Applications", 1st Edition, Elsevier, 2012.

Web References

- 1. https://en.wikipedia.org/wiki/Nanomedicine
- 2. https://www.medicalnewstoday.com/articles/244972
- 3. https://www.azonano.com/article.aspx?ArticleID=4840
- 4. https://youtu.be/ZS1QPndpD2w
- 5. https://youtu.be/iiT_KJJ1Uhs

COs/POs/PSOs Mapping

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

Correlation Level: 1- Low; 2 - Medium; 3 - High.





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19BME81	HUMAN ASSIST DEVICES	-	•	Г	C	1115
		3	0	0	3	45

Course Objectives

- To Introduce the concepts of Cardiac assist devices.
- To Learn various sensory and renal devices.
- To Apply design tools for ear analysis devices.
- To understand the functions of Prosthetic devices.
- To gain knowledge in nerve stimulator devices

Course Outcomes

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

- CO1 Understand the concepts of Cardiac assist devices (K2)
- **CO2** Classify the various sensory and renal devices **(K2)**
- CO3 Infer the merits of human assist system and its influence to environment ear devices. (K2)
- CO4 Apply processing conditions to functional Prosthetic devices (K3)
- CO5 Gain knowledge in nerve stimulator devices (K2)

UNIT I CARDIAC ASSIST DEVICES

Principle of External counter pulsation techniques, intra-aortic balloon pump, Auxiliary ventricle and schematic for temporary bypass of left ventricle, prosthetic heart valves.

UNIT II SENSORY AND RENAL DEVICES

Classification of Visual Impairments, Prevention and cure of visual impairments, Visual Augmentation, Tactile vision substitution, auditory substitution and augmentation, tactile auditory substitution, Assistive devices for the visual impaired. Artificial Renal: Dialysis action, Membrane, Dialysate, Monitoring Systems, Wearable Artificial Kidney, Implanting Type - Modeling and analysis.

UNIT III HEARING AIDS

Hearing aids: Common tests – audiograms, air conduction, bone conduction, masking techniques, hearing aids – principles, drawbacks in the conventional unit, DSP based hearing aids.

UNIT IV PROSTHETIC DEVICES

Hand and arm replacement – different types of models, externally powered limb prosthesis, feedback in orthotic system, functional electrical stimulation, sensory assist devices.

UNIT V NERVE STIMULATOR DEVICES

Electrotherapy, Transcutaneous electrical nerve stimulator, Interferential current, Galvanic stimulation, Uses, safety aspects. Deep brain stimulation. Bio-feedback - Efficacy ratings - Major modalities – Applications.

Text Books

- 1. Levine S.N. (ed), "Advances in Bio-medical engineering and Medical physics", Vol. I, Inter university publications, New York, 1968
- 2. R.S. Khandpur, Handbook of Biomedical Instrumentation, Tata McGraw Hill, 2nd Edition, Edition- 2003.
- 3. Rory A Cooper, An Introduction to Rehabilitation Engineering, Taylor and Francics, CRC Press, 2006

Reference Books

1. Albert M. Cook and Webster J.G, "Therapeutic Medical Devices", Prentice Hall Inc., New Jersey, 1982.

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- 2. Soonhwa Seok, Edward L. Meyen, Boaventura DaCosta, "Handbook of Research on Human Cognition and Assistive Technology: Design, Accessibility and Transdisciplinary Perspectives", Paratext, USA, 2010.
- 3. Joseph D.Bronzino, The Biomedical Engineering Handbook, Third Edition: Three Volume Set, CRC Press, 2006
- 4. Short Textbook of Prosthetics and Orthotics- R Chinnathurai- Jaypee Brothers Medical Publishers (P) Ltd,2010
- 5. D.S. Sunder, "Rehabilitation Medicine", 3rd Edition, Jaypee Medical Publication, 2010

Web References

- 1. https://youtu.be/vM_lxxVLhkg
- 2. https://youtu.be/JLVpOsVjieE
- 3. https://youtu.be/d2RHnB5T5eM
- 4. https://youtu.be/oN95Idnh9Q4
- 5. https://youtu.be/ZfLmNOF1JNM

COs/POs/PSOs Mapping

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

Correlation Level: 1- Low; 2 - Medium; 3 – High.

U19BME82	NEURAL NETWORKS	L	•	F	C	піз
		3	0	0	3	45

- To understand the physiology behind generation of nerve impulses.
- To learn the Neuro excitability to evaluate nervous system.
- **To** study various techniques in artificial neural networks system.
- **To** realize the functions of Artificial neural network models
- To know the functions of Self organization maps.

Course Outcomes

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

- CO1 Understand the physiology behind generation of nerve impulses. (K2)
- CO2 Explain the Neuro excitability to evaluate nervous system. (K2)
- CO3 Describe various techniques in artificial neural networks. (K2)
- CO4 Analyze the functions of Artificial neural network models. (K3)
- CO5 Realize the functions of Self organization maps. (K3)

UNIT I INTRODUCTION

Cellular Physiology of Nerve Cells - Generation of Nerve Action Potential - Ionic Permeability and Membrane Potential - Measuring the Long-distance Signal in Neurons - Changes in Relative Sodium Permeability During an Action Potential - Voltage-dependent Sodium Channels of the Neuron –Molecular Properties of the Voltage-sensitive Sodium Channel - Molecular Properties of Voltage-dependent Potassium - Channels - Calcium-dependent Action Potentials.

UNIT II NERVE EXCITABILITY

Nerve Excitability: Functional insights derived from axonal structures, Nerve excitability findings - Nerve conduction studies - Electro physiologic study of Neuromuscular Junction: H-Reflex and F-Reflex, Blink reflex and other cranial nerve reflexes, Evaluation of autonomic nervous system.

UNIT III ARTIFICIAL NEURAL NETWORKS

Neural networks basics, Biological neuron and their artificial model, McCullohpitts model, Network parameters-weights, activation, threshold function - Hebbrule, delta rule, Perception learning algorithm, Tutorial: Perceptron convergence theorem, MADALINE, ADALINE Problem

UNIT IV ARTIFICIAL NEURAL NETWORK MODELS

Feed forward networks, Back propagation network- structure and algorithm, BPN application - Associative memory, Recurrent network - Hopfield network - Radial basis function network, Matlab programming for back propagation neural network, Tutorial: Boltzman machine, Issues in network design

UNIT V SELF ORGANIZATION MAPS (SOM)

Self-organizing maps-pattern clustering, SOM-topological mapping, cohune's SOM, Learning vector quantization, Competitive models-min, max net, Adaptive resonance theory (ART)-introduction, network and processing in art, Associative memory model, Basics of support vector machine (SVM) and radial, Tutorial: Self organizing maps in MATLAB, Visualization using U-matrix

Text Books

- 1. Mathews G.G. "Cellular Physiology of Nerve and Muscle", 4th Edition, Blackwell Science, UK, 2003.
- 2. Jacek M. Zurada , "Introduction Artificial Neural System" Jaico Pub. House, 2004.
- 3. LaureneFausett, "Fundamentals of Neural Networks: Architectures, Algorithms, and Applications", Pearson Education India, 3rd Edition, 2008.

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- 1. C.M.Bishop, "Pattern Recognition and Machine Learning", Springer-Verlag, 1st Edition, 2006.
- 2. S. N. Sivanandam, S. N Deepa, "Introduction to Neural Networks Using Matlab 6.0", Tata McGraw-Hill, 2006.
- 3. B.Yegnanarayana, "Artificial Neural Networks", Prentice Hall of India, 3rd Edition, 2006.
- 4. Mohamad H. Hassoun, "Fundamentals of Artificial Neural Network", Cambridge MIT Press, 1st Edition,1995.
- 5. Neural Networks and Artificial Intelligence for Biomedical Engineering by Donna L. Hudson and Maurice E. Cohen, IEEE Press, 2000.

Web References

- 1. https://youtu.be/LV4A_naqN7g
- 2. https://youtu.be/ar7B2E8nDp8
- 3. https://m.youtube.com/watch?v=3I7kIJAi0fk&feature=youtu.be
- 4. https://youtu.be/s8pDf2Pt9sc
- 5. https://youtu.be/xflvfkGnl64

COs/POs/PSOs Mapping

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

Correlation Level: 1- Low; 2 - Medium; 3 - High.

A. M

	BIOMETRIC RECOGNITION SYSTEMS	L	Т	Ρ	С	Hrs
019BME05		3	0	0	3	45

- To understand the basics of Biometrics.
- To understand the different technologies used in fingerprint
- To gain knowledge about different technologies used in face recognition.
- 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 - Demonstrate the knowledge of engineering principles underlying biometric systems. (K2)

- CO2 Apply algorithms to model finger print. (K2)
- CO3 Classify different face recognition and hand geometry pattern (K3)
- CO4 Analyze the design and performance of biometrics. (K2)
- CO5 Explain various computations of authentication methods (K2)

UNIT I INTRODUCTION TO BIOMETRICS

Introduction and back ground – biometric technologies – passive biometrics – active biometrics - Biometric systems – Enrollment – templates – algorithm – verification – Biometric applications – biometric characteristics- Authentication technologies –Need for strong authentication - Protecting privacy and biometrics and 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 modeling of fingerprint images – fingerprint enhancement – Feature extraction – fingerprint classification – fingerprint matching

UNIT III FACE RECOGNITION AND HAND GEOMETRY

Introduction to face recognition, Neural networks for face recognition – face recognition from correspondence maps – Hand geometry – scanning – Feature Extraction - Adaptive Classifiers - Visual-Based Feature Extraction and Pattern Classification - feature extraction – types of algorithm – Biometric fusion.

UNIT IV MULTIMODAL BIOMETRICS AND PERFORMANCE EVALUATION (9 Hrs)

Voice Scan – physiological biometrics –Behavioral 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 Systems – Biometric authentication by fingerprint -Biometric Authentication by Face Recognition. Expectation -Maximization theory - Support Vector Machines. Biometric authentication by fingerprint – 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.

(9 Hrs)

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(9 Hrs)

Text Books

- 1. James Wayman, Anil Jain, Davide Maltoni, Dario Maio, "Biometric Systems, Technology Design and Performance Evaluation", Springer, 2005
- 2. S.Y. Kung, S.H. Lin, M.W.Mak, "Biometric Authentication: A Machine Learning Approach" PrenticeHall,2005

Reference Books

- 1. Paul Reid, "Biometrics for Network Security", Pearson Education, 2004.
- 2. Nalini K Ratha, Ruud Bolle, "Automatic finger print Recognition System", Springer, 2003.
- 3. L C Jain, IHayashi, S B Lee, U Halici, "Intelligent Biometric Techniques in Fingerprint and Face Recognition" CRCPress, 1999.
- 4. John Chirillo, Scott Blaul, "Implementing Biometric Security", John Wiley, 2003.
- 5. Arun A.Ross, Karthik Nanda Kumar, Anil K.Jain, "Handbook of Multibiometrics", Springer, 2006.

Web References

- 1. https://www.thalesgroup.com/en/markets/digital-identity-and-security/government/inspired/biometrics
- 2. https://searchsecurity.techtarget.com/definition/biometricauthenticationhttps://www.ifsecglobal.com/gl obal/biometric-security-systems-guide-devices-fingerprint-scanners-facial-recognition/
- 3. http://www.findbiometrics.com/Pages/glossary.html
- 4. http://www.biometrics.gov/Documents/privacy.pdf

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

COs/POs/PSOs Mapping

Correlation Level: 1- Low; 2 - Medium; 3 – High.

U19BME84	TISSUE ENGINEERING	L	Т	Ρ	С	Hrs
•••=		3	0	0	3	45

- To understand the fundamentals of tissue engineering including cell migration
- To train students in cutting-edge cell and tissue engineering techniques
- To acquire knowledge based on molecular cell biology
- To develop the skills for scaffold engineering
- To make students to have depth understanding about biological case study

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Course Outcomes

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

- CO1 Understand the fundamentals of tissue engineering and cell migration (K2)
- CO2 Explain cell types and cell culture (K2)
- CO3 Gain knowledge based on molecular cell biology (K2)
- CO4 Develop the skills needed for scaffold engineering (K3)
- CO5 Specify the different types of biodegradable biomaterials that can be used in tissue engineering applications (K3)

UNIT I INTRODUCTION

Basic definition, Structural and organization of tissues: Epithelial, connective; vascularity and angiogenesis, basic wound healing, cell migration, development and use in therapeutic.

UNIT II CELL CULTURE

Different cell types, progenitor cells and cell differentiations, different kind of matrix, cell-cell interaction. Aspect of cell culture: cell expansion, cell transfer, cell storage and cell characterization, 3-D architecture and cell incorporation - Bioreactors.

UNIT III MOLECULAR BIOLOGY

Cytokines, growth factors and hormone - Cell signaling, growth factor signaling, growth factor delivery in tissue engineering, cell attachment: differential cell adhesion, receptor-ligand binding, and Cell surface markers.

UNIT IV SCAFFOLD ENGINEERING

Biomaterials for tissue engineering, Properties: porosity, mechanical strength, 3-D architecture and cell incorporation. Engineering tissues for replacing bone, cartilage, tendons, ligaments, skin and liver.

UNIT V CASE STUDIES

Case study: transplantation for liver, musculoskeletal, cardiovascular, neural, tissue engineering. Ethical, FDA and regulatory issues of tissue engineering.

Text Books

- 1. Clemens van Blitterswijk, "Tissue Engineering", Academic Press, 2008.
- 2. Robert. P. Lanza, Robert Langer & William L. Chick, "Principles of Tissue Engineering", 5th Edition, Academic press, 2020.
- 3. Anthony Atala, Robert Lanza, Tony Mikos, Robert Nerem, "Principles of Regenerative Medicine, 5th Edition, Academic press, 2018.

Reference Books

1. Endarle, Blanchard & Bronzino, "Introduction to Biomedical Engineering", Academic press.

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- 2. B. Palsson, J.A. Hubbell, R.Plonsey& J.D. Bronzino, "Tissue Engineering", CRC- Taylor & Francis.
- 3. Clemens A. Van Blitterswijk and Jan De Boer, "Tissue Engineering", 2nd Edition, Academic Press, 2015.
- 4. John P. Fisher, Antonios G. Mikos, Joseph D. Bronzino, "Tissue Engineering",1st Edition, CRC Press, 2007.
- 5. Bojana Obradovic, "Cell and Tissue Engineering", 1st Edition, Springer-Verlag Berlin Heidelberg Press, 2012.

Web Resources

- 1. https://en.wikipedia.org/wiki/Tissue_engineering
- 2. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2475566/
- 3. https://www.nature.com/subjects/tissue-engineering
- 4. https://youtu.be/PNNiK9dgJXo
- 5. https://youtu.be/uLexdKS8pcw

COs/POs/PSOs Mapping

COs					Prog Outco	ram Spo omes (F	ecific 'SOs)								
	P01	PO2	PO3	PO4	PO5	P06	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3 3 2 2 2 2 1 3 3											3	1	2
2	3											3	3	1	2
3	3	3	2	2	2	2	1	3	-	-	-	3	3	1	2
4	3	3	2	2	2	2	1	3	-	-	-	3	3	1	2
5	3	3	2	2	2	2	1	3	-	-	-	3	3	1	2

Correlation Level: 1- Low; 2 - Medium; 3 – High.

PROFESSIONAL ELECTIVE - VI

BRAIN COMPUTER INTERFACE AND	L	т	Ρ	С	Hrs
APPLICATIONS	3	0	0	3	45

Course Objectives

- Understand the basic concept of brain computer interface
- To understand aboutvarious signal acquisition used in BCI
- Learn about the signal processing methods used in BCI
- Understand the various machine learning method
- To get an adequate knowledge of application of BCI

Course Outcomes

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

CO1 – Understanding the basic concept of brain computer interface. **(K2)**

- CO2 Perform various signal acquisition used in BCI (K2)
- CO3 Develop a signal processing involved in BCI (K3)
- CO4 Understanding the concept of Machine learning used in BCI (K3)

CO5 - Develop various application using BCI. (K2)

UNIT I INTRODUCTION TO BCI

Introduction - Brain structure and function, Brain Computer Interface Types - Synchronous and Asynchronous -Invasive BCI - Partially Invasive BCI - Non-Invasive BCI, Structure of BCI System, BCI Monitoring Hardware, EEG, ECoG, MEG, fMRI

UNIT II BRAIN ACTIVATION

Brain activation patterns - Spikes, Oscillatory potential and ERD, slow cortical potentials, Movement related potentials - Mu rhythms, motor imagery, Stimulus related potentials - Visual Evoked Potentials – P300 and Auditory Evoked Potentials, Potentials related to cognitive tasks.

UNIT III FEATURE EXTRACTION METHODS

Data Processing – Spike sorting, Frequency domain analysis, Wavelet analysis, Time domain analysis, Spatial filtering -Principal Component Analysis (PCA), Independent Component Analysis (ICA), Artifacts reduction, Feature Extraction - Phase synchronization and coherence.

UNIT IV MACHINE LEARNING METHODS FOR BCI

Classification techniques –Binary classification, Ensemble classification, Multiclass Classification, Evaluation of classification performance, Regression - Linear, Polynomial, RBF's, Perceptron's, Multilayer neural networks, Support vector machine, Graph theoretical functional connectivity analysis

UNIT V APPLICATIONS OF BCI

Case Studies - Invasive BCIs: decoding and tracking arm (hand) position, controlling prosthetic devices such as orthotic hands, Cursor and robotic control using multi electrode array implant, Cortical control of muscles via functional electrical stimulation. Noninvasive BCIs: P300 Mind Speller, Visual cognitive BCI, Emotion detection, Ethics of Brain Computer Interfacing

Text Books

- 1. Rajesh.P.N.Rao, "Brain-Computer Interfacing: An Introduction", 1st Edition, Cambridge University Press, 2013.
- 2. Jonathan Wolpaw, Elizabeth Winter Wolpaw, "Brain Computer Interfaces: Principles and practice", 1st Edition, Oxford University Press, 2012.
- 3. Bernhard Graimann, Brendan Allison, GertPfurtscheller, "Brain-Computer Interfaces: Revolutionizing Human-Computer Interaction", Springer, 2010.

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(9 Hrs)

- 1. Ella Hassianien, A & Azar. A. T, "Brain-Computer Interfaces Current Trends and Applications", Springer, 2015.
- 2. Ali Bashashati, Mehrdad Fatourechi, Rabab K Ward, Gary E Birch," A survey of signal Processing algorithms in brain–computer interfaces based on electrical brain signals" Journal of Neural Engineering, Vol.4, 2007.
- 3. Bishop C.M., "Neural networks for Pattern Recognition", Oxford Clarendon Press, 1995.
- 4. Andrew Webb, "Statistical Pattern Recognition", Wiley International, 2nd Edition, 2002.

Web Resources

- 1. https://youtu.be/PWRGe3uyS4c
- 2. https://youtu.be/jVB-jn2E62Y
- 3. https://youtu.be/gmli6EyiNRw
- 4. https://youtu.be/5Q0gemu-h3Q
- 5. https://youtu.be/Qv-H6QSYKhA

COs/POs/PSOs Mapping

COs				Program Specific Outcomes (PSOs)											
	P01	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	2	2	2	2	1	3	-	-	-	3	3	2	2
2	3	3	2	2	2	2	1	3	-	-	-	3	3	2	2
3	3	3	2	2	2	2	1	3	-	-	-	3	3	2	2
4	3	3	2	2	2	2	1	3	-	-	-	3	3	2	2
5	3	3	2	2	2	2	1	3	-	-	-	3	3	2	2

Correlation Level: 1- Low; 2 - Medium; 3 - High.

A. M

- To learn various MEMS design techniques.
- To understand different types of fabrication techniques.
- To understand the electrostatic and piezoelectric sensors
- To Acquire knowledge on microfluidic systems
- To Know the application of Bio MEMS

Course Outcomes

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

- CO1 Determines various MEMS design techniques. (K1)
- CO2 Elucidate explain different types of fabrication techniques. (K3)
- CO3 Able to gain different actuators and their principles of operation at the micro Scale level. (K2)

BIO MEMS

- CO4 Acquire knowledge about microfluidic systems. (K2)
- **CO5** Performs MEMS in different field of medicine. **(K2)**

UNIT I MEMS DESIGN

Mechanics for MEMs design- static bending of thin plates, mechanical vibration, thermos mechanics, fracture and thin film mechanics. Mechanical sensors and actuators – beam and cantilever – microplates, strain, pressure and flow measurements.

UNIT II MEMS FABRICATION

Materials for MEMS - Active substrate materials - Silicon and its compounds, Silicon piezo resistors, Gallium Arsenide, quartz, polymers. Micromachining photolithography, thin film deposition, doping, etching, bulk machining, wafer bonding, LIGA.

UNIT III BIOMEMS SENSORS

Bio-MEMS micro sensors and actuators- Inertia sensor, Pressure sensor, flow sensor, tactile sensor, comb drive, Piezoelectric sensor and actuator – inchworm motor, inertia sensor, flow sensor.

UNIT IV MICROFLUID DYNAMICS

Fluid dynamics, continuity equation, momentum equation, equation of motion, fluid flow in microconduits. Microscale fluid, expression for liquid flow in a channel, fluid actuation methods, dielectrophoresis, microfluid dispenser, microneedle, micromixers, micropumps-continuous flow system.

UNIT V BIOMEMS APPLICATIONS

MicroTAS detection and measurement methods, microsystem approaches to PCR, DNA Protein sensor, MEMS based drug delivery, BioMEMS Chips, Sensors, Implanted Devices, Microprobe arrays and Environmental applications.

Text Books

- 1. Sandeep K.S. Gupta, Tridib Mukherjee, Krishna Kumar Venkatasubramanian, "Body Area Networks Safety, Security, and Sustainability", 2nd Edition, Cambridge University Press, 2013.
- 2. Wanjun Wang, Stephen A.Soper, "BioMEMs: Technologies and Applications", 1st Edition, CRC Press, 2007.
- 3. Mauro Ferrari, Rashid Bashir, Steven Wereley, "BioMEMS and Biomedical Nanotechnology, Vol IV Biomolecular Sensing, Processing and Analysis" Springer US, 1st Edition, 2007.

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- 1. Marc J. Madou , "Fundamentals of Microfabrication: The Science of Miniaturization", 2nd Edition, CRC Press, 2002.
- 2. S Nihtianov A. Luque, "Smart Sensors and MEMS Intelligent Sensing Devices and Microsystems for Industrial Applications", 2nd Edition, Woodhead Publishing, 2018.
- 3. Guang-Zhong Yang, "Body Sensor Networks", 1st Edition, Springer, 2006.
- 4. Teena James, Manu Sebastian Mannoor, Dentcho V. Ivanov, "BioMEMS Advancing the Frontiers of Medicine", MDPI Publication, 2008.
- 5. Siva Yellampalli, "MEMS Sensors", Intechopen, 2018.

Web Resources

- 1. https://en.wikipedia.org/wiki/Bio-MEMS
- 2. http://www.isssonline.in/journal/03paper12.pdf
- 3. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4719786/
- 4. https://youtu.be/a7ygFgMLhBk
- 5. https://youtu.be/NICKFtkw--w

COs/POs/PSOs Mapping

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

Correlation Level: 1- Low; 2 - Medium; 3 – High.

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U19BME86 REH	BILITATION ENGINEERING
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- To gain knowledge about rehabilitation and its development •
- To understand the principles behind rehabilitation
- To know about various therapeutic exercise technique
- To know about management of communication and VR .
- To Understand about Orthotic and Prosthetic Devices

Course Outcome

After completion of the course, students shall have ability to,

CO1 - Gain adequate knowledge about the needs of rehabilitations and its future development. (K2)

- CO2 Explain the principle concepts in sensory & Motor rehabilitation. (K3)
- CO3 Apply the different types of Therapeutic Exercise Technique. (K2)
- **CO4** Design and apply different types of Hearing aids, visual aids and their application in biomedical field. (K3)
- CO5 Acquire adequate knowledge about different types of models of Hand and arm replacement. (K4)

UNIT I INTRODUCTION

Introduction to Rehabilitation, Epidemiology of Rehabilitation, Health, Levels of Prevention, Preventive Rehabilitation, Diagnosis of Disability, Functional Diagnosis, Importance of Psychiatry in Functional diagnosis, Impairment disability handicap, Primary & secondary Disabilities, Rehabilitation team Classification of members, The Role of Psychiatrist, Occupational therapist, Physical therapist, Recreation therapist, Prosthetist - Orthotist, Speech pathologist, Rehabilitation nurse, Social worker, Corrective therapist, Psychologist, Music therapist, Dance therapist & Biomedical engineer.

UNIT II PRINCIPLES OF REHABILITATION

Introduction, The Human Component, Principles of Assistive Technology Assessment, Principles of Rehabilitation Engineering- Key Engineering Principles, Key Ergonomic Principles - Practice of Rehabilitation and Assistive Technology.

UNIT III THERAPEUTIC EXERCISE TECHNIQUE

Co-ordination exercises, Frenkels exercises, Gait Analyses-Pathological Gaits, Gait Training, Relaxation Exercises-Methods for training Relaxation, Strengthening Exercises-Strength training, Types of Contraction, Mobilization exercises, Endurance exercises.

UNIT IV MANAGEMENT OF COMMUNICATION & VIRTUAL REALITY

Impairment-introduction to communication, Aphasia, Types of aphasia, Treatment of aphasic patient, Augmentative communication-general form of communication, types of visual aids, Hearing aids, Types of conventional hearing aid, Writing aids. Introduction to virtual reality, Virtual reality-based rehabilitation, Hand motor recovery systems with Phantom haptics, Robotics and Virtual Reality Applications in Mobility Rehabilitation.

UNIT V ORTHOTIC, PROSTHETIC DEVICES & RESTORATION TECHNIQUES

General orthotics, Classification of orthotics-functional & regional, General principles of Orthosis, Calipers- FO, AFO, KAFO, HKAFO. Prosthetic devices: Hand and arm replacement, Body powered prosthetics, Myoelectric controlled prosthetics and Externally powered limb prosthetics. Functional Electrical Stimulation Systems-Restoration of hand function, restoration of standing and walking, Hybrid Assistive Systems (HAS).

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Text Books

- Dr. S. Sunder, "Rehabilitation Medicine", 3rd Edition, Jaypee Medical Publications, New Delhi. 2010.
 Joseph D.Bronzino, "The Biomedical Engineering Handbook", 3rd Edition, CRC Press, 2006.

Reference Books

- 1. Rory A Cooper, An Introduction to Rehabilitation Engineering, Taylor & Francis, CRC press, 2006.
- 2. Susan B O'Sullivan, Thomas J Schmitz, Physical Rehabilitation. 5th Edition, Davis publications, 2007.

Web Resources

- 1. https://en.wikipedia.org/wiki/Rehabilitation_engineering
- 2. https://www.embs.org/about-biomedical-engineering/our-areas-of-research/rehabilitation-engineering/
- 3. https://bme.unc.edu/rehabilitation-engineering/
- 4. https://youtu.be/-y2jDL-diz0
- 5. https://youtu.be/s3rEAIwLEXM?t=2

COs/POs/PSOs Mapping

COs				Program Specific Outcomes (PSOs)											
	P01	PO2	PO3	PO4	PO5	P06	P07	P08	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	-	2	2	2	-	-	-	-	-	-	3	2	-
2	3	2	-	2	2	2	-	-	-	-	-	-	3	2	-
3	3	2	-	2	2	2	-	-	-	-	-	-	3	2	-
4	3	2	-	2	2	2	-	-	-	-	-	-	3	2	-
5	3	2	-	2	2	2	-	-	-	-	-	-	3	2	-

Correlation Level: 1- Low; 2 - Medium; 3 – High.

WEARABLE SYSTEMS

Course Objectives

- To Study about sensors and its application in wearable systems
- To Learn about applications of wearable systems
- To Acquire knowledge on energy harvesting
- To gain knowledge on wireless health systems
- To provide knowledge on wearable systems applications

Course Outcomes

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

- CO1 Able to acquire the knowledge about the need of wireless health systems sensors. (K2)
- CO2 Provides signal processing for wearable systems. (K3)
- CO3 Explains the need of energy harvesting. (K2)
- CO4 Gain knowledge about wireless health systems. (K2)
- **CO5** Explain the applications of wearable systems. **(K3)**

UNIT I SENSORS FOR WEARABLE SYSTEMS

Need for wearable systems, Sensors for wearable systems-Inertia movement sensors, Respiration activity sensor, Inductive plethysmography, Impedance plethysmography, pneumography, Wearable ground reaction force sensor, GSR, Radiant thermal sensor, Wearable motion sensors, CMOS – Based Biosensors, E-Textiles, Bio compatibility

UNIT II SIGNAL PROCESSING

Wearability issues -physical shape and placement of sensor, Technical challenges - sensor design, signal acquisition, Constraint on sampling frequency for reduced energy consumption, light weight signal processing, Rejection of irrelevant information, Data mining

UNIT III ENERGY HARVESTING FOR WEARABLE DEVICES

Solar cell, Vibration based, Thermal based, Human body as a heat source for power generation, Hybrid thermoelectric photovoltaic energy harvests, Thermopiles.

UNIT IV WIRELESS HEALTH SYSTEMS

Need for wireless monitoring, Definition of Body area network, BAN and Healthcare, Technical Challenges-System security and reliability, BAN Architecture – Introduction, Wireless communication techniques.

UNIT V APPLICATIONS OF WEARABLE SYSTEMS

Medical Diagnostics, Medical Monitoring-Patients with chronic disease, Hospital patients, Elderly patients, Multi parameter monitoring, Neural recording, Gait analysis, Sports Medicine, Smart Fabrics

Text Books

- 1. Helena Jelinkova, "Lasers for medical applications: Diagnostics, Therapy and Surgery", 1st edition, Woodhead Publishing, 2013.
- 2. Markolf. H.Neimz, "Laser tissue interactions-Fundamentals and applications", 3rd edition, Springer, 2014.
- 3. Subhas Chandra Mukhopadhyay and Tarikul Islam, "Wearable Sensors Applications, design and implementation", IOP Publishing Ltd, 2017.

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- 1. Orazio Svelto and David C. Hanna, "Principles of lasers", 5th edition, Springer, 2010.
- 2. William T. Silfvast, "Laser fundamentals", 2nd edition, Cambridge University Press, 2009.
- 3. Bonfiglio, Annalisa, De Rossi, Danilo, "Wearable Monitoring Systems", 1st Édition, Springer US, 2011.

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- 1. https://en.wikipedia.org/wiki/Smart_wearable_system
- 2. https://www.ncbi.nlm.nih.gov/pubmed/15227552
- 3. https://www.researchgate.net/publication/232811306_Smart_wearable_systems_Curren status_and_future_challenges
- 4. https://youtu.be/tpTnraEagw4
- 5. https://m.youtube.com/watch?v=Mj1aH7CkNCw

COs		Program Outcomes (POs)													Program Specific			
	PO1	P01 P02 P03 P04 P05 P06 P07 P08 P09 P010 P011 P012													PSOS)			
1	3	3	2	2	3	-	-	-	-	-	-	3	3	2	2			
2	3	3	2	2	3	-	-	-	-	-	-	3	3	2	2			
3	3	3	2	3	3	-	-	-	-	-	-	3	3	2	2			
4	3	3	2	3	2	-	-	-	-	-	-	3	3	2	2			
5	3	3	2	3	3	-	-	-	-	-	-	3	3	2	2			

COs/POs/PSOs Mapping

Correlation Level: 1- Low; 2 - Medium; 3 – High.

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- To gain fundamental knowledge about the clinical engineering
- To explore the various health policy
- To get an adequate knowledge about the clinical trials used.
- To understand the quality management in health care.
- To get an adequate knowledge about the application in healthcare.

Course Outcomes

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

CO1 - Understand the fundamentals of clinical engineering. (K2)

- CO2 Explain how the various health policy used in hospital. (K3)
- CO3 Analyze the overall concept of clinical trials. (K3)
- CO4 Demonstrate the quality management concept in health care. (K3)
- CO5 Apply the concept of clinical engineering in hospital management. (K2)

UNIT I – INTRODUCTION

Evolution of Clinical Engineering – interactions of a clinical engineer, Hospital Organization and the Role of Clinical Engineering, Clinical Engineering Programs - Role to be performed in hospital – Staff structure in hospital.

UNIT II – NATIONAL HEALTH POLICY

Need for evolving health policy, Health organization in state, Health financing system, Health Education, Health insurance, Health legislation.

UNIT III – CLINICAL TRIALS

Glossary of terms in clinical trials- History, Requirements new drug development process - need for new drug - selection of a chemical compound as a potential drug - screening of chemical compounds - translation medicine - assessment of preclinical data - Goals of clinical trials - Target population and patient selection.

UNIT IV – QUALITY MANAGEMENT IN HEALTH CARE

Quality management in hospitals and clinical laboratories - Necessity for standardization and Quality Management - NABH and NABL standards – FDA - Joint Commission of Accreditation of hospitals ICRP and other standard organization - Methods to monitor the standards - Overview of Medical Device regulation and regulatory agencies.

UNIT V – APPLICATION IN HEALTH CARE

Computer application in ICU - Picture Archival System (PACS) for Radiological images department - Clinical laboratory administration - Patient data and medical records, Communication.

Text Books

- 1. Ernesto Iadanza , "Clinical Engineering Handbook (Biomedical Engineering)", Academic Press, 2nd edition, 2019.
- 2. Joseph Dyro, "Clinical Engineering Handbook", Academic Press; 1st edition, 2004.
- 3. Samantha Jacques, Barbara Christe, "Introduction to Clinical Engineering", Academic Press, 1st edition, 2020.

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- 1. Shein-Chung Chow, Jen-Pei Liu, "Design and Analysis of Clinical Trials: Concepts and Methodologies", John Wiley & Sons, 2008.
- 2. Eleanor McFadden, "Management of Data in Clinical Trials", Wiley Publishers, 2nd Edition, 2007.
- 3. Susanne Prokscha, "Practical Guide to Clinical Data Management, Taylor & Francis, 3rd edition, 2012.
- 4. Richard K.Bondel, Sheila A.Varley, Colin F.Webb, "Clinical Data Management", Wiley Publications, 2nd Edition, 2002.
- 5. John I. Gallin, Frederick P. Ognibene , Principles and Practice of Clinical Research, Academic Press Publications, 3rd Edition, 2002.

Web References

- 1. https://youtu.be/08J-7EnPZXw
- 2. https://youtu.be/I1NvIWjcd38
- 3. https://www.powershow.com/viewfl/410beB
- 4. https://youtu.be/I1NvIWjcd38
- 5. https://youtu.be/aUsk9SBap-0

COs/POs/PSOs Mapping

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

OPEN ELECTIVE – I

ELECTRICAL SAFETYLTPCHrs(Common to ECE, ICE, MECH, CIVIL, Mechatronics, CCE,
BME, IT, CSE)30345

Course Objectives

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- 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



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workplace safety practices.

Text books

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

Reference books

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

Web References

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

COs/POs/PSOs Mapping

COs					Progr	am Ou	utcom	es (PC)s)				Progr Outco	am Spe mes (P\$	cific SOs)
	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	3	2	-	2	-	-	-	-	-	-	1	-	2
2	3	3	3	2	-	2	-	-	-	-	-	-	1	-	2
3	3	3	3	2	-	2	-	-	-	-	-	-	1	-	2
4	3	3	3	2	-	2	-	-	-	-	-	-	1	-	2
5	3	3	3	2	-	2	-	-	-	-	-	-	1	-	1



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ENGINEERING COMPUTATION WITH MATLAB L T P C Hrs

U19ECO41

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

Mechatronics)

Course Objectives

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

Course Outcomes

After completion of the course, students will be able to

- CO1 State the basics of MATLAB (K1)
- CO2 Explain how to work with matrices, and their operations (K2)

CO3 - Use the MATLAB functions relevant to communication engineering, (K3)

- CO4 Demonstrates various file operations in MATLAB (K3)
- CO5 Applying the plotting capabilities of MATLAB effectively to various systems. (K3)

UNIT I INTRODUCTION TO MATLAB

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

UNIT II LOOPS& CONTROL STATEMENTS

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

UNIT III PLOTS IN MATLAB & GUI

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

UNIT IV MISCELLANEOUS TOPICS

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

UNIT V SIMULINK & APPLICATIONS

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.

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Text Books

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

Reference Books

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

Web References

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

COs Mapping with POs and PSOs

005					Progr	am O	utcom	nes (P	Os)				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	2	2	-	2	3	-	-	-	-	-	-	-	1	3	-
2	2	2	-	2	3	-	-	-	-	-	-	-	1	3	-
3	2	2	-	2	3	-	-	-	-	-	-	-	-	3	-
4	2	2	-	2	3	-	-	-	-	-	-	-	-	3	-
5	2	2	-	2	3	-	-	-	-	-	-	-	-	2	-

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U19ECO42

CONSUMER ELECTRONICS Т Ρ С Hrs (Common to EEE, ICE, CSE, MECH, IT, CIVIL, BME, 3 3 45 0 0 Mechatronics)

Course Objectives

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



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Text Books

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

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

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- 1 http://www.scientificamerican.com/article.cfm?id = expertsbluetooth-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

CO5					Progr	am O	utcom	nes (P	Os)				Prog Outc	ram Spe omes (P	ecific SOs)
003	PO1	PO2	PO3	PO4	PO5	P06	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	-	2	1	-	1	-	-	-	-	-	-	-	1	-
2	2	-	2	1	-	1	-	-	-	-	-	-	-	1	-
3	2	-	2	1	-	1	-	-	-	-	-	-	-	1	-
4	2	-	2	1	-	1	-	-	-	-	-	-	-	1	-
5	2	-	2	1	-	1	-	-	-	-	-	-	-	1	-

COs Mapping with POs and PSOs

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

Course Outcomes

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

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

UNIT I INTRODUCTION TO WWW & HTML

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, web site structure.

UNIT II STYLE SHEETS

Need for CSS, introduction to CSS, basic syntax and structure, using CSS, background images, colors and properties, manipulating texts, using fonts, borders and boxes, margins, padding lists, positioning using CSS, CSS2.

UNIT III JAVASCRIPTS

Client side scripting, What is JavaScript, How to develop JavaScript, simple Javascript, variables, functions, conditions, loops and repetition.

UNIT IV 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.

UNIT V 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 toXSL, XML transformed simple example, XSL elements, transforming with XSLT.

Text Books

- 1. P.J. Deitel AND H.M. Deitel," Internet and World Wide Web How to Program", Pearson Education, 2009.
- 2. Keith Wald, Jason Lengstorf," Pro PHP and jQuery", Paperback, 2016.
- 3. Semmy Purewal, "Learning Web App Development", O'Reilly Media, Inc.

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

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- 1. https://www.w3schools.com
- 2. https://www.geeksforgeeks.org/web-technology/
- 3. https://www.guru99.com/cakephp-tutorial.html
- 4. https://www.ithands.com/blog/cms-or-php-framework-which-technology-is-better-for-my-business
- 5. http://Oriel.ly/learning-web-app

COs/POs/PSOs Mapping

COs					Progr	am O	utcon	nes (P	'Os)				Prog Outco	ram Sp omes (F	ecific PSOs)
	P01	PO2	PO3	PO4	PO5	PO11	PO12	PSO1	PSO2	PSO3					
1	3	3	3	3	3	3	3	3	-	-	3	-	3	2	-
2	2	2	2	2	-	2	-	2	-	2	-	2	3	2	-
3	3	3	3	3	3	3	3	3	-	-	3	-	3	2	-
4	2	2	2	2	-	2	-	2	-	2	-	2	3	2	-
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ANALYSIS OF ALGORITHMS

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

Mechatronics)

Course Objectives

- To analyze the performance of algorithms in terms of time and space complexity
- To understand how the choice of algorithm design methods such as divide and conquer, greedy method impacts the performance of programs.
- 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

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.

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Text Books

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

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- 1. Michael T. Goodrich and Roberto Tamassia, "Algorithm Design: Foundations, Analysis and Internet Examples", Wiley India, 2006.
- 2. Sara Baase and Allen Van Gelder, "Computer Algorithms Introduction to Design and Analysis", 3rd Edition, Pearson Education Asia, 2010.
- 3. Donald E Knuth, "The Art of Computer Programming, Volume I & II", Revised Re-Third Edition, Addison Wessely, 2011.
- 4. Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman, "Data Structures and Algorithms", Pearson Education, Reprint 2006.
- 5. Harsh Bhasin, "Algorithms Design and Analysis", Oxford university press, 2016.

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- 1. https://www.tutorialspoint.com/design_and_analysis_of_algorithms/
- 2. https://www.javatpoint.com/daa-tutorial
- 3. https://www.guru99.com/design-analysis-algorithms-tutorial.html
- 4. https://www.geeksforgeeks.org/fundamentals-of-algorithms/
- 5. https://swayam.gov.in/nd1_noc20_cs71/preview

COs					Progr	am O	utcon	nes (P	'Os)				Progr Outco	am Spo mes (F	ecific PSOs)
	P01	PO2	PO3	PO4	PO5	PO11	PO12	PSO1	PSO2	PSO3					
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2	3	2	3	3	2	2	1	-	-	-	-	-	3	2	-
3	3	3	3	3	2	2	2	-	2	-	-	-	3	2	-
4	3	2	3	3	3	2	2	-	-	-	3	-	3	2	-
5	3	3	3	3	2	2	2	-	-	-	3	2	3	2	-

COs/POs/PSOs Mapping

DATABASE SYSTEM: DESIGN & DEVELOPMENT

(Common to EEE, ECE, ICE, BME)

Course Objectives

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- Understand the various data models, conceptualize E-R diagram and depict using relational model
- Gain knowledge about database languages and frame guery using Relational Algebra and SQL
- Understand and design an efficient database schema using the various normal forms
- Impart knowledge on data storage and transaction processing, concurrency control techniques and recovery procedures
- Explore knowledge on tools and practice case studies

Course Outcomes

After completion of the course the students will be able to

CO1 - Explain the concepts of Database Management System and develop Entity Relationship model and Relational Models for a given application (K2)

- CO2 Manipulate and build database queries using Structured Query Language and relational algebra (K2) CO3 - Apply data normalization principles to develop a normalized database for a given application.(K3)
- CO4 Explain various storage & indexing techniques, transactions and recovery techniques (K2)
- CO5 Apply tools like NoSQL, MongoDB, Cassandra on real time applications (K3)

UNIT I INTRODUCTION

Database Systems- Data Models - Database System Architecture - Entity-Relationship Model - ER Diagram-Extended ER Model - ER into Relational Model - Relational Model: Structure of Relational Databases, Database Schema, Keys, Tables

UNIT II DATABASE LANGUAGES

Relational Algebra - Extended-Relational Algebra Operations -SQL: Introduction - DDL - DML - Integrity Constraints-Set Operations-Joins - Nested Queries - View- Trigger - Stored Procedures

UNIT III RELATIONAL-DATABASE DESIGN

Introduction to Schema Refinement - Decomposition - Lossless Decomposition - Functional Dependencies - Normal Forms - First Normal Form, Second Normal Form, Third Normal Form, Boyce-Codd Normal Form, Fourth Normal Form.

UNIT IV DATA STORAGE

RAID - File Organization - Indexing, Ordered Index, Index files, Hashing - Static and dynamic hashing. Transactions: Transaction concepts and states- Concurrent Execution-Serializability-Concurrency Control: Lock based Protocol - Timestamp based Protocol - Recovery System: - Log-Based Recovery - Shadow Paging

UNIT V CASE STUDY

NoSQL - Document Database : MongoDB - Multi-dimensional: Cassandra

Text Books

- 1. Silberschatz, Korth, Sudarshan, Database System Concepts, 7th Edition McGraw-Hill Higher Education. International Edition. 2019.
- 2. Ramez Elmasri, and Shamkant B. Navathe, Fundamentals of Database Systems (7th edition), Publisher: Pearson,2016

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Reference Books

- 1. Raghu Ramakrishnan, —Database Management Systems, Fourth Edition, McGraw-Hill College Publications, 2015.
- 2. Date C J, Kannan A and Swamynathan S, —An Introduction to Database SystemsII, 8th Edition, Pearson Education, New Delhi, 2006.
- 3. Alan Beaulieu, Mastering SQL Fundamentals, Second Edition, O'Reilly, 2009
- 4. Kristina Chodorow; Shannon Bradshaw MongoDB: The Definitive Guide, 3rd Edition, O'Reilly Media, Inc., 2018.
- **5.** Pramod J. Sadalage (Author), Martin Fowler, NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence 1stEdition, Kindle Edition

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- 1. http://www.database.com/
- 2. http://cassandra.apache.org/
- 3. https://www.mongodb.com/

CO-POs/PSOs Mapping

COs					Prog	am O	utcom	es (PC	Ds)				Prog Outco	ram Spo omes (P	ecific 'SOs)
	P01	PO2	PO3	PO4	PO5	PO11	PO12	PSO1	PSO2	PSO3					
1	2	1	-	-	-	-	-	-	-	-	-	-	-	-	-
2	3	2	1	1	-	-	-	-	-	-	-	-	-	-	-
3	3	2	1	1	-	-	-	-	-	-	-	-	-	-	-
4	2	1	-	-	-	-	-	-	-	-	-	-	-	-	-
5	3	2	1	1	-	-	-	-	-	-	-	-	-	-	-

R PROGRAMMING Hrs L Т Ρ С U19ITO42 3 0 0 3 45

(Common to EEE, ECE, ICE, BME, MECH, Mechatronics)

Course Objectives

- To understand the basics in R programming in terms of constructs, control statements, string functions
- To learn to apply R programming for Text processing •
- To understand the use of data frames and tables •
- To able to appreciate and apply the R programming from a statistical perspective
- To understand the interface model

Course Outcomes

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

- CO1 Create artful graphs to visualize complex data sets and functions.(K3)
- CO2 Write more efficient code using parallel R and vectorization.(K3)
- CO3 Create data frames and working with tables.(K3)
- CO4 Interface R with C/C++ and Python for increased speed or functionality.(K2)
- CO5 Find new packages for text analysis, image manipulation & perform statistical analysis. (K4)

UNIT I INTRODUCTION

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 & Analytics Series, 2013.

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Reference books

 Mark Gardener, "Beginning R – The Statistical Programming Language", Wiley, 2013
Robert Knell, "Introductory R: A Beginner's Guide to Data Visualisation, Statistical Analysis and Programming in R", Amazon Digital South Asia Services Inc, 2013.

Web References

- 1. https://www.coursera.org/learn/r-programming
- 2. https://www.r-project.org/

CO-POs/PSOs Mapping

COs					Prog	ram O	utcom	nes (P	Os)				Prog Outco	ram Spo omes (F	ecific PSOs)
	P01	PO2	PO3	PO4	PO5	PO11	PO12	PSO1	PSO2	PSO3					
1	1	-	-	-	-	-	-	-	-	-					
2	3	2	1	1	-	-	-	-	-	-	-	-	-	-	-
3	3	2	1	1	-	-	-	-	-	-	-	-	-	-	-
4	3	2	1	1	-	-	-	-	-	-	-	-	-	-	-
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(Common to EEE, ECE, ICE, CIVIL, BME)

RAPID PROTOYPING

Course Objectives

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- To understand the development of RP systems
- To learn the classification of liquid based and solid based rapid prototyping systems
- To understand the powder based rapid prototyping systems
- To learn about the materials for rapid prototyping systems
- To discuss about the reverse engineering and new technologies

Course Outcomes

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

CO1 - Acquire knowledge about the product development(K1)

CO2 -Analyse the classification of liquid based and solid based rapid prototyping systems(K4)

CO3 - Analyse the powder based rapid prototyping systems(K4)

CO4 -Acquire knowledge about the materials for rapid prototyping systems(K1)

CO5 - Acquire knowledge about reverse engineering and new technologies(K1)

UNIT I INTRODUCTION

History – Development of RP systems – Applications in Product Development, Reverse Engineering, Rapid Tooling, Rapid Manufacturing- Principle – Fundamental – File format– Other translators – medical applications of RP - On demand manufacturing – Directmaterial deposition - Shape Deposition Manufacturing.

UNIT II LIQUID BASED AND SOLID BASED RAPID PROTOTYPING SYSTEMS (9 Hrs)

Classification – Liquid based system - Stereolithography Apparatus (SLA), details of SLprocess, products, Advantages, Limitations, Applications and Uses. Solid based system- Fused Deposition Modeling, principle, process, products, advantages, applications and uses - Laminated Object Manufacturing.

UNIT III POWDER BASED RAPID PROTOTYPING SYSTEMS

Selective Laser Sintering – principles of SLS process, principle of sinter bondingprocess, Laser sintering materials, products, advantages, limitations, applications anduses. Three Dimensional Printing – process, major applications, research and development. Direct shell production casting – key strengths, process, applications anduses, case studies, research and development. Laser Sintering System, e-manufacturing using Laser sintering, customized plastic parts, customized metal parts,e-manufacturing - Laser Engineered Net Shaping (LENS).

UNIT IV MATERIALS FOR RAPID PROTOTYPING SYSTEMS

Nature of material – type of material – polymers, metals, ceramics and composites liquidbased materials, photo polymer development – solid based materials, powder basedmaterials - case study.

UNIT V REVERSE ENGINEERING AND NEW TECHNOLOGIES

Introduction, measuring device- contact type and non-contact type, CAD model creationfrom point cloudspreprocessing, point clouds to surface model creation, medical dataprocessing - types of medical imaging, software for making medical models, medicalmaterials, other applications - Case study.

Text Books

- 1. Rafiq I. Noorani, Rapid Prototyping Principles and Applications, Wiley & Sons, 2006.
- 2. 2. Chua C.K, Leong K.F and Lim C.S, Rapid Prototyping: Principles and Applications, second edition, World Scientific, 2003.

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3. Amitav Ghosh Introduction to Rapid Prototyping, North West Publication, New Delhi, 2008.

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- 1. Hopkinson N, R.J.M, Hauge, P M, Dickens, "Rapid Manufacturing An Industrial revolution for the digital age", Wiley, 2006
- 2. Ian gibson, "Advanced Manufacturing Technology for Medical applications: Reverse Engineering, Software conversion and Rapid Prototying", Wiley, 2006
- 3. Paul F.Jacobs, Rapid Prototyping and Manufacturing, "Fundamentals ofStereolithography", McGraw Hill 1993.
- 4. Pham D.T and Dimov, "Rapid Manufacturing", Springer Verlog 2001.
- 5. Liou W.Liou, Frank W.Liou ,"Rapid Prototyping and Engineering applications : A tool box for prototype development", CRC Press, 2007.

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- 1. https://nptel.ac.in/courses/112/104/112104265/
- 2. https://www.digimat.in/nptel/courses/video/112104265/L01.html
- 3. https://nptel.ac.in/courses/112/107/112107078/
- 4. https://www.youtube.com/watch?v=oDdOqLbImVQ
- 5. https://www.youtube.com/watch?v=OhNnKTaciVI

Program Specific Program Outcomes (POs) Outcomes (PSOs) COs **PO1** PO2 PO3 PO4 P05 | P06 | P07 | P08 | P09 | P010 | P011 PO12 PSO1 PSO2 PSO3 3 3 3 3 1 2 1 1 1 1 ------2 2 1 3 3 3 3 1 1 1 ------1 2 3 3 3 3 3 --1 1 ----1 4 3 3 3 3 1 2 1 1 1 ------5 3 3 3 3 1 2 1 1 1 ------

COs Mapping with POs and PSOs

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ENERGY AND ENVIRONMENT

(Common to EEE, ECE, MECH, BME, IT, Mechatronics)

Course Objectives

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- 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

After completion of the course, the 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,

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- 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.
- 5.D.P.Kothari, K.C Singal, Rajesh Ranjan, "Renewable Energy sources and Emerging Technologies" second edition, PHI, India

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- 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

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- 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

COs					Progr	am O	utcom	nes (P	Os)				Progr Outco	ram Spo omes (F	ecific PSOs)
	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	2	1	2	2	1	-	-	-	-	3	-	-	-
CO2	1	1	1	-	-	2	1	-	-	-	-	3	-	-	-
CO3	2	2	2	2	2	3	3	-	1	1	2	3	-	-	-
CO4	2	2	2	2	3	3	3	-	1	1	2	3	-	-	-
CO5	2	2	2	2	3	3	3	-	1	1	2	3	-	-	-



	BUILDING SCIENCE AND ENGINEERING	L	Т	Ρ	С	Hours
01962042	(Common to EEE, MECH, BME)	3	0	0	3	45

(Common to EEE, MECH, BME)

Course Objectives

- Understand the basic materials in civil engineering and Have an insight to different types of doors, • windows.
- Analyze the types of foundation.
- Gain the knowledge of bylaws for the planning of a public/private building
- Understand the different methods and materials of interiors for building
- Understand the concept of landscaping

Course Outcomes

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

CO1 - Apply the knowledge of engineering fundamentals to understand, the characteristics of basic civil engineering materials (K2)

CO2 - Apply the knowledge of engineering fundamentals and analyze the types of foundation (K2)

CO3 - Develop plan, section and apply bylaws and investigate causes and remedies for cracks, have an insight to cost effective construction (K3)

CO4 - Understand, design and work in a team and develop the interiors(K5)

CO5 - Understand, design and work in a team and develop landscaping for buildings as per design guidelines.(K5)

UNIT I MATERIALS FOR CONSTRUCTION

Cement concrete: introduction, ingredients of cement, grade of concrete, properties..Steel :definition, types of steel, uses of steel, market forms of steel used in construction Doors and windows : location of doors and windows, types of doors, types of windows, Stairs : requirements of good stairs, types, stairs of different materials

UNIT II FOUNDATION AND STRUCTURAL MEMBERS

Selection of site, substructure, objectives of foundation, site inspection, soils, loads on foundations, essential requirements of good foundation, types of foundation, failure of foundation and remedial measures. Structural members: columns, lintels, roofing (flat roof and sloped roof), flooring (types of floors and floor covering), damp proofing, plastering.

UNIT III BUILDING PLANNING AND MAINTAINENCE

Plan, section and elevation .Introduction, classification of buildings, components of buildings, building bylaws, orientation of buildings, ventilation, acoustic requirements, Superstructure: introduction, brick masonry, stone masonry and rcc. Building maintenance Deterioration of concrete, deterioration of masonry works, prevention of cracks and leaks, cost effective construction, anti-termite treatment in building.

UNIT IV INTERIOR DESIGN

Functional requirement of interior designer, basic elements of interior design, design problems :Interior design for spacious rooms, comfortable rooms, theme rooms, living area, cooking area, drinking area dining area, home offices, sleeping area, bathrooms, public/private buildings

UNIT V LANDSCAPING

Elements of Landscape architecture, specialization in landscape, landscape products, landscape materials, and water efficient landscaping, design guidelines for interior landscape

(9 Hrs)

(9 Hrs)

(9 Hrs)

(9 Hrs)

(9 Hrs)

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Text Books

- 1. Basic civil engineering : M.S.palanichamy fourth edition Tata mcgraw hill limited ,2005
- 2. Basic civil engineering : sateeshgopi ,pearson, 2010
- 3. Building Science: Concepts and Applications: Jens Pohl, Wiley-Blackwell, 2011

Reference Books

- 1. Basic civil engineering : Dr.B.C.Punmia, Ashok kumarjain, ArunkumarjainLaxmi publications year of publication ,2004
- 2. Basic civil engineering : S.S.Bhavikatti New Age International Limited, 2010
- 3. Interior Design and Decoration: Seetharaman P.2019

Web References

- 1. https://www.youtube.com/watch?v=XsFeVuVQE-E
- 2. https://www.youtube.com/watch?v=LYvDoy7MtkE
- 3. https://www.youtube.com/watch?v=zjZVIFt3WQY
- 4. https://www.youtube.com/watch?v=pYAXsbsFBC8
- 5. https://www.youtube.com/watch?v=PIY63QacRTc

COs/POs/PSOs Mapping

COs					Progr	am O	utcom	nes (P	Os)				Progr Outco	ram Spo omes (F	ecific PSOs)
	P01	PO2	PO3	PO12	PSO1	PSO2	PSO3								
1	3	2	2	1	1	3	3	3	2	3	3	3	-	-	-
2	3	3	2	3	1	3	3	3	2	3	3	3	-	-	-
3	3	3	2	3	1	3	3	3	2	3	3	3	I	-	I
4	3	3	2	3	2	3	3	3	2	3	3	3	I	-	I
5	3	3	2	3	2	3	2	3	2	3	3	3	-	-	-



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 (9 Hrs)

Data structures – Mapping E-R Model to Relational model – data manipulation – integrity – advantages – rules for fully relational systems - relational algebra - relational algebra queries.

UNIT - III STRUCTURED QUERY LANGUAGE AND NORMALIZATION

SQL – Data definition – manipulation – views SQL in procedural programming – data integrity and constraints - triggers - data control - database security. Normalization - Undesirable properties - single-valued normalization - desirable properties of decompositions - multivalued dependencies

UNIT -IV STORAGE INDEXING AND TRANSACTIONS MANAGEMENT (9 Hrs)

Different types of memories - secondary storage - buffer management - file structures - heap files - sorted files - index and types - indexed sequential file - B-tree - B+ tree. Transaction management - concepts examples - schedules - serializability - concurrency control - deadlocks - lock and multiple granularity nonlocking techniques.

UNIT -V DATABASE BACKUP, RECOVERY AND SECURITY

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.

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(9 Hrs)

(9 Hrs)

Academic Curriculum and syllabi R-2019

3. Ramez Elmasri and Shamkant Navathe, Durvasula V L N Somayajulu, Shyam K Gupta, "Fundamentals of Database Systems", Pearson Education, United States of America, 2018.

Reference Books

- 1. Silberschatz, Korth.H and Sudarshan.S, "Database System Concepts", 6th Edition, McGraw-HillInternational, 2011.
- 2. Hector Garcia-Molina, Jeffrey D.Ullman, Jennifer Widom, "Database System The Complete Book, 1st Edition, Pearson 2002.
- 3. Date CJ, Kannan A, Swamynathan S, An Introduction to Database System, 8th Edition, Pearson Education-2006.
- 4. Raghu Ramakrishna, Johannes Gehrke, Database Management Systems, 3rd Edition, McGraw Hill, 2014.
- 5. Ramez Elmasri, Durvasul VLN Somyazulu, Shamkant B Navathe, Shyam K Gupta, Fundamentals of Database Systems", 7th Edition, Pearson Education, 2016.

Web References

- 1. https://docs.oracle.com/cd/E11882_01/server.112/e41084/toc.htm MySQL Online Documentation
- 2. http://dev.mysql.com/doc/
- 3. http://www.rjspm.com/PDF/BCA-428%20Oracle.pdf
- 4. http://www.w3schools.com/
- 5. https://www.codecademy.com/learn/learn-

COs/POs/PSOs Mapping

COs					Prog	ram O	utcom	nes (P	Os)				Prog Outco	ram Sp omes (F	ecific PSOs)
	PO1	PO2	PO3	PO4	PO5	P06	P07	PO8	PO9	PO10	P011	PO12	PSO1	PSO2	PSO3
1	3	1	1	-	1	-	-	-	-	-	1	1	-	2	-
2	3	1	1	-	1	-	-	-	-	-	1	1	-	2	-
3	3	3	1	-	1	-	-	-	-	-	1	1	-	2	-
4	3	1	1	-	1	-	-	-	-	-	1	1	-	2	-
5	3	1	1	-	1	-	-	-	-	-	1	1	-	2	-

OPEN ELECTIVE-II

U19HSO51 Ρ С Hrs L т PRODUCT DEVELOPMENT AND DESIGN 3 1 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.

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(9 Hrs)

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(9 Hrs)

(9 Hrs)

(9 Hrs)



- 1. Ashby, M. F., & Johnson, K... *Materials and design: the art and science of material selection in product design.* Butterworth-Heinemann.
- 2. Kevin Otto and Kristin Wood, "Techniques in Reverse Engineering and New Product Development", Pearson Education, Chennai, Edition III.
- 3. Chitale A.V. and Gupta R.C., "Product Design and Manufacturing", 6th Edition, PHI.
- 4. Taurt Pugh,"Tool Design Integrated Methods for Successful Product Engineering", Addison Wesley Publishing, New york, NY
- **5.** Kumar, A., Jain, P. K., & Pathak, P. M. Reverse engineering in product manufacturing: an overview. DAAAM international scientific book,

Web References

- 1. http://www.worldcat.org/title/product-design-and-development/oclc/904505863
- 2. https://www.pdfdrive.com/product-design-and-development-e38289913.html
- 3. https://www.smashingmagazine.com/2018/01/comprehensive-guide-product-design/
- 4. https://www.smashingmagazine.com/2018/01/comprehensive-guide-product-design/
- 5. https://ocw.mit.edu/courses/sloan-school-of-management/15-783j-product-design-and-developmentspring-2006/lecture-notes/clas1_int_crse_6.pdf
- 6. https://swayam.gov.in/nd1_noc20_de05/preview

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

U19HSO52	INTELLECTUAL PROPERTY 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: To disseminate knowledge on Design, Geographical Indication, Plant Variety and Layout Design Protection and their registration aspects **(K1)**

CO5: Organizing their idea or innovations and analyse ethical and professional issues which arise in the intellectual property law context. **(K4)**

UNIT I OVERVIEW OF INTELLECTUAL PROPERTY

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

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(9 Hrs)

(9 Hrs)

(9 Hrs)

(9 Hrs)

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L	т	Ρ	С	Hrs
3	0	0	3	45

UNIT V OTHER FORMS OF IP

(9 Hrs)

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Design: meaning and concept of novel and original - Procedure for registration, effect of registration and term of protection Geographical Indication (GI) Geographical indication: meaning, and difference between GI and trademarks - Procedure for registration, effect of registration and term of protection.

Text Books

- 1. Nithyananda, K V. Intellectual Property Rights: Protection and Management. India, IN: Cengage Learning India Private Limited, 2019
- 2. Neeraj, P., & Khusdeep, D. Intellectual Property Rights. India, IN: PHI learning Private Limited. 2014

Reference Books

- 1. Ahuja, V K. Law relating to Intellectual Property Rights. India, IN: Lexis Nexis, 2017.
- 2. Deborah E. Bouchoux, Intellectual Property: The Law of Trademarks, Copyrights, Patents and Trade Secrets, Cengage Learning, Third Edition, 2012.
- 3. Edited by Derek Bosworth and Elizabeth Webster, The Management of Intellectual Property, Edward Elgar Publishing Ltd., 2013.
- 4. Prabuddha Ganguli, Intellectual Property Rights: Unleashing the Knowledge Economy, McGraw Hill Education, 2011.
- 5. S.V. Satakar, Intellectual Property Rights and Copy Rights, Ess Ess Publications, New Delhi, 2002.
- 6. V. Scople Vinod, Managing Intellectual Property, Prentice Hall of India pvt Ltd, 2012.

Web References

- 1. Subramanian, N., & Sundararaman, M. (2018). Intellectual Property Rights An Overview. Retrieved from http://www.bdu.ac.in/cells/ipr/docs/ipr-eng-ebook.pdf
- 2. World Intellectual Property Organisation. (2004). WIPO Intellectual property Handbook. Retrieved from https://www.wipo.int/edocs/pubdocs/en/intproperty/489/wipo_pub_489.pdf
- 3. Cell for IPR Promotion and Management (http://cipam.gov.in/)
- 4. World Intellectual Property Organisation (https://www.wipo.int/about-ip/en/)
- 5. Office of the Controller General of Patents, Designs & Trademarks (http://www.ipindia.nic.in/)
- 6. Journal of Intellectual Property Rights (JIPR): NISCAIR

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

COs/POs/PSOs Mapping

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

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MARKETING MANAGEMENT ANDLTPCHrsRESEARCH300345

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)

(9 Hrs)

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Text Books

- 1. Philip Kolter & Keller, "Marketing Management", Prentice Hall of India, 14th edition, 2012.
- 2. Lilien, Gary I., and Arvind Rangaswamy. "Marketing managers make ongoing decisions about product features, prices, distribution options", The Handbook of Marketing Research: Uses, Misuses, and Future Advances (2006).

Reference Books

- 1. Chandrasekar. K.S., "Marketing Management Text and Cases", 1st Edition, Tata McGraw Hill Vijaynicole, 2010.
- 2. Kothari, C. "Research Methodology Methods and Techniques", New Age International (P) Ltd., 2017
- 3. RajanSexena. Marketing Management: Text cases in Indian Context.(3rd edition) New Delhi, Tata McGraw hill, 2006
- 4. Moisander J, Valtonen A, "Qualitative marketing research: A cultural approach", Sage Publisher, 2006.
- 5. Malhotra NK, Satyabhushan Dash, "Marketing Research: An Applied Orientation", 7th ed, Pearson Education, 2019

Web References

- 1. https://swayam.gov.in/nd1_noc20_mg26/preview
- 2. https://swayam.gov.in/nd1_noc20_mg26/preview
- 3. https://www.entrepreneur.com/encyclopedia/market-research

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

COs/POs/PSOs Mapping

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

U19HSO54 PROJECT MANAGEMENT FOR ENGINEERS L T P C 3 0 0 3

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.

Text Books

- 1. Erik Larson and Clifford Gray. "Project Management: The Managerial Process". 6th Edn. McGraw Hill Education; 2017.
- **2.** Harold Kerzner. "Project Management: A systems approach to Planning, Scheduling and Controlling. 12th Edn. John Wiley & Sons; 2017

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(9 Hrs)

(9 Hrs)

(9 Hrs)

(9 Hrs)

(9 Hrs)



Hrs



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

COs/POs/PSOs Mapping

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

		L	Т	Ρ	С
U19HSO55	FINANCE FOR ENGINEERS				
		2	1	0	3

Course Objectives

- To develop a deeper understanding of the fundamentals of Accounting and Finance
- To learn how to apply mathematical principles in Finance and the concepts of Risk and Return
- To understand the need and procedure for conducting Financial Analysis for better decision-making
- To be familiar with the modes of generating funds for business and their implications
- To understand the scientific ways to determine deployment of funds in business

Course Outcomes

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

CO1: Understand basic concepts in accounting and finance and their importance for engineers (K2)

CO2: Demonstrate knowledge and understanding of the applications of mathematics in finance (K3)

CO3: Conduct Financial Analysis and use the outcome in making informed decisions in investing (K4)

CO4: Identify and Appreciate various sources of procurement of funds in business and their critical evaluation (K2)

CO5: Know how to scientifically determine the investing in long-term and short-term assets in business (K3)

UNIT I: UNDERSTANDING THE FUNDAMENTALS

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 –

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(9 Hrs) Financial

(9 Hrs)

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B.Tech. Biomedical Engineering



Determinants of Working Capital in a Business. Components of Working Capital. Dividends: Concept and Meaning – Implications of Dividend Decisions on Liquidity Management.

Text Books

- 1. R. Narayanaswamy, Financial Accounting A managerial perspective, PHI Learning, New Delhi. (2015 or later edition)
- 2. C. Paramasivan and T. Subramanian. Financial Management. New Age International, New Delhi. (2015 or later edition)

Reference Books

- 1. S.N. Maheswari, Sharad K. Maheswari & Suneel K. Maheswari. Accounting For Management. Vikas Publishing (2017 or later edition)
- 2. Varun Dawar & Narendar L. Ahuja. Financial Accounting and Analysis. Taxmann Publications. (2018 or later edition)
- 3. Athma. P. Financial Accounting and Analysis. Himalaya Publishing House. (2017 or later edtion)
- 4. Prasanna Chandra. Financial Management. Tata-McGraw Hill Publishers, New Delhi. (2019 or later edition)
- 5. S.C. Kuchhal. Financial Management. Chaitanya Publishing House, Allahabad. (2014 or later edition)

Web Resources

- 1. http://www.annualreports.com/
- 2. http://www.mmachennai.org/
- 3. https://finance.yahoo.com/
- 4. https://icmai.in/icmai/
- 5. https://nptel.ac.in/courses/110/107/110107144/
- 6. https://web.utk.edu/~jwachowi/wacho_world.html
- 7. https://www.icai.org/indexbkp.html
- 8. https://www.icsi.edu/home/
- 9. https://www.investopedia.com/
- 10. https://www.moneycontrol.com/
- 11. https://www.rbi.org.in/

COs/POs/PSOs Mapping

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



U19EEO63

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.

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Text Books

- 1. S. Rao and Dr. B. B. Parulekar, "Energy Technology", Khanna Publication, 3rd Edition, 1999.
- 2. B. H. Khan, "Non-Conventional Energy Resources", Tata McGraw Hill Education, 2nd Edition, 2009.
- 3. D. P. Kothari, K. C. Singal, Rakesh Ranjan, "Renewable Energy Sources and Emerging Technologies", PHI, 2011

Reference Books

- 1. G. D. Rai, "Non-conventional energy sources", Khanna Publication. 4th Edition, 2002.
- 2. Pulfrey, David. L, "Photo voltaic Power Generation", Van Nostrand reinhold Company, 1983.
- 3. Abbasik, "Renewable Energy Sources and their Environment", PHI, 2008.
- 4. Steve Doty, Wayne C. Turner, "Energy Management Handbook", Fairmont Press, 8th Edition, 2012.
- 5. S.A.Abbasi and N. Abbasi, "Renewable Energy Sources and Their Environmental Impact", PHI, 2001.

Web References

- 1. https://www.tutorialspoint.com/renewable_energy/index.htm
- 2. https://nptel.ac.in/courses/112/107/112107291/
- 3. https://byjus.com/physics/conventional-and-nonconventional-sources-of-energy/
- 4. https://www.jagranjosh.com/general-knowledge/nonconventional-sources-of-energy-1448698715-1
- 5. https://wb.gov.in/departments-power-and-non-conventional-energy-sources.aspx

<u> </u>					Prog	gram O	utcome	es (POs	;)				Program Specific Outcomes (PSOs)			
COS	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	
1	3	1	1	2	-	1	2	-	-	-	-	1	-	-	-	
2	3	1	1	2	-	1	2	-	-	-	-	1	-	-	-	
3	3	1	1	2	-	1	2	-	-	-	-	1	-	-	-	
4	3	1	1	2	-	1	2	-	-	-	-	1	-	-	-	
5	3	1	1	2	-	1	2	-	-	-	-	1	-	-	-	

COs / POs and PSOs Mapping

U19ECO63

ELECTRONIC PRODUCT **DESIGN AND PACKAGING**

Mechatronics)

Course Objectives

- To provide basic knowledge about Electronic Product and Packaging
- To introduce and discuss various issues related to the system packaging
- To get clear idea about design of packages which can withstand higher temperature, vibrations and shock •
- To Design of PCBs which minimize the EMI and operate at higher frequency
- To acquire depth knowledge about the concepts of Testing and testing methods

Course Outcomes

After completion of the course, students are able to

- **CO1** Explain the basics of Electronic Product and Packaging. (K2)
- **CO2** Infer various issues related to the system packaging. (K2)
- CO3 Summarize the clear idea about design of packages which can withstand higher temperature, vibrations and shock (K2)
- CO4 Describe the design of PCBs which minimize the EMI and operate at higher frequency (K2)
- **CO5** Explain the various testing methods (K2)

UNIT I : OVERVIEW OF ELECTRONIC 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

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(Common to EEE, CSE, IT, ICE MECH, BME,
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 References

- 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-followin-2018/
- 4. https://en.wikipedia.org/wiki/Electronic_packaging
- 5. https://nptel.ac.in/courses/108/108/108108031/

COs /POs/PSOs Mapping

COs					Prog	ram O	utcom	es (PC	Ds)				Prog Outco	ram Spo omes (F	ecific PSOs)
	P01	PO2	PO3	PO4	PO5	P06	PO7	P08	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	1	1	-	-	-	-	-	-	1	-	-	2	-	1
2	3	1	1	-	-	-	-	-	-	1	-	-	2	-	1
3	3	1	1	-	-	-	-	-	-	1	-	-	2	-	1
4	3	1	1	-	-	-	-	-	-	1	-	-	2	-	1
5	3	1	1	-	-	-	-	-	-	1	-	-	2	-	1

111005064	PLATFORM TECHNOLOGY	L	т	Ρ	С	Hrs
01903004	(Common to EEE, ECE, ICE, CIVIL & BME)	3	0	0	3	45

Course Objectives

- To understand the fundamentals of developing modular application by using object oriented concepts.
- To utilize the C# and .NET framework to build distributed enterprise applications.
- To develop Console Application, Windows Application and Web Applications.
- To connect to multiple data sources and managing them effectively.
- To develop the Enterprise kind of applications

Course Outcomes

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

- CO1 Understand the concept of .NET Framework. (K2)
- CO2 Develop, implement and creating Applications with C#. (K4)
- CO3 Evaluate various graphics and window forms. (K5)
- CO4 Integrating front end applications with Database connectivity. (K3)
- CO5 Classifying various Enterprise applications into real world problems. (K3)

UNIT I INTRODUCTION TO .NET FRAMEWORK

.NET Framework - Common language Runtime (CLR) - Common Type System (CTS) - Common language Specification (CLS) - Compilation process - Assemblies - Namespaces - Command line compiler.

UNIT II C# FUNDAMENTALS

C# class - object - string formatting - Types - scope - Constants - C# iteration - Control flow - Operators -Array - String - Enumerations - Structures - Custom namespaces. Programming constructs - value types and reference types – object oriented concepts – Encapsulation – Inheritance – polymorphism – Interfaces – collections - Multithreading.

UNIT III GRAPHICS AND WINDOWS FORMS

Tool box controls – Container control – Menu – Tool bar – Tool tip Controls during design time – Run time – Graphics programming GDI+.

UNIT IV DATABASE PROGRAMMING

Data Access with ADO.NET - Architecture - Data reader - Data Adapter - Command - Connection - Data set - Data binding - Data Grid Control - XML based Data sets.

UNIT V J2EE

Enterprise Edition Overview - Multi-Tier Architecture - Best Practices - Comparison between J2EE and .NET.

Text Books

- 1. David Chappell, "Understanding .NET A Tutorial and Analysis", Addison Wesley, 2002.
- 2. Herbert Schildt, "C# 3.0 The Complete Reference", McGraw-Hill Professional, Third Edition, 2008.
- 3. Keogh, "J2EE The Complete Reference", Tata McGraw-Hill, 2008.

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Reference Books

- 1. Andrew Troelsen, "Pro C# 5.0 and the .NET 4.5 Framework", Sixth edition, A Press, 2012.
- 2. Joh Skeet, "C# in depth, Manning publications", Third Edition, 2014.
- 3. Adrew Stellman and Jennifer Greene, "Head First C#", Third Edition, O'Reilly, 2013.
- 4. Rod Johnson, "J2EE Design and Development", Wrox, 2002
- 5. Michael Schmalz, "C# Database Basics", O'Reilly Media, January 2012.

Web Resources

- 1. https://www.nptel.ac.in/
- 2. https://www.c-sharpcorner.com/csharp-tutorials
- 3. https://www.guru99.com/c-sharp-tutorial.html

COs/POs/PSOs Mapping

CO'S					Prog	ram O	utcom	es (PC)s)				Prog Outco	ram Spo omes (F	ecific 'SOs)
	P01	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	1	-	-	-	3	2	-	-	-	-	-	-	-	1	-
2	1	2	2	2	-	-	-	-	-	-	-	-	-	1	-
3	2	3	-	3	3	-	2	-	-	-	-	-	-	1	-
4	2	-	-	-	-	-	-	-	2	-	-	-	-	1	-
5	2	2	2	2	-	1	-	-	-	-	-	-	-	1	-

	GRAPHICS DESIGNING	L	Т	Ρ	С	Hrs
U19CSO65	(Common to EEE, ECE, ICE, CIVIL & BME)	3	0	0	3	45

Course Objectives

- To develop basic skills using graphics and theory used in design process.
- Create computer-based projects using Adobe Photoshop.
- Understand, develop and employ visual hierarchy using images and text
- Use a computer to create and manipulate images and layers for use in various print and digital mediums.
- To acquire the knowledge of Animation

Course Outcomes

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

CO1 – Develop the basic design elements of graphics. (K3)

- CO2 Apply the various photoshop tools. (K3)
- CO3 Modify the image size, selection and grids using tools. (k3)
- CO4 Create and Work with colored layers. (K4)
- CO5 Apply different methods for Animation & Panoramic Picture creation. (K5)

UNIT I BASIC CONCEPTS

Basic Concepts of Designing - Design Principles – Basics of design elements – Typography – Color theory - Introduction to Graphics - Introduction to Photoshop - Bitmap and Vector Images - Understanding Image Size and Resolution

UNIT II INTRODUCTION TO PHOTOSHOP

Introduction to Tools - Environment - layout of Photoshop - Design layout setup - color - resolution setting - using basic marquee - selection tools Usage of lasso tools - Using brushes - using and filling colors - layers Using text tool - free transform tool - Exercise: Designing Greeting card / Advertisement

UNIT III IMAGE SIZE, SELECTION, GRID AND GUIDES

Modifying Image Size - Resolution, Marquee - Lasso - Magic Wand - Selection Tools – Selecting – Saving - Crop tool - Coping Selection And Image - Grid and Guide Options – Masks – Channel - Painting and editing - Working with quick masks - Painting (Brush, and its effects) - Blending Modes, Color palettes – Editing - Background - Color - Touchup - Cleanup - Gradient tools - layer blending modes - all types of text tools - shape tools Exercise : Designing Magazine cover - Poster - Brochure

UNIT IV LAYERS

The layer Palette - Changing and controlling layer order - Editing layers - Adjustment layers - Layer Effects Filters - Actions - Automation - Extract - Filter Gallery - Liquefy, Pattern making - Vanishing point - Built in Bitmap Filters - 3rd party Plug-ins - Using predefined Actions - Creating and Recording Actions - Using built in automation - Learning Filter effects - managing the files with layers and layer effects - plugins Manipulation tools - Image control options – HUE - Levels - brightness control Using image – modifying - changing color Exercise : Converting black and white photo to color - designing a photo album

UNIT V ANIMATION & PANORAMIC PICTURE CREATION

Creating product Packaging designs - CD cover - Book and magazine front cover - Envelope - Visiting card - Color correction and color channel management - Design automation theory and Practical's Samples and

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demos - guidelines for freelance work - website links - resource sharing - Preparing Image For Print and Web -

Calculating Image size and Resolution, Changing Image Dimensions - Layout Preview - Color Separation - Optimizing Images for Web - File Formats - Creating Webpages - web photo galleries

Text Books

- 1. <u>A</u>dobe Creative Team, "Adobe Photoshop Classroom in a Book", Adobe system incorporation, Adobe Press, 2010.
- 2. Katherine A.Hughes, "Graphic Design", Learn It, Do It, CRC Press 2019.
- 3. Ken Pender, "Digital color in Graphics Design", CRC Press 2012.

Reference Books

- 1. Mike Wooldridge, "Teach Yourself Visually Adobe Photoshop CS 5", Wiley Publishing, 2010
- 2. Lesa Snider, "Photoshop the missing Manual", O'Reilly Media, Inc, 2010.
- 3. Poppy Evans, Aaris Sherin, Irina Lee, "The Graphic Design", Rockport, 2013.
- 4. Peter Bauer, "Photoshop CC for Dummies", Wiley, 2013.
- 5. Scott Onstott, "Enhancing CAD Drawings with Photoshop", Wiley, 2006

Web Resources

- 1. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-831-user-interface-design-andimplementation-spring-2011/lecture-notes/MIT6_831S11_lec18.pdfhttp://www.moshplant.com/director/bezier/
- 2. https://www.cs.montana.edu/courses/spring2004/352/lectures/CS351-GUIDesign.pdf
- 3. https://www.university.youth4work.com/study-material/graphic-design-lecture
- 4. https://kmayeunhia.wordpress.com/lecture-notes/
- 5. https://nptel.ac.in/courses/106/106/106106090/

COs/POs/PSOs Mapping

COs					Prog	jram O	utcom	es (PO	s)				Prog Outo	gram Sp comes (F	ecific PSOs)
	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	3	-	-	1	1	-							
2	3	2	2	1	-	-	1	2	-						
3	3	2	-	1	-	2	-	-	-	-	-	-	1	2	-
4	-	2	-	3	-	-	-	-	-	-	-	-	2	2	-
5	3	2	1	-	-	2	-	-	-	-	-	-	2	2	-



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U19ITO63

ESSENTIALS OF DATA SCIENCE

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

Course Objectives

- To gain knowledge about the concepts involved in data analytics.
- To discover insights in data using R programming.
- To summarize the operations involved in Hadoop Map Reduce.
- To make use of algorithms related to regression and classification.
- To examine data using time series analysis and text analysis

Course Outcomes

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

- CO1 Experiment with data analytics using R language. (K3)
- CO2 Demonstrate clustering algorithms and association rules. (K3)
- CO3 Use algorithms related to regression and classification. (K3)
- CO4 Explore data using time series analysis and text analysis. (K2)
- CO5 Summarize Hadoop platform to solve map reduce problems. (K2)

UNIT I DATA ANALYTICS USING R

Big Data Overview-Examples of Big Data Analytics-Data Analytics Lifecycle overview-Phases in the lifecycle-GINA Case Study-Introduction to R programming-Exploratory Data Analysis-Statistical Methods for Evaluation.

UNIT II CLUSTERING AND ASSOCIATION RULES

Overview of clustering-Scope of Clustering Techniques- K Means clustering- Additional Algorithms- Clustering in practise: Fake news identification-Overview of Association rules-Apriori Algorithm-Evaluation of Candidate Rules-Applications of Association Rules-An Example: Transactions in a grocery store-Validation and Testing-Diagnosis

UNIT III REGRESSION AND CLASSIFICATION

Scope of Regression Techniques-Linear Regression-Logistic Regression-Additional Regression models-Scope of Classification Techniques-Decision Trees-Naïve Bayes-Diagnostics of Classifiers-Additional Classification Methods-Applications: Prediction of crop yield

UNIT IV TIME SERIES ANALYSIS AND TEXT ANALYSIS

Overview of Time Series Analysis-ARIMA Model-Additional Methods-Text Analysis Steps-A Text Analysis Example-Collecting Raw Text-Representing Texts-TFIDF-Categorizing documents by topics-Determining Sentiments-Gaining Insights.

UNIT V HADOOP MAP REDUCE AND DATA ANALYTICS

Installing and Understanding Hadoop-HDFS and Map Reduce Architecture-Hadoop Map Reduce Example-Hadoop Map Reduce in R-Data Analytics Problems: Exploring web pages categorization - Computing the frequency of stock market change-Real Time Recommender model using Apache Spark.

Text Books

1. David Dietrich, Barry Heller and Beibei Yang, "Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data", EMC Education Services, Reprint 2015, Wiley, ISBN: 9788126556533.

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Academic Curriculum and syllabi R-2019

- 2. VigneshPrajapathi, "Big Data Analytics with R and Hadoop", Packt Publishing, 2013, Birmingham, Mumbai.
- 3. Bill Franks, "Taming the Big Data Tidal Wave: Finding opportunities in Huge DataStreams with Advanced Analytics", John Wiley & sons, 2012.

Reference Books

- 1. Roger D. Peng, "R Programming for Data Science", LeanPub, 2015.
- 2. Bart Baesens, "Analytics in a Big Data World: The Essential Guide to Data Science and its Applications", Wiley Publishers, 2014.

Web References

- 1. www.ibm.com/Data Analytics/
- 2. https://www.ijser.org/researchpaper/Importance-of-Clustering-in-Data-Mining.pdf
- 3. https://datafloq.com/read/7-innovative-uses-of-clustering-algorithms/6224
- 4. https://publications.waset.org/10011058/improving-fake-news-detection-using-k-means-and-support-vector-machine-approaches
- 5. https://statisticsbyjim.com/regression/when-use-regression-analysis/

COs					Progr	am O	utcom	es (P	Os)				Prog Outco	ram Spo omes (P	ecific 'SOs)
	P01	PO2	PO3	PO4	PO5	PO6	P07	P08	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	1	1	2	-	-	-	-	-	-	-	-	1	I
2	3	2	1	1	2	-	-	-	-	-	-	-	-	1	-
3	3	2	1	1	2	-	-	-	-	-	-	-	-	1	-
4	2	1	-	-	2	-	-	-	-	-	-	-	-	1	-
5	2	1	-	-	2	-	-	-	-	-	-	-	-	1	-

COs/POs/PSOs Mapping (BME)

MOBILE APPLICATION DEVELOPMENT

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

Mechatronics)

Course Objectives

- To understand the basic concepts of mobile computing
- To be familiar with the network protocol stack
- To learn the basics of mobile telecommunication system
- To be exposed to Ad-Hoc networks
- To gain knowledge about different mobile platforms and application development

Course Outcomes

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

- CO1 Explain the basics of mobile telecommunication system (K2)
- CO2 Articulate the required functionality at each layer for given application (K2)
- CO3 Identify solution for all functionality at each layer. (K2)
- CO4 Use simulator tools and design Ad hoc networks (K3)
- CO5 Develop a mobile application (K3)

UNIT I INTRODUCTION

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

- 1. Prasant Kumar Pattnaik, Rajib Mall, "Fundamentals of Mobile Computing", PHI Learning Pvt. Ltd, New Delhi 2012.
- 2. Jochen H. Schller, "Mobile Communications", Second Edition, Pearson Education, New Delhi, 2007
- 3. C.K.Toh, "AdHoc Mobile Wireless Networks", First Edition, Pearson Education, 2002.

Dr. A.Vijayalakshmi

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Reference Books

- 1. Dharma Prakash Agarval, Qing and An Zeng, "Introduction to Wireless and Mobile systems", Thomson Asia Pvt Ltd, 2005.
- 2. William.C.Y.Lee, "Mobile Cellular Telecommunications-Analog and Digital Systems", Second Edition, TataMcGraw Hill Edition, 2006.
- 3. UweHansmann, LotharMerk, Martin S. Nicklons and Thomas Stober, "Principles of Mobile Computing", Springer, 2003.

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- 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					Progr	am O	utcom	es (P	Os)				Prog Outco	ram Spo omes (F	ecific PSOs)
	P01	PO2	PO3	PO4	PO5	PO6	P07	P08	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	1	-	-	-	-	-	-	-	-	-	-	-	1	-
2	2	1	-	-	-	-	-	-	-	-	-	-	-	1	-
3	2	1	-	-	1	-	-	-	-	-	-	-	-	1	-
4	3	2	1	1	-	1	-	-	-	-	-	-	-	1	-
5	3	2	1	1	2	1	-	-	-	-	-	-	-	1	-

U19ICO63 FUZZY LOGIC AND NEURAL NETWORKS L Ρ С Hrs Т 3 0 3 0 45

(Common to CSE, IT, CIVIL, BME)

Course Objectives

- To expose the students to learn different architecture of neural network.
- To provide adequate knowledge about different training algorithm of neural network. -
- To provide adequate knowledge about properties and operations of fuzzy sets.
- To provide comprehensive knowledge of fuzzy logic control to real time systems.
- To provide adequate knowledge of Neuro-fuzzy logic controllers.

Course Outcomes

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

CO1 - Understand properties of fuzzy set, fuzzy relations, fuzzy rule base and algorithm (K2)

CO2 - Understand fuzzy logic controllers and its applications. (K2)

- CO3 Understand neural network architecture. (K2)
- CO4 Learn various training algorithm of neural network and its application. (K2)
- CO5 Understand Neuro-fuzzy logic controllers. (K2)

UNIT I INTRODUCTION TO FUZZY LOGIC

Fuzzy sets - properties of fuzzy sets - operations on fuzzy sets. Fuzzy relations linguistic variables -Linguistic approximation. Fuzzy statements: Assignments, Conditional and unconditional statements fuzzy rule base - fuzzy algorithm

UNIT II FUZZY LOGIC CONTROL SYSTEM

Fuzzy logic controller – Fuzzification, Membership functions. Triangular, Trapezoidal, Grassian – Membership value assignments using neural networks, intention, inference - knowledge base - Inference Mechanism -Defuzzification case study: Fuzzy logic controller for a temperature process - inverted pendulum control problem.

UNIT III INTRODUCTION TO NEURAL NETWORK

Motivation for the development of neural networks - artificial Neural networks - biological neural networks -Typical architecture – Training common Activation functions. McCulloh Pitts neuron: Architecture, algorithm and applications - Back propagation neural net - standard architecture - Algorithm - derivation of learning rules - number of hidden layers - Hopfield net architecture algorithm and applications Adaptive Resonance Theory: Architecture and operation

UNIT IV NEURAL NETWORKS BASED ON COMPETITION

Kohinoor's Self Organizing map- Counter propagation Networks - Neural networks for control: Schemes of neuro control -Inverse dynamics. Case study: Neuro controller for a temperature process and Inverted Pendulum problem

UNIT V NEURO FUZZY LOGIC CONTROL

Adaptive fuzzy controller - self timing and self organizing controllers - stability of FLC - Non linear Fuzzy control - Fuzzy neuron.

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

Reference Books

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

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- 1. https://lecturenotes.in/subject/922.
- 2. https://www.ifi.uzh.ch/dam/jcr:0000000-2826-155d-0000-00005e4763e3/fuzzylogicscript.pdf.
- 3. https://nptel.ac.in/courses/106/105/106105173/.

COs/POs/PSOs Mapping

COs					Prog	ram O	utcom	es (PC	Ds)				Prog Outco	ram Spo omes (F	ecific PSOs)
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
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2	3	3	-	3	3	2	-	-	-	2	-	2	2	-	1
3	3	3	2	3	3	2	-	-	-	2	-	2	2	-	1
4	3	3	3	3	3	2	-	-	-	2	-	2	2	-	1
5	3	3	3	2	2	2	-	-	-	2	-	2	2	-	1



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CREATIVITY INNOVATION AND NEW PRODUCT С Hrs т Ρ

DEVELOPMENT

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(Common to EEE, ECE, ICE, CIVIL, BME, Mechatronics)

Course Objectives

- To understand the need for creativity and innovation
- To learn about the project selection and evaluation •
- To learn about the Patent and IPR
- To understand the quality standards and new product planning
- To learn model preparation and evaluation

Course Outcomes

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

- CO1 Describe the creativity and problem solving. (K1)
- CO2 Analyse the methods for project selection and evaluation. (K4)
- CO3 Analyse the patent laws and IPR. (K4)
- CO4 Describe the new product planning. (K1)
- CO5 Acquire knowledge about the patent applications. (K1)

UNIT I INTRODUCTION

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

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- 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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- 3. https://nptel.ac.in/courses/110/107/110107094/
- 4. https://www.youtube.com/watch?v=H6OlyjLJf6k
- 5. https://www.youtube.com/watch?v=CnKeVs-_9zs

COs/POs/PSOs Mapping

COs				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	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	1	1	-	-	-	-	-	-	-	-	1	-	1
2	3	2	1	1	-	-	-	-	-	-	-	-	1	-	1
3	3	2	1	1	-	-	-	-	-	-	-	-	1	-	1
4	3	2	1	1	-	-	-	-	-	-	-	-	1	-	1
5	3	2	1	1	-	-	-	-	-	-	-	-	1	-	1



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- 1. Dr. Mrinalini Pandey, Disaster Management, Wiley India Pvt. Ltd, 2014
- 2. Tushar Bhattacharya, Disaster Science and Management, McGraw Hill Education (India) Pvt. Ltd, 2017
- 3. Jagbir Singh, Disaster Management : Future Challenges and Opportunities, K W Publishers Pvt. Ltd, 2013

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Course Objectives

- To provide basic conceptual understanding of disasters
- To understand approaches of Disaster Management
- To build skills to respond to disaster
- To understand the safety precaution
- To know the basic planning and policy act of the disaster

Course Outcomes

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

- CO1 Infer Disasters, man-made Hazards and Vulnerabilities (K2)
- CO2 Summarize the disaster management studies (K2)
- CO3 Identify disaster mitigation and management mechanism (K1)
- CO4 Estimate the disaster safety precaution (K2)
- **CO5** Determine the disaster plan and act **(K3)**

UNIT - I – DEFINITION AND TYPES

Hazards and Disasters, Risk and Vulnerability in Disasters, Natural and Man-made disasters, earthquakes, floods drought, landside, land subsidence, cyclones, volcanoes, tsunami, avalanches, global climate extremes. Man-made disasters: Terrorism, gas and radiations leaks, toxic waste disposal, oil spills, forest fires.

DISASTER MANAGEMENT

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

UNIT – II STUDY OF IMPORTANT DISASTERS

Earthquakes and its types, magnitude and intensity, seismic zones of India, major fault systems of Indian plate, flood types and its management, drought types and its management, landslide and its managements case studies of disasters in Sikkim (e.g) Earthquakes, Landslide). Social Economics and Environmental impact of disasters.

UNIT - III MITIGATION AND MANAGEMENT

Concepts of risk management and crisis management - Disaster management cycle - Response and Recovery - Development, Prevention, Mitigation and Preparedness- Planning for relief.

UNIT – IV SAFETY PROCESS

Coping with Disaster: Coping Strategies; alternative adjustment processes - Changing Concepts of disaster management - Industrial Safety Plan; Safety norms and survival kits - Mass media and disaster management

UNIT - V PLANNING AND ACT

Planning for disaster management: Strategies for disaster management planning - Steps for formulating a disaster risk reduction plan - Disaster management Act and Policy in India - Organizational structure for disaster management in India - Preparation of state and district disaster management plans

Text books

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- 4. J. P. Singhal, Disaster Management, Laxmi Publications, 2019
- 5. C. K. Rajan, NavalePandharinath, Earth and Atmospheric Disaster Management : Nature and Manmade, B S Publication, 2009

Reference Books

- 1. M.M. Sulphey, Disaster Management, PHI Learning Private Limited, 2016.
- 2. Disaster Science and Management by T. Bhattacharya, McGraw Hill Education (India) Pvt Ltd Wiley 2015
- 3. Earth and Atmospheric Disasters Management, N. Pandharinath, CK Rajan, BS Publications 2009.
- 4. National Disaster Management Plan, Ministry of Home affairs, Government of India
- 5. Manual on Disaster Management, National Disaster Management, Agency Govt of India.

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- 1. <u>http://www.ndma.gov.in/images/policyplan/dmplan/draftndmp.pdf</u>
- 2. http://nidm.gov.in/pdf/guidelines/new/sdmp.pdf
- 3. http://sdmassam.nic.in/pdf/publication/undp/disaster_management_in_india.pdf

COs/POs/PSOs Mapping

				I	Progra	am Ou	ıtcom	es (Po	Os)				Progr Outco	ram Spo omes (F	ecific PSOs)
	P01	PO2	PO3	PO4	PO5	PO6	P07	P08	PO9	PO10	P011	PO12	PSO1	PSO2	PSO3
CO1	3	2	3	3	1	-	1								
CO2	3	2	3	3	1	-	1								
CO3	3	2	3	2	3	3	2	-	2	2	2	3	1	-	1
CO4	3	2	3	2	3	3	2	-	2	2	2	3	1	-	1
CO5	3	2	3	2	3	3	2	-	2	2	2	3	1	-	1

AIR POLLUTION AND SOLID WASTE MANAGEMENT L T P C Hours

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

Course Objectives

U19CEO64

This course should enable the students to

- Provide general understanding of air pollution, air pollutants, their sources and their effects
- Provide knowledge about meteorological parameters, air sampling and measurement of pollutants.
- Provide knowledge of air pollution controlling technologies, air pollution due to automobiles and general Idea of noise pollution.
- Study the importance of solid waste management by processing, treatment, disposal and reuse of solid waste.
- Study about the equipment used for waste collection and transportation of solids waste.

Course Outcomes

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

CO1 - Understand the type, sources & effect of air pollutants (K2)

CO2 - Know the meteorological aspects and various methods of measurement and estimation of pollutants (K4)

- CO3 Gain knowledge about air pollution control equipment's and basics of Noise pollution (K3)
- CO4 Understand about the concept of solid waste management (K2)
- CO5 Gain knowledge about the Equipments used to collection and transportation methods (K3)

UNIT I INTRODUCTION TO AIR POLLUTION

Introduction to air pollution: Air pollution episodes, Atmosphere and its zones, classification and sources of air pollutants, effects of air pollutants on man, plants animal & materials

UNIT II METEOROLOGICAL ASPECTS

Meteorological Aspects: Atmospheric stability, plume behavior, Ambient air sampling and stack sampling, collection of particulates and gaseous pollutants, methods of estimation.

UNIT III AIR POLLUTION CONTROL METHODS

Air pollution control methods and equipment: Principle of control methods for particulates and gaseous pollutants, gravity settlers, electrostatic precipitators, bag filters cyclones, wet scrubbers, automobile exhaust: Pollution due to diesel and petrol engines, exhaust treatment and abatement, noise Pollution: Sources, ill effects, control measures.

UNIT IV SOLID WASTE MANAGEMENT

Introduction to solid waste management, sources, quantification and characterization, classification and components, sampling and analysis, Method of collection

UNIT V EQUIPMENT

Equipment used for collection and transportation, transfer stations, solid waste processing and management. Treatment and disposal methods: composting, sanitary landfills, Incineration – concept, components and applications, leachate management.

Text Books

- 1. M.N. Rao & H.V.N. Rao, 1988, Air Pollution, Tata McGraw Hill Publishing Co. Ltd.
- 2. C.S. RAO, 2007, Environmental Pollution Control Engineering, New Age International, Wiley Estern Ltd. New Delhi.
- 3. Stern A. C., 1973, Air pollution, Academic Press.

B.Tech. Biomedical Engineering

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- 4. A.D. Bhide & Sunderesan B.B., 1983, Solid Waste Management in Developing countries, INSDOC, New Delhi.
- 5. Tohobanoglous, 1993, Intgrated Solid Waste Management Engineering Principle and Management Issues, McGraw-Hill publication Ltd.

Reference books

- 1. P. Aarne Vesilind, William Worrell & Debra Reinhart, 2002, Solid Waste Engineering, Cengage Learning India pvt. Ltd.
- 2. Dr. Y Anjaneyulu, 2002, Air Pollution and Control Technologies, Allied Publisher pvt. Ltd.
- 3. Waste Management: A Reference Handbook. Contributors: Jacqueline Vaughn Author. Publisher: ABC-Clio
- 4. K. V. S. G. Murlikrishna, 1995, Air Pollution, Kaushal& Company.

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- 3. https://nptel.ac.in/content/storage2/courses/104103022

COs					Prog	ram O	utcon	nes (P	Os)				Prog Outco	ram Spo omes (F	ecific PSOs)
	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO 9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	2	3	2	3	3	3	3	3	2	3	3	2	3
CO2	3	3	2	3	3	3	3	2	3	2	2	3	3	3	3
CO3	3	3	3	2	2	2	3	3	3	3	2	3	3	3	2
CO4	2	3	2	3	2	3	2	3	3	2	2	3	3	3	3
CO5	3	3	3	2	3	3	3	3	3	2	3	3	3	3	3

COs/POs/PSOs Mapping

(Common to EEE, MECH, CIVIL, ICE MECHATRONICS, BME)

Course Objectives

U19CCO63

- · 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

NETWORK ESSENTIALS

• 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 Protocols: Shared Secret Key, The Diffie-Hellman Key Exchange, Authentication Using Kerberos. Wireless Security- issues and challenge

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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.
- Rich Seifert, James Edwards, "The All New Switch Book: The Complete Guide to LAN Switching Technology", 2nd Edition, Wiley Publishing Inc, 2011

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- 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 'SOs)
	P01	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
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2	2	1	2	1		-	1	1	1	-					
3	2	1	2	1		1	-	-	-	-	-	1	1	1	-
4	2	1	1	1		1	-	-	-	-	-	1	1	1	-
5	2	1	1	1	1	1	-	-	-	-	-	1	1	1	-

COs/POs/PSOs Mapping

WEB PROGRAMMING (Common to EEE,ECE, MECH, CIVIL, ICE MECHATRONICS, BME)

Course Objectives

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- 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.

Reference Books

1. Ralph Moseley, "Developing Web Applications", Wiley India Pvt. Ltd, 2013

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B.Tech. Biomedical Engineering

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- 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.

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- 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					Prog	ram O	utcom	es (PC)s)				Program Specific Outcomes (PSOs)			
	PO1	PO2	PO12	PSO1	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	-	-	

COs/POs/PSOs Mapping

DATA SCIENCE APPLICATION OF VISION Т Ρ С Hrs

(Common to EEE, ECE, CSE, IT, ICE, MECH, CIVIL, CCE, 3 3 Ω 0 BME, Mechatronics)

Course Objectives

U19ADO62

- 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 - Kmeans 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.

B.Tech. Biomedical Engineering

(9 Hrs)



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(9 Hrs)

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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, "EventDetection, Query, and Retrieval for Video Surveillance", IGI Global, 2009.
- Matthew Turk, Gang Hua, "Vision-based Interaction", First Edition, Morgan Claypool, 2013.
 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 References

- 1. https://www.kaggle.com/learn/computer-vision
- 2. https://machinelearningmastery.com/what-is-computer-vision/
- 3. https://www.udemy.com/course/pythoncv/
- 4. https://www.analyticsvidhya.com/blog/2019/03/opencv-functions-computer-vision-python/
- 5. https://www.youtube.com/watch?v=N81PCpADwKQ&ab_channel=ProgrammingKnowledge

COs/POs/PSOs Mapping

COs					Progr	am O	utcon	nes (P	'Os)				Program Specific Outcomes (PSOs)				
	P01	PO2	PO3	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	1	1		
4	1	2	2	2	1	-	I	-	-	-	-	-	1	2	-		
5	2	1	2	2	1	-	-	-	-	-	-	-	1	1	1		

ELECTRICAL ENERGY CONSERVATION AND Hrs L Т Ρ С

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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B.Tech. Biomedical Engineering

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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 References

- 1. https://nptel.ac.in/courses/108/106/108106022/
- 2. https://www.youtube.com/watch?v=onlhwmbL8CA
- 3. https://www.youtube.com/watch?v=CTt4y8bokWs
- 4. https://ieeexplore.ieee.org/document/7977655
- 5. https://ieeexplore.ieee.org/document/993185
- 6. https://ieeexplore.ieee.org/document/6450335

COs/POs/PSOs Mapping

					Prog	ram O	utcom	es (PC)s)				Prog Outo	gram Sp comes (pecific PSOs)
COs	P01	PO2	PO12	PSO1	PSO2	PSO3									
1	2	2	3	-	-	-	-	-	-	-	-	1			
2	3	2	3	-	-	-	-	-	-	-	-	1			
3	3	2	3	-	-	-	-	-	-	-	-	1			
4	3	2	2	-	-	-	-	I	-	-	-	1			
5	2	2	3	-	-	-	-	-	-	-	-	1			

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



U19CSO76	ARTIFICIAL INTELLIGENCE (Common to EEE, ICE, CIVIL, MECH,CCE, FT)	L 3	Т 0	P 0	C 3	Hrs 45
Course Objectives						
To cover fundament	als of Artificial Intelligence,					
To understand vario	us knowledge representation techniques.					
To provide knowledge	ge of AI systems and its variants					
• To understand the p	lanning and different learning.					
• To understand the c	ommunication process of language translator.					
Course Outcomes						
On successful completi	on of this course students will be able to					
CO1 - Understand the b	basics of Artificial Intelligence. (K1)					
CO2 - Apply AI proble Knowledge based	em solving techniques, knowledge representation, and red systems (K3)	easor	ing r	nethoo	ds in	
CO3 - Develop simple analyze and inter	e intelligent / expert system using available tools and pret domain knowledge. (K3)	techr	niques	s of A	Al to	
CO4 - Become familiar CO5 - Understanding th	with planning and different learning methods. (K3) ne human language to Machine language and Robotics. (K1)				
UNIT I INTRODUCTI	ON			(9	Hrs)	
Introduction - Foundation uninformed search tech	ons of AI – History of AI –Structure of AI agents, Problem s iniques.	olving	g - Inf	ormec	l and	
UNIT II KNOWLEDG	E REPRESENTATION AND REASONING			(9	Hrs)	
Logical Agents –Propo Representation	sitional logic - First-Order Logic - Forward and backward o	chaini	ng -	Knowl	edge	
UNIT III UNCERTAII	N KNOWLEDGE AND REASONING			(9	Hrs)	
Basic probability notation	ons - Bayes rule – Wumpus world revisited - Bayesian netwo	ork.		· ·	,	
UNIT IV PLANNING	AND LEARNING			(9	Hrs)	
Introduction to planning planning algorithm- Lea Reinforcement Learning	g, Planning in situational calculus - Representation for pla arning from examples- Knowledge in Learning - Statistica g.	inning I Lea	g – Pa rning	artial o Metho	order ods -	
UNIT V COMMUNICA Natural Language Proc	ATING, PERCEIVING AND ACTING essing – Natural Language for communication – Perception	- Rot	ootics	(9	Hrs)	

Text Books

- 1. Kevin Night, Elaine Rich, Nair B., "Artificial Intelligence (SIE)", McGraw Hill2008.
- 2. Stuart Russel, Peter Norvig "AI A Modern Approach", 2nd Edition, Pearson Education 2007.
- 3. Patrick Henry Winston," Artificial Intelligence", Addison Wesley, Books Third edition, 2000.

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Reference Books

- 1. George F Luger, Artificial Intelligence, Pearson Education, 6th edition, 2009.
- 2. Peter Jackson, "Introduction to Expert Systems", 3rd Edition, Pearson Education, 2007.
- 3. EngeneCharniak and Drew Mc Dermott," Introduction to Artificial intelligence, Addison Wesley 2000.
- 4. Patrick Henry Winston," Artificial Intelligence", Addison Wesley, Books Third edition, 2000.
- 5. Nils J. Nilsson," Principles of Artificial Intelligence", Narosa Publishing House, 2000.

Web Resources

- https://www.tutorialspoint.com/artificial_intelligence/index.htm
- https://www.javatpoint.com/artificial-intelligence-tutorial
- https://www.w3schools.com/ai/
- https://www.mygreatlearning.com/blog/artificial-intelligence-tutorial/
- https://nptel.ac.in/courses/112/103/112103280/

COs/POs/PSOs Mapping

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

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CLOUD TECHNOLOGY AND ITS L T P C Hrs APPLICATIONS

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U19CSO77

(Common to EEE, ICE, MECH, CIVIL, BME, 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 data centres 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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(9 Hrs)

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(9 Hrs)



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				Program Specific Outcomes (PSOs)											
	PO1 PO2 PO3 PO4 PO5 PO6 PO7 PO8 PO9 PO10 PO11 PO12													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

U19IT076

С Hrs Т Ρ 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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60					Progr	am O	utcom	es (P	Os)				Program Specific Outcomes (PSOs)			
COS	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	P011	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

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Course Objectives

U19IT077

- To learn basics of VR and AR systems
- To know about basic Augment reality functions
- To know about basic Virtual reality functions
- To know about Virtual reality environment and steps to work on it
- To learn various application on AR and VR

Course Outcomes

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

- CO1 Understand the concepts of VR (K2)
- CO2 Summarize different VR modelling Process (K2)
- CO3 Identify applications of virtual reality environment (K2)
- CO4 Explore and work on Augmented Reality environment (K2)
- CO5 Illustrate applications related to VR and AR (K3)

UNIT I VIRTUAL REALITY AND 3D COMPUTER GRAPHICS

Introduction - Benefits of virtual reality - The Virtual world space – Positioning the virtual observer – Stereo perspective projection – 3D clipping – Colour Theory – Simple 3D modelling – Illumination models – Reflection models – Shading algorithms

AUGMENTED AND VIRTUAL REALITY

UNIT II VR MODELLING PROCESS

Geometric modelling - kinematics modelling- physical modelling - behaviour modelling - model Management.

UNIT III CONTENT CREATION CONSIDERATIONS FOR VR

Methodology and terminology - user performance studies - VR health and safety issues – Usability of virtual reality system - cyber sickness -side effects of exposures to virtual reality environment

UNIT IV AUGMENTED REALITY (AR)

Introduction – Benefits of AR – Key players of AR technology - Understanding Augmented reality - Working with AR and System structure

UNIT -V APPLICATIONS ON VR

Medical applications- robotics applications- Advanced Real time Tracking-other applications- games, movies, simulations

Text Books

- 1. Kelly S. Hale , Kay M. Stanney," Handbook of Virtual Environments: Design, Implementation, and Applications", Human Factors and Ergonomics ,Second Edition , 2014.
- 2. C. Burdea and Philippe Coiffet, "Virtual Reality Technology", Gregory, John Wiley and Sons, Inc., Second Edition, 2008.
- 3. Jason Jerald, "The VR Book: Human-Centred Design for Virtual Reality". Association for Computing Machinery and Morgan and Claypool, New York, 2015.

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Reference Books

- 1. Dieter Schmalstieg and Tobias Hollerer ,"Augmented Reality: Principles and Practice (Usability) ", Pearson Education (US), Addison-Wesley Educational Publishers Inc, New Jersey, United States, 2016.
- 2. Steve Aukstakalnis, "Practical Augmented Reality: A Guide to the Technologies, Applications, and Human Factors for AR and VR (Usability)", Addison-Wesley Professional; 1 edition, 2016.
- 3. Tony Parisi , "Learning Virtual Reality: Developing Immersive Experiences and Applications for Desktop, Web, and Mobile", OReilly Media, 1st edition, 2015.
- 4. Tony Parisi ,"Programming 3D Applications with HTML5 and WebGL: 3D Animation and Visualization for Web Pages", OReilly Media, 1st edition, 2014.

Web References

- 1. https://www.coursera.org/courses?query=augmented%20reality
- 2. https://nptel.ac.in/courses/106/106/106106138/
- 3. http://www.vrmedia.it/en/xvr.html
- 4. http://www.hitl.washington.edu/artoolkit/

COs/POs/PSOs Mapping

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

U19ICO75

INDUSTRIAL AUTOMATION



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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
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COs/POs/PSOs Mapping

COs						F	Progra	am Out	come	s (POs)		Pro Out	gram S <mark> </mark> comes(oecific PSOs)
	PO1	PO2	PO3	PO4	PO5	P06	P07	P08	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	1	-	-	1	-	-	-	1	1	2	1	-	1
2	3	3	1	-	-	1	-	-	-	1	1	2	1	-	1
3	3	2	1	-	-	1	-	-	-	1	1	2	1	-	1
4	2	3	1	-	-	1	-	-	-	1	1	2	1	-	1
5	3	2	1	-	-	1	-	-	-	1	1	3	1	-	1



Dr. A.Vijayalakshmi

Hrs ТР С L **U19CEO76 GLOBAL WARMING AND CLIMATE CHANGE** 3 0 0 3 45

Course Objectives

This course should enable the students to

- Understand the basics and importance of global warming.
- Gain adequate knowledge about the characteristic of atmosphere components.
- Gain knowledge about impart of climate change. •
- Gain knowledge about the Changes in Climate and Environment
- Impart knowledge about the mitigation measures

Course Outcomes

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

- CO 1 Understand the concept and effects of global warming (K2)
- CO 2 Understand Climate system, earth's atmosphere and its components.(K2)
- CO 3 Analyze the Impacts of Climate Change on various sectors (K4)
- CO 4 Assess the concept about carbon credit and clean development mechanism.(K3)
- CO 5 Understand climate changes, its impact and mitigation activities.(K2)

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

UNIT I EARTH'S CLIMATE SYSTEM

Ozone layer-Role of ozone in environment-ozone depleting -Green House gases- Effects of Greenhouse Gases- Global Warming -Hydrological Cycle – Radiative Effects and Carbon Cycle.

UNIT II ATMOSPHERE AND ITS COMPONENTS

Importance of Atmosphere-Physical Chemical Characteristics of Atmosphere- Vertical structure of the atmosphere-Composition of the atmosphere-Atmospheric stability-Temperature profile of the atmosphere-Lapse rates-Temperature inversion-effects of inversion on pollution dispersion.

UNIT III IMPACTS OF CLIMATE CHANGE

Causes of Climate change : Change of Temperature in the environment-Melting of ice Pole-sea level rise-Impacts of Climate Change on various sectors – Agriculture, Forestry and Ecosystem – Water Resources – Human Health - Industry, Settlement and Society - Methods and Scenarios - Projected Impacts for Different Regions- Uncertainties in the Projected Impacts of Climate Change - Risk of Irreversible Changes.

UNIT IV OBSERVED CHANGES AND ITS CAUSES

Climate change and Carbon credits- Initiatives in India-Kyoto Protocol-Intergovernmental Panel on Climate change- Climate Sensitivity and Feedbacks -The Montreal Protocol - UNFCCC - IPCC -Evidences of Changes in Climate and Environment - on a Global Scale and in India.

UNIT V CLIMATE CHANGE AND MITIGATION MEASURES

Clean Development Mechanism – Carbon Trading- examples of future Clean Technology – Biodiesel – Natural Compost – Eco- Friendly Plastic – Alternate Energy – Hydrogen – Bio-fuels — Mitigation Efforts in India and Adaptation funding. Key Mitigation Technologies and Practices–Carbon sequestration – Carbon capture and storage (CCS) - International and Regional cooperation- Remedial measures.

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- 1. Joan Fitzgerald "Greenovation: Urban Leadership on Climate Change, Oxford University Press 2020.
- 2. J. David Neelin" Climate change and climate modelling" Cambridge University press (2011).
- 3. Robin Moilveen "Fundamentals of weather and climate" Oxford University Press (2nd Edition) (2010),
- 4. Andrew Dessler and Edward A. Parson "The Science and Politics of Global Climate Change" 2009
- 5. Dash Sushil Kumar, "Climate Change An Indian Perspective", Cambridge University Press India Pvt. Ltd, 2007.

Reference Books

- 1. Bill McKibben(2012), The Global Warming Reader: A Century of Writing About Climate Change, Penguin.
- 2. JasonSmerdon(2009) Climate Change: The Science of Global Warming and Our Energy Future, Columbia University
- 3. Adaptation (2006) and mitigation of climate change-Scientific Technical Analysis. Cambridge University Press, Cambridge.
- 4. J.M. Wallace and P.V. Hobbs (2006) Atmospheric Science, Elsevier / Academic Press.
- 5. Jan C. van Dam,(2003) Impacts of "Climate Change and Climate Variability on Hydrological Regimes", Cambridge University Press,.

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- 2. https://www.warmheartworldwide
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COs/POs/PSOs Mapping

COs			Program Specific Outcomes (PSOs)												
	P01	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	3	3	3	3	3	3	3	3	3	3	-	-	-
CO2	3	3	2	3	3	3	3	3	3	2	3	3	-	-	-
CO3	3	3	3	3	3	3	3	3	3	3	3	3	-	-	-
CO4	2	3	3	2	3	3	3	3	3	3	3	3	-	-	-
CO5	3	3	3	3	3	3	3	3	3	3	3	3	-	-	-

U19CCO76

Course Objectives

- Understand system requirements for mobile applications •
- Generate suitable design using specific mobile development frameworks •

MOBILE APPLICATIONS

DEVELOPMENT USING ANDROID

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

- 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-IINTRODCTION

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 VIOS

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.

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Text Books

- 1. Lauren Darcey and Shane Conder, "Android Wireless Application Development", Pearson Education, 2nd edition 2011.
- Charlie Collins, Michael D. Galpin, Matthias Käppler, "Android in Practise", Manning Publications Co., 1st edition, 2012.
- 3. Jeff McWherter, Scott Gowell, "Professional Mobile Application Development", John Wiley & Sons, Inc., 2012.

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- 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 References

- 1. http://developer.android.com/develop/index.html
- 2. http://developer.android.com/reference/
- 3. https://www.udacity.com/course/developing-android-appsfundamentals--ud853-nd

COs/POs/PSOs Mapping

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

U19CCO75

DATA SCIENCE USING PYTHON L Ρ С т (Common to EEE, ECE, MECH, 3 3 0 0

CIVIL, ICE, 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 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.

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- 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.

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- 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.

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- 2. https://www.cs.uky.edu/~keen/115/Haltermanpythonbook.pdf
- 3. http://math.ecnu.edu.cn/~lfzhou/seminar/[Joel_Grus]_Data_Science_from_Scratch_First_Princ.pdf
- 4. https://www.edx.org/course/python-basics-for-data-science
- 5. https://www.edx.org/course/analyzing-data-with-python

COs/POs/PSOs Mapping

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

DATA SCIENCE APPLICATION OF NLP

U19ADO73

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

BME, Mechatronics)

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

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.
- 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.

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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

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

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ARTIFICIAL INTELLIGENCE APPLICATIONS С L Т Ρ **U19AD074** 0 3

0 (Common to EEE, ECE, CSE, IT, ICE, MECH, CIVIL, BME) 3

Course Objectives

- To study the basic design concept of AI.
- To understand the Machine learning concepts.
- To learn the concept of Deep learning and its applications
- To learn the concept of RPA.
- To acquire the skill to design a chatbot using NLP.

Course Outcomes

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

CO1 - Apply the concept of data science. (K3)

- CO2 Understand the concept of Machine learning. (K2)
- CO3 Understand the concept of Deep Learning. (K2)
- CO4 Apply the design ideas in RPA. (K3)
- CO5 Make use of NLP concepts to create chatbot. (K3)

UNIT I INTRODUCTION

Introduction – Alan Turing and Turing test - The rise and fall of expert system - technological drivers of modern AI -Structure of AI - Data: types of Data - Big Data - Database and other tools - Data Process - Ethics and Governance - Data terms.

UNIT II MACHINE LEARNING

Machine learning - Standard deviation - the normal distribution - Naive Bayes Classifier - K-Nearest Neighbor - Linear regression - K-Means Clustering.

UNIT III DEEP LEARNING

Deep Learning - Difference between Deep Learning and Machine learning - ANN - Backpropagation - RNN -CNN - GAN - Deep Learning Applications - Use Case: detecting Alzheimer's Disease - Deep Learning Hardware - When to use Deep Leaning? - Drawbacks of deep learning.

UNIT IV ROBOTIC PROCESS AUTOMATION

RPA - pros and cons of RPA - Determine the right function to automate - assess the processes - RAP and AI -RPA in the real world.

UNIT V NATURAL LANGUAGE PROCESSING

Challenges of NLP - Understanding How AI translated Language - NLP in real World - Voice Commerce -Virtual assistants - Chatbot - Future of NLP - The Future of AI.

Text Books

- Daniel Jurafsky, James H. Martin, "Speech and Language Processing" Third Edition. 2000. 1.
- 2. S. Kanimozhi Suguna, M. Dhivya, Sara Paiva, "Artificial Intelligence (AI) Recent Trends and Applications" CRC Press, 2021.
- 3. Navin Sabharwal; Amit Agrawal, "Cognitive Virtual Assistants Using Google Dialogflow" Apress, 2020.

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- Durkin, J., "Expert systems Design and Development", Macmillan, 1994. 1
- Peter Jackson, "Introduction to Expert Systems", Addison Wesley Longman, 1999. 2.
- Amir Shevat," Designing Bots: Creating Conversational Experiences" O'Reilly, 2017. 3.
- Anik Das and Rashid Khan,"Build Better Chatbots: A Complete Guide to Getting Started with Chatbots" 4 Apress,2017.
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- 2. https://pytorch.org/tutorials/beginner/chatbot_tutorial.html
- 3. https://www.mygreatlearning.com/blog/basics-of-building-an-artificial-intelligence-chatbot/
- 4. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-034-artificial-intelligence-fall-2010/lecture-videos/lecture-3-reasoning-goal-trees-and-rule-based-expert-systems/
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COs		Program Outcomes (POs)													Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3		
1	2	1	2	1	1	-	-	-	-	-	-	-	-	1	2		
2	2	1	1	1	2	-	-	-	-	-	-	-	1	1	1		
3	2	2	1	2	2	-	-	-	-	-	-	-	-	1	1		
4	1	2	2	2	1	-	-	-	-	-	-	-	2	-	1		
5	2	2	2	2	1	-	-	-	-	-	-	-	1	1	-		

COs/POs/PSOs Mapping

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